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HEAd '20

6th International Conference on Higher Education Advances

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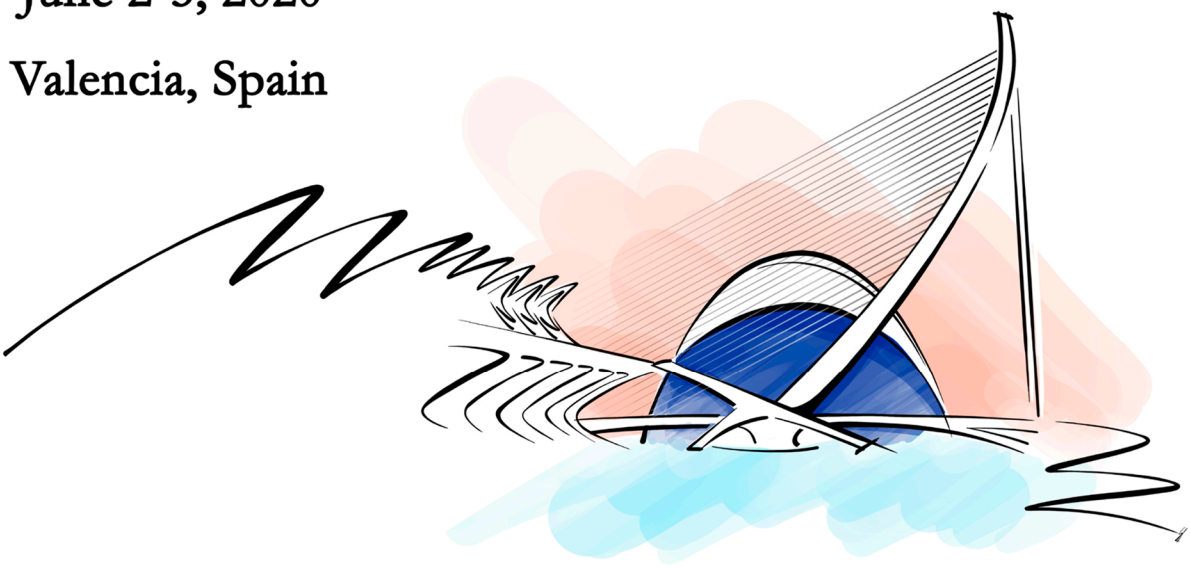

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Preface

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Abstract

The series of HEAd conferences have become a leading forum for researchers and practitioners to exchange ideas, experiences and research results relating to the preparation of students and the organization of higher educational systems. The sixth edition (HEAd'20) was celebrated during 2-5 June 2020. It was organized from Valencia, Spain; although held virtually because of the COVID-19 outbreak. This preface gives an overview of the aims, objectives and scope of HEAd'20, as well as the main contents of the scientific program and the process followed to select them.

Keywords: *Higher education, innovative materials, educational technology, evaluation and assessment, globalization in education.*

Editorial Universitat Politècnica de València

1. Preface to HEAd'20

This volume contains the selected papers of the Sixth International Conference on Higher Education Advances (HEAd'20), which was virtually organized from Valencia, Spain during 2-5 June 2020. Despite the COVID-19 outbreak, this sixth edition was a great success of participation and consolidates the series of HEAd conferences as a leading forum for researchers and practitioners to exchange ideas, experiences and research results relating to the preparation of students and the organization of higher educational systems.

The selection of the scientific program was directed by Paloma Merello, who led a team of 229 program committee members representing 50 countries in all five continents. Following the call for papers, the conference received 280 full paper submissions from 47 different countries. All the submitted papers were reviewed by at least two program committee members under a double blind review process. Finally, 121 papers were accepted as full papers for oral presentation during regular sessions. Additionally, 42 submissions were accepted for presentation in the innovative non-linear sessions, which allowed for increased interaction and participation. The program committee chair congratulates all the authors for having their papers accepted in the proceedings of such a competitive conference.

HEAd'20 also featured two keynote speakers that overviewed important and actual topics: Dr. César Ortega-Sánchez (Curtin University, Australia) talked about understanding students' needs in the age of the Internet, relating this to the change in the learning process due to the mobility restrictions approved after the coronavirus outbreak. The second keynote speech was delivered by Dr. Janet Lord (Manchester Metropolitan University, United Kingdom) dealt with the transformative leadership for equity, social justice and change in higher education.

The main conference was preceded by the Special Interest Group symposium entitled Pedagogy for Higher Education Large Classes (PHELC). This virtual workshop, led by Ann Marie Farrell and Anna Logan, celebrated its second edition by focusing on the assessment for large classes.

Although virtually held, the conference was hosted by the Faculty of Business Administration and Management of the Universitat Politècnica de València, which has been recently ranked as the best technical university in Spain by the Academic Ranking of World Universities (ARWU) 2019.

The organizing committee would like to thank all of those who made this year's HEAd a great success. Specifically, thanks are indebted to the invited speakers, authors, program committee members, reviewers, session chairs, presenters, sponsors, supporters and all the attendees. Our final words of gratitude must go to the Faculty of Business Administration

and Management of the Universitat Politècnica de València for supporting, once again, the HEAd conference, making it possible to become a great event.

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The Impact of Government Policy on Higher Education International Student Recruiters

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Abstract

This paper explores higher education actors involved in the recruitment of internationalstudents and their perceptions of their home country's government policy on their practice. It examines case study institutions from three countries Canada, Hong Kong, and the United Kingdom. This study shows higher education institutions do not exist in a vacuum and regardless of their location, government policy shapes perceptions for international student recruiters who believe that government policies contribute or hinder their practice. All of the participants, regardless of location, show a high level of awareness of government policy that greatly shapes their strategies. More specifically, recruiters find tensions arising from these policies with government shaping recruitment priorities and restricting or instigating competitive responses, while their institutions do not challenge government policy (enough). The findings suggest that government policies establish the "playing field" for recruiters as they attempt to navigate an increasingly competitive environment but at the same time, these perceptions are highly localized and need to be understood in their individual settings.

Keywords: *internationalization; government policies; recruiters; students.*

1. Introduction

This study compares higher education institutions (HEI) from different parts of the world to understand how their government policy frameworks shape practice for international student recruiters. It argues that international student recruitment for HEIs is complex due to government policies and these policies may have direct or in-direct impacts on the practice. There is much unknown about how actors involved in international student recruitment activities conceptualize and respond to government forces. Other studies argue for greater understanding of international student recruitment activities in HEIs from the supply-side and the challenges faced by those involved in the practice as institutions aim to manage government policy changes and other forces on their practice (Asaad et al., 2015; Findlay et al., 2017; Mosneaga & Agergaard, 2011; O'Connor, 2017; Zinn & Johansson, 2015). There is a need for more critical perspectives on international student recruitment practice to offer accounts and descriptions from those involved and how they interpret government policies in their day-to-day practice. This study will provide these perspectives and will further our understanding of how government policy shapes international student recruitment from the supply-side (Findlay et al., 2017).

2. Literature Review

The link between government policy and international student recruitment is currently not well understood (O'Connor, 2017; Sá & Sabzalieva, 2017). O'Connor (2017) studied international strategy from the student and institutional perspective at an Irish university and found there are conflicts in the practice of recruiting international students that are highly local. Their national and local institutional policies are designed to attract international students for economic recovery and diversity, but the institution had a passive acceptance of these students, impacting the international student experience on campus. This study examines one institution in Ireland and sheds light on practice problems associated with government policies that affect the recruitment of international students and suggests further studies of institutions in other jurisdictions will hold value (O'Connor, 2017). This study supports this argument that further research is necessary to understand government policies in the context of local, institutional dynamics and that institutional actors shape practice based on their interpretations of these policies.

These practices suggest a competitive and marketized landscape at a national level that contributes to local, institutional approaches to international student recruitment. Previous studies show marketization and government policy shaping higher education and argue it is important to examine institutional level impacts in the context of their government policy frameworks (Cudmore, 2005; Marginson, 2017; Mosneaga & Agergaard, 2011, O'Connor, 2017, Sá & Sabzalieva, 2018). Beech (2018) explored international student recruitment staff

from ten UK institutions. This study examined changes to the UK visa system and the impacts on recruitment methods through the relationships staff had with educational agents. It found that student mobility is an industry driven by market forces and institutional responses are important in facilitating student mobility. Geddie (2015) furthers this argument in a study of twenty-nine higher education policymakers in the UK and Canada and found that national policies change and evolve at local levels and that there are "perceived competitive relations between places and actors" (p. 245). This suggests that actors' perceptions at local, institutional levels are important in conceptualizing government policy.

Similarly, Findlay et al. (2017) study of stakeholders in the UK higher education sector show that institutions and inter-university organizations have different motivations to attract international students to the UK and suggest that financial motives and the drive to be "globally excellent" serves to position institutions globally to attract international students. At the same time, respondents in the study perceived government policy to restrict these objectives. Findlay et al. (2017) is a comprehensive study of international students who chose to study in the UK and a small set of actors involved in attracting students to the UK. Findlay et al. (2017) argue more studies need to examine the institutional or supply-side perspectives of international student recruitment as there is limited literature on internal operations of HEIs and how they perceive government policies on their practice. This study extends studies such as Findlay et al. (2017) and O'Connor (2017) by taking the supply-side view (or institutional view) of international student recruitment practice by exploring practitioners, in three different countries, as a basis to compare their perceptions. It does this by examining complexities such as government policy contexts and how practitioners view these policies impacting their practice. These studies show that system actors may have different perspectives on government policies, but little is understood about how these policies are perceived. Furthermore, there are limited comparisons of international student recruitment practitioners from different countries. This study explores the local, institutional response government policies facing practitioners of international student recruitment in Canada, Hong Kong, and the UK.

3. Methods

The study examines three institutions from three separate countries in an international comparison. The main research question guiding this study is how do practitioners' view of government policies as influencing their international student recruitment practice? As such, the primary data for this study considers the views and perspectives of the participants nvolved in international student recruitment in each case in the context of their national policy frameworks that existed in 2017. Therefore, semi-structured interviews with international student recruitment practitioners were the primary data collection method in this study while document analysis of government policies was used to inform the interview guide and

contributed to understanding the context and settings. This paper uses case study method to explore the practice of international student recruitment at three HEIs and examines the perspectives of participations thereby creating a cross-case study analysis (Stake, 2013). Case study research is useful for institutional management as it allows for several data sources in real-world contexts, where there was no previous research before (Jensen & Rodgers, 2002). There are few empirical studies on HEIs, and the case study approach provides the flexibility to examine multiple sources and to gather appropriate qualitative data for the study.

The case study sites are the University of Prince Edward Island, Canada (UPEI); the University of Hong Kong, Hong Kong (HKU) and Lancaster University, United Kingdom. Each of these institutions actively recruits international students (both graduate and undergraduate). An important factor in choosing the case studies was the different national settings that shape international student recruitment presenting opportunities to compare institutions. While each institution showed that 20 – 26% of their student population is international, recruiters may view their practices differently and face similar or different challenges in their practice as a result of these policies. These unique circumstances contribute to understanding government policy influence in each case by recognizing these macro-level policies may have different impacts than anticipated and these impacts on international student recruitment have not been previously explored in an international comparison of three separate countries.

The sample consisted of participants within each institution who are directly involved in attracting prospective international students. These are typically individuals with titles such as recruiter, international manager, or overseas manager. Within each institution, the sample was purposive in that only those individuals who had direct involvement with students were invited to participate. The size of the sample varied according to the number of individuals involved in the practice until a saturation point was reached, meaning a sufficient number participants representing the functional areas of the collective activity were interviewed (Guba & Lincoln, 1994). This point was measured in all institutions, as there were a finite number of potential participants. As such, the study involved three interviews at the University of Hong Kong case study (population three); four interviews at the UPEI case study (population six); and seven interviews at Lancaster University (population eleven). This variation in size was reflective, not only of the level of effort and resources dedicated to international student recruitment but also how the institutions assigned responsibilities. In total, the study involved fourteen interviews across the three case study locations. The interviews were conducted in-person and each one recorded.

4. Findings

The findings show the three case study HEIs share similar perceptions of government policy on their practice namely that these policies acti as a"playing field" and restrict their ability to compete and respond to competitive markets. However, the participants' views of national policies suggest local context is needed. For example, UPEI understood that government played a central role in funding the jurisdiction's only university and the participants viewed the government as an enabler of international student recruitment. Meanwhile, the other two institutions viewed government and their policies as a constraint and participants viewed government as negatively impacting their practice through policies. The subjects at HKU and Lancaster believed the policies inhibited international student recruitment efforts through the quota for HKU and immigration policy for Lancaster University. These views of government were unique to each case study as the policies and relationships with government varied in each setting (Beech, 2018, Findlay et al., 2017, O'Connor, 2017).

The Hong Kong government through the UGC established the quota for international students to HKU and this quota system monitored compliance. The quota served to mediate international student recruitment by limiting the number of students who can attend the institution. As such, government controlled the nature and extent of international student recruitment at HKU. The institution recruited students by adopting strategies that focused on the institutional brand and by attracting "top students". At the same time, the quota limited the scope of international student recruitment for the institution, both in financial and human terms. There was less incentive to dedicate resources to actual recruitment practice when the quota limited capacity and financial gains (Asaad et al., 2015). The quota also constrained the choice of markets that the recruiters visited and forced the recruiters to direct resources to China, limiting diversity and choice of top students. *"Mainland China is not international, but it's not local"* (interviewee 3, HKU). This government view of international students directed China to be the main market for HKU, but it also created divergent priorities for the institution. "*You have to prioritize and you're obviously trying to get as many representation as you can within the 600 number, this magic number that's been hanging over our head"* (interviewee 3, HKU). Six hundred were the maximum number of students that HKU could enroll based on the quota system. As such, international student recruitment strategies were adopted based on the parameters established within the quota system and necessitated the recruiters to make decisions that adhered to the six hundred limit while ensuring Mainland Chinese students were a main contributor to their target.

In the UK, Lancaster also experienced government policy constraints in the form of the removal of the post-study work visa and the on-going Brexit discourse. Participants discussed government policy and media communication as shaping perceptions amongst prospective students and this created challenges for recruiters as they attempted to overcome these negative messages.

"*It is just negative media that gets out. A few years ago, was the close of the post study work visa. Messaging went out to say that UK is closed (closed borders for students), you can't work you got to go home. So I think there are certain markets where India being one, the students are expected to stay in country, get some work experience, get a job, earn some money, pay off some of their debts before returning home. So, Government policy now is restricting that*" (interviewee 8, Lancaster).

The participants discussed the challenges of negative government policies as the realities they faced as they entered markets or established recruitment priorities. Recruiters believed the policies and discourse is well known amongst prospective students and that recruiters had to overcome negative perceptions of the UK in their approach to students.

Meanwhile, in Canada, the national and provincial government had placed considerable importance on recruiting international students for economic benefits. *"We need to import talent, train them, and encourage them to stay, develop businesses and contribute to the economy. (interviewee 1, UPEI)* This neo-liberal approach to attracting international students created a national policy environment that encouraged the international student recruitment game for HEIs in Canada. This raised expectations for institutions to attract students for national economic interests but also for institutional sustainability. At UPEI, 50% of their operating budget came from self-sourced revenues such as students ("Short-term Enrolment Plan", 2016). Even though government funding may be challenging for HEIs, the recruiters at this institution viewed immigration and marketing policies from all levels of government as highly positive.

5. Discussion and Conclusion

The case studies exist in different government policy contexts that influence their practices of attracting international students. In Hong Kong, international student recruitment was highly controlled with a quota system while in Canada it has become progressively more flexible to attract international students to study and work post-graduation. At the same time, the UK is experiencing a shifting policy environment in immigration that respondents describe as impacting the recruitment of international students. The findings show that the institutions do not exist in a vacuum and regardless of their location, government policy shapes perceptions for recruiters who believe that government policies contribute or hinder their practice. All of the participants, regardless of location, show a high level of awareness of government policy that greatly shapes their strategies. "*Key export trends (e.g. competition, regulation) should be constantly monitored...to formulate marketing strategies that are aligned to changes in export market conditions*" (Asaad et al., 2014, p. 156). This study provides insight into how recruiters perceive government policy impacting their international student recruitment practice. These findings confirm the importance of close

monitoring of government policy for international student recruitment (Asaad et al., 2013, 2014, 2015; Hemsley-Brown & Oplatka, 2010; Marginson, 2017, Sá & Sabzalieva, 2018) and further suggest that the impact of policy be discussed and understood amongst all actors involved in the practice (Ross et al., 2013). As HEIs expand their recruitment efforts, greater attention needs to be paid to these investments. *Fundamentally, all colleges and universities do the same things and deliver the same things. This sets up a race to build more and grow larger"* (Sickler, 2017, p. 4). This should assist institutions to contextualize to national policy changes on their practices thereby enhancing their understanding of the impacts of these investments.

These findings are of value to policy-makers, administrators, and researchers, regardless of country or HEI. These insights may be used to understand national policy changes on institutional strategy and enable institutions and governments to collaborate in positive manner. This study showed that there is value in examining actors' perceptions of government policy on their international student recruitment efforts. Additional case study locations in other parts of the world may further these findings. Future studies should consider how national policy shapes different types of practices also may help institutions improve performance. Previous literature shows there is little research examining the internal operations of HEIs from different jurisdictions and the lack of different actors' perspectives on international student recruitment practice (Findlay et al., 2017; Ross et al., 2007, 2013). Expanding the research to different jurisdictions and including different institutional practices such as research and teaching may add insights into the complexity facing higher education and its practitioners as they operate in global environments.

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Lessons learnt – The role of peer-to-peer lecture films in a first year material science laboratory course

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Abstract

At HTW Berlin material science is taught to first year students in combination with laboratory exercises on materials testing. Still, basic knowledge upon theory is necessary to work practically during lab sessions. Therefore homework reading is assigned and additionally lecture films guide students through the laboratory routine prior to class. Initially inspired by students these lecture films were conducted during a one term student semester project according to the peer-to-peer approach supervised by lecturers and film experts. Since establishing the lecture films in summer semester 2015 time consuming explanations were redundant and the students were prepared better gaining more knowledge during practical work than those who did not have access to the films. After watching the introductory films download activities increased and online lectures were prepared carefully. However, the initial increase in final test results is not valid taken into account all grades from 2015 up to now. Still, even if the academic output is not better with our without the implementation of lecture films, the better handling of laboratory equipment and the more smoothly running lab courses account for at least a part time success.

Keywords: *lecture films, inverted classroom, peer to peer, material science, laboratory.*

1. Introduction and peer-to-peer laboratory videos

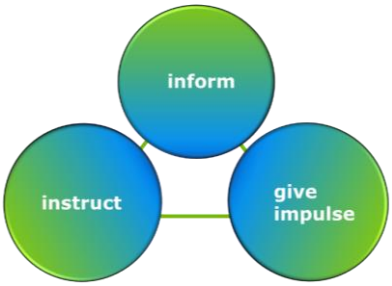
Material Science is taught to first year mechanical engineering students at HTW Berlin via the "design-led" teaching approach: Ashby (2013), Pfennig (2016-1/2), Pfennig (2018) first facing the engineering product, then introducing its properties and later relating these to microstructure, atomistic structure and progressing to the physics and chemistry of materials. Teaching goal is the understanding of material science, but moreover to educate students and prepare them for their role as a maker of things (Ashby 2013).

Students enroll into HTW applied university come from multiple different educational backgrounds, which is a benefit and a great challenge at the same time. It is necessary to study the scientific background of material properties to understand the material test results gained in the lab course. The concept follows a blended learning scenario where scientific backgrounds are self-studied via online-lectures. Discussions are encouraged, but each student is responsible for her/his own progresseion. Therefore a great variety of teaching material is provided via moodle: Pfennig (2016-2), Pfennig (2018).

In the blended learning setting implementing lecture videos into "inverted classroom" teaching scenarios: Berret (2012), Pfennig (2016-2), Pfennig (2018), Pfennig (2019-2) has a positive effect on self-efficacy beliefs and intrinsic motivation Thai (2017). Note, that there is a difference between audio or video recordings of lectures comprising at least 5 different techniques: Crooka (2017) and short lecture videos of relevant course material: Pfennig (2016-1). In general students rate lecture videos as easy to use and effective learning tools: Kay (2012) and place significant value on the use of videos: Gulley (2016), Kon (2015). Videos provide an audio and visual stimulus covering different learning methodologies. Presupposed the video included is analogous to the desired learning outcomes of the lecture: Al-Jandan (2015) lecture videos are definitely a reinforcement, rather than a replacement for lectures: Havergal (2015). Interpolated questions within online videos were preferred by students and may increase the learner's engagement with the material: Rose (2016) and help to boost actual performance: Szpunar (2014).

Involving students directly into teaching activities (preparation of lecture videos) engage studets in critical thinking: Colorado State University (2015), thus, producing deeper learning outcomes: Goto and Schneider (2010). As "peer-to-peer": Ware (2015) literally means "from students for students" this concept was applied for planning and completing lecture videos at HTW Berlin according to the 3I-model: Pfennig (2016-1/2), Pfennig (2018) (figure 1). Effective operation of the lecture films is based on students` experience and their special needs when preparing for specific topics in material science. Therefore 4-6 students worked on a full concept and implementation and integration of three to six lecture films, each two to eight minutes long. The film making was supervised by the lecturer and director of photography of the HTW: Pfennig (2016-1/2), Pfennig (2019-1).

inform, instruct, give impulse.



Information
Short video inputs to replace the traditional frontal type of teaching basic knowledge for inverted classroom setups

Instruction
"How-to videos" to qualify students to work with machines/setups respectively theoretical models for quantitative or qualitative research.

Impulse
Short documentary videos for advanced students serve as an additional motivation and affirmation. These videos encourage the individual to critically examine his or her own views and promote cross-border collaboration.

Fig. 1. 3I Model Overview: Pfennig (2018).

5 "how-to" motion picture lecture videos (11:42 min) on materials testing and introduction to the laboratory course as well as 7 animated scientific lecture videos: Pfennig (2019-1/2) were produced to make the materials science laboratory come to life. These are integrated into micro lectures on Moodle and various teaching material: Pfennig (2018) (figure 2):

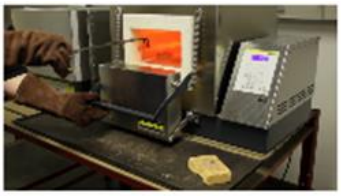
Laboratory introduction **5 films /11:42** **How to video** **Motion picture**	Heat treatment (3:08 min) Ultrasonic testing (1:22 min) Microstructure (1:44 min) Tensile strength testing (1:19 min) Hardness (3:09 min)	 	https://www.youtube.com/playlist?list=PLUOlZMSZYz5wHGs9vEu-5DWqmsktUvtx7

Fig. 2. 5 "how-to" motion picture lecture videos (11:42 min) on materials testing and introduction to the laboratory course. Scientific lecture films are not openly available yet.

The material science laboratory course basically addresses first year students in mechanical engineering, economical engineering, and automotive engineering. In general students did not find it appealing to pick suiting lectures and study properly on their own when preparing for the lab course. Hence, most lab courses were very challenging, a lot of time was consumed by repeated explanations making the lab course disappointing for lecturers. The joy of hands-on courses could not be felt: Pfennig (2016-1). This research now provides broader test results and a first resume on the efficiency of "how-to" lecture videos in a first year material science laboratory course.

2. Course results

The concept of implementing lecture films prior to the laboratory course applied first in spring semester: Pfennig (2016-1) and overall results slightly increased (grade average in WS2014/15: 1,92 (64 students) compared to SS2015: 1,87 (84 students). Lower grades in WS2015 (1,99) are due to large differences of the results obtained from mechanical engineering (1,80) and automotive engineering students (2,17). In SS 2016 (1,58) and SS 2017 (1,50) grades were better than all previous semesters counting for both, students of mechanical and automotive engineering. Winter semester 2016/17 (1,86) and spring semester 2018 (1,83) and 2019 (1,96) showed a good average for all experiments. Winter semester 2017/18 and 2018/19 displayed the worst results since data collection. Here, the special situation of german higher education has to be taken into account with refugees entering the system. Students with migration background of these particular semester showed severe lack of language skills and therefore averagely scored significantly lower. With semesters of 65% of the students coming from Maghreb countries even lecture video supported laboratory courses did not deliver sufficiently satisfying results. It might also be possible that the outstanding results of the mechanical engineering students in winter semester 2014/15 raised the grade point average of this semester so that the results obtained by the following semesters are comparedly better than figure 3 shows.

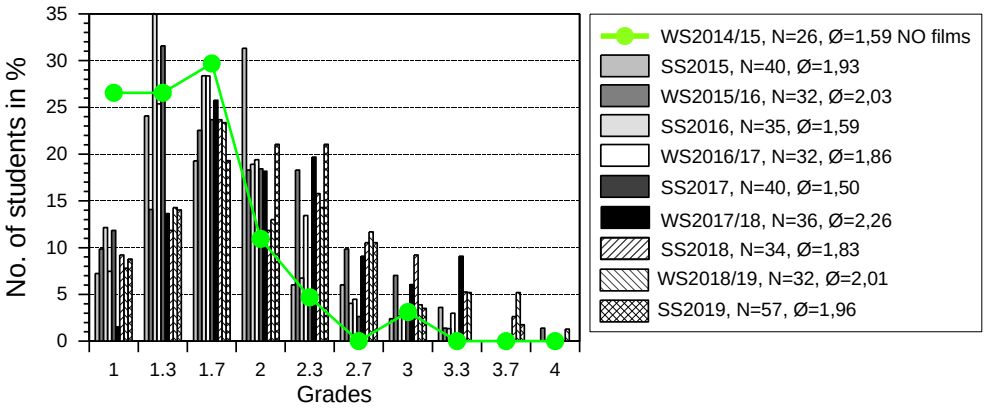


Fig. 3. Accumulated grades for 5 different experiments of students taking a lab course at HTW comparing fall semester 2014 without lecture films (green line) and all semesters from spring semester 2015 until spring semester 2019 with lecture films (histogram).

Considering every experiment of the laboratory course separately, a slight shift towards better grades after watching and working with lecture films was noticeable for the most difficult themes: ultrasonic testing and microstructural analysis. Still, there is no significant increase in grades. Although there is a shift towards lower grades since establishing lecture films as means of self-taught learning prior to laboratory classes, the number of students failing the class is very low (figure 3).

3. Evaluation and Discussion

Because lecture films appeal to many students, are easily accessible, repeatable and time and locally independent (figure 4) the combination of watching the films and preparing online lectures are prefered by most students. YouTube statistics show that once the students started to watch the films they completed at least 75% (figure 4).

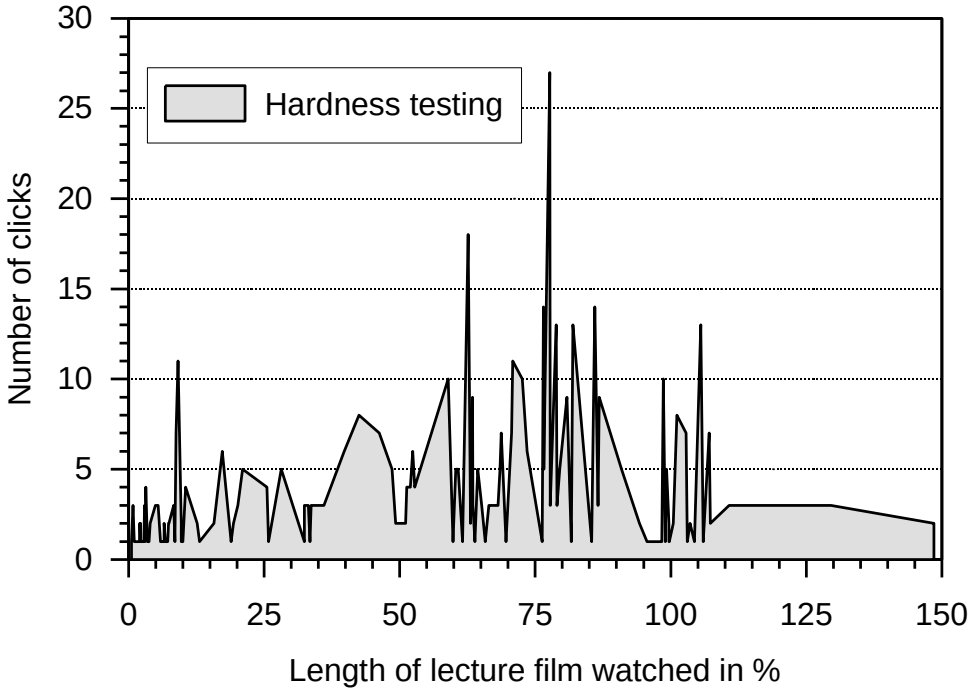


Fig. 4. Number of clicks as a function of the actual length watched in percent of the lecture film "hardness testing. Results exceeding 100% indicate the film end and titles. Most students watched more than 75% of the lecture film.

After watching the introductory films more download activity was noticed assumedly accompanied by studying of the lectures that were provided to prepare the experiments. Most students were well prepared for class, e.g. notes and handwritten summaries were brought along, mindmaps and summary sheets were downloaded and memorized. The additional learning material meant to understand the science behind the results they produced in the lab was regarded helpful. Student groups worked homogenously with lots of inspiration. They asked important questions, initiated discussions, were eager to dispose their knowledge and learn more of the details. Even those students, who did not attend the lecture classes increased their understanding of complicated correlations.

Nearly 50% of the students watched lecture films before the face-to-face laboratory lecture, and preferred films over books or online lectures because the explanation is given directly

(figure 5). However, more students state that they watched the lecture videos after face-to-face time and therefore used the videos for post-processing of the laboratory course content. Approximately 1/3 of the students state that lecture videos give an extra degree of freedom in their learning methods. Lecture videos may be used at any time provided a working internet connection helping students who have to take care of family or work. In general the combination of interactive online lectures, tests and quizzes with the lecture videos provides a highly appreciated learning environment: Pfennig (2018).

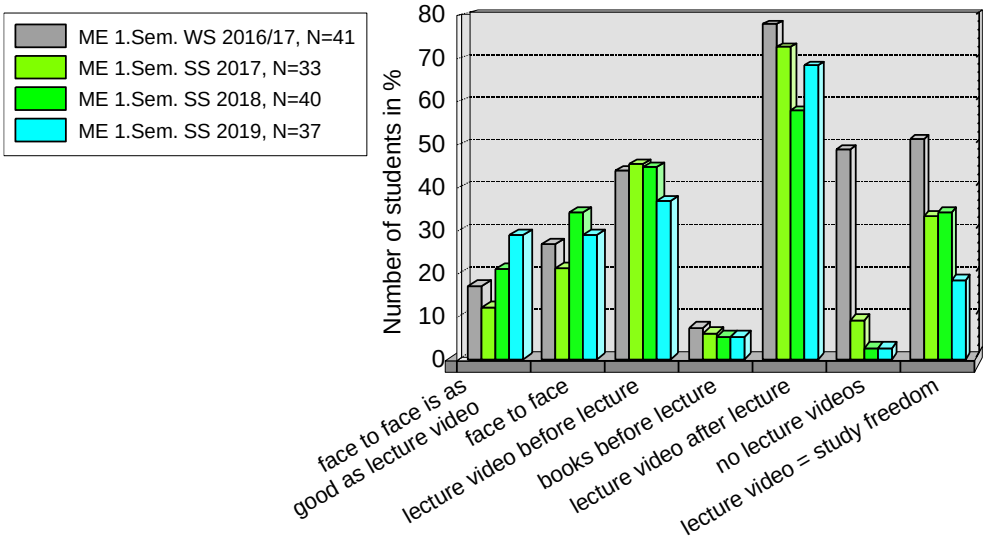


Fig. 5. Preference of lecture materail in first year material science course. (multiple choices were possible)

In general, students achieved lower grades after implementation of lecture videos as means of laboratory preparation. This may be due to the "easy going" attitude towards lecture videos in the first semester. Students may have not taken lecture films as a serious method of preparing, leaving them with the feeling of being experts after watching the difficult content only once. Grades achieved in the laboratory course is directly attributed to the students` learning ability and motivation before the course. Even if not all of the lab excercises accounted for better results and the sum of all 5 experiments did not show an improvement of grades there is an increase in students` attention and individual improvement of pre-lab course test results. Course discussions are encouraged and led with a deeper understanding of the background science. Lecture films are therefore a probate media to encourage students to self-study and prepare for a laboratory course. These films therefore provide excellent requirements in these inverted laboratory classroom scenarios as shown by various authors: Berrett (2012), Pfennig (2016-2), Pfennig (2019-1), Thai (2017). However, it is assumed that students need to learn how to study using lecture videos in the first place to be accounted as

fully accepted and useful teaching media. It is therefore necessary to guide students how to use lecture films in a higher education context. Lecture films have to be worked with in a similar way as books: take your time, look for explanations of difficuls words or settings and write down and summarize the essentials.

4. Conclusion

The peer-to-peer approach of involving students into the implementation of teaching material in an interdisciplinary concept of teaching materials science was successfully chosen to produce lecture videos by guided student project groups. Self studying teaching material was carefully prepared to introduce 5 different materials testing experiments in a practical materials science laboratory course.

In general students rate these introductory videos as beneficial and entertaining because for most of them it is the first time working in a laboratory. After watching the lecture films as means of an inverted classroom learning scenario students knew how to work the equipment and therefore fewer mistakes occurred during the experimental procedures. They were prepared better for the questioning prior to the experiment, got involved into deeper discussions and most of them had taken serious notes improving their learning skills. Data from the course showed enhanced download activity of learning materials after watching the introductory film. However, even with an initial shift of the pre-test results to better grades with the implementation of lecture films starting summer semester 2015, the evaluation over 9 semester does not show a great benefit in terms of students`grades. Introductory videos do not automatically enhance the students` learning outcome. Moreover, this is directly attributed to the students learning ability and motivation before the course. Still, the implementation of lecture videos was assessed as beneficial in terms of knowledge upon upcoming laboratory procedures (do-s and don`t-s), concentration and attentiveness as well as scientific level of communication during class.

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A Comparison of students' attitudes and attainment on an enterprise module for scientists and engineers

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Abstract

We compared data from an enterprise course aimed at scientists and engineers using the Unit Evaluation Questionnaire, coursework marks and qualitative feedback quotes with the aim of identifying any issues for embedding enterprise and entrepreneurship units in science and engineering degrees. Enterprise courses in many universities are often offered as units within other degree programmes which fulfill chartered bodies requirements for enterprise education and for employability. Whilst broadly accepted to be successful, others have reported students views on enterprise education be mixed as they feel its out of their comfort zone, and some are not open to studying units outside of their main subject, however we found student results and satisfaction to be at least as good as faculty and departmental norms. Qualitative comments suggest despite initial misgivings, they enjoy applying their subject knowledge to entrepreneurial issues and appreciate it not being a generic course. Students were not adversely affected by different assessment techniques and performed similarly to departmental/faculty averages. We found that it was key for courses to be tailored to science and engineering students such as by allowing them to study a company from their subject area for their assignments and giving science examples resulted in better engagement and feedback.

Keywords: *Enterprise and Entrepreneurship Education; Science and Engineering Assessment; Interdisciplinary Teaching.*

1. Introduction

Many studies have shown that enterprise education is beneficial for science and engineering students (e.g. Souitaris et al., 2007; Maresch et al., 2016) not just in the context of starting their own business or commercializing research, but also as part of an employability focus with those having participated being seen as more employable by employers (O'Leary, 2012 and 2017). The Quality Assurance Agency for Higher Education in the UK (QAA, 2018) suggests all students should have some enterprise education as part of their overall development. Embedding enterprise in the curriculum for these students has been discussed (e.g. Clements, 2011; Handscombe et al., 2008). Tradeoffs exist between efficiency issues – whether to use subject specific content for small groups of individual subject areas or use more generic courses with larger classes with the opportunity to mix with students from different backgrounds and subject areas, but where content is less tailored to subject areas. There are also a variety of activities on offer extracurricular at Universities (Papadopoulou, and Phillips, 2019 and Phillips, 2010), but some faculties and schools have decided that compulsory enterprise training is required for all students as part of their degree programmes which aligns with chartered body recommendations for degree courses.

Enterprise Education is useful for preparing students for an uncertain job market and producing high growth technology firms. Researchers also have found that Enterprise Education leads to higher Entrepreneurial Intention which is a good predictor of starting a business (Kautonen 2015, Martin et al 2013). Maresch (2016) found that Entrepreneurial Intention was raised more in business students than science and engineering suggesting this was because students who already have some business education are more likely to absorb entrepreneurship skills and knowledge. Further, it is suggested that science and engineering students can develop a social identity which rejects entrepreneurship in favour of pure science (Jungert 2013). However, it was found that an approach keeping the subject area (science and engineering) at the core of the teaching was a successful strategy for engaging students and reducing the construction of a negative social identity, in fact one study found that Entrepreneurial Intention was especially raised in electrical engineers (Duval-Couetil et al., 2012) and another in Spanish engineering students (Barba-Sánchez and Atienza-Sahuquillo, 2018). Our strategy was to use many science and engineering examples and encompass product development into the taught material and assessment, and with an applied assessment rather than an exam.

We consider a final year undergraduate enterprise course adapted for a range of science and engineering students. The course was of twelve two hour sessions, consisting of opportunity spotting and value creation, market research, basics of finance, risk management, cost control, sources of funding and growing a business. It is intended as a 10 credit unit within other subject areas (science and engineering), to address the need for graduates to be enterprising whether they start a business themselves or work in a larger organization. This

course was made compulsory for many students based on feedback from employers and experts from the Chartered Bodies that accredit each degree programme, with employers complaining of students not able to apply their knowledge immediately and requiring training which is expensive for companies to provide. Since only about 5% of students will become self-employed on graduation, courses need to be relevant for those going to work for a wide range of organisations. These units fit well with employer and alumni needs and suggestions, but short term, lecturers need to get good feedback from students and often compulsory courses outside of the main subject area get poor feedback if students cannot see the relevance and they feel it is out of their comfort zone. This problem can arise with lecturers needing good feedback, rather than maybe teaching what is needed, or not teaching for the audience but simply transposing business school courses onto science students. In terms of summative assessment, often enterprise courses have a more practical element of assessment such as reflective journals (Phillips, 2008), posters, feasibility reports, business plans, or pitch presentations. They also can involve group working and Enquiry Based Learning (Sanchez-Romaguera and Phillips, 2018). Alumni entrepreneurs have said that the more practical the courses and the assessment, the more valuable for those planning to start a business (Phillips, 2018).

For many of the students, the assessment for the unit was different to what they were used to which was primarily examination and lab work. It consisted of a 4000 word assignment whereby the student analysed the current state of a company from their own subject area using financial measures and suggested a ways the company could add further value to the company's products or services based on market research and with costing. This was part of "dealing with uncertainty", an important learning outcome of an enterprise course which students can be uncomfortable with, especially students from a subject area where a defined numerical answer is the norm. Using real data from databases, speaking to customers or companies gave a more practical and applied assignment which was hoped would appeal to students. There were also two "consultancy" sessions where students could meet with the lecturer and ask specific questions and discuss their assignment, it was hoped this would alleviate any issues students might have with the assignment by providing reassuring guidance. An important issue is not just whether entrepreneurial intention is raised, but whether students are able to adapt to the demands of different assessments and the aim of this paper is to understand any issues there might be in improving the offering so not only are outcomes achieved but students feel confident in taking entrepreneurship courses and also give good feedback which is important to teaching staff.

2. Methodology

We compared students from science and engineering subject areas in four separate classes – computer science, electrical engineering, and two mixed class (chemical engineering,

mechanical engineering and biotechnology) and looked at data over a three year period from each of these classes. We used feedback from the Unit Evaluation Questionnaire from each area (filled in anonymously and electronically at the end of the course), student assignment marks and comparing with school averages where possible. We also investigated qualitative comments to further understand any issue that students felt were important for this type of course. This data collected was also anonymous giving students a chance to freely reflect their views. Class sizes ranged from 37-76 students and data was collected from the years 2016/17, 2017/18 and 2018/19. For most classes, the sessions were 2 hours per week for 12 weeks but for electrical engineers sessions they were three weeks of 4 hours per week, a three week break then a further three weeks of 4 hours per week, although no comments were made by students about lecture scheduling.

3. Results and Discussion

From the qualitative comments, it is clear that the students initially had similar fears to those found by other researchers that the method of assessment was different to what they were used to, and as final year students, were worried that this might impact their marks with students commenting -

"*A 100% coursework module is very heavy, and whilst support was given from the lecturer, formal instructions and advice given about the subject at the beginning was quite brief, can be open to discussion a lot which is very risky, especially if a full 3rd year module depends on it*"

"*And could provide a guide as to how to do the assessment, what is expected of this type of work as most people have never done a piece of work to this level before.*"

We also found the phenomena that some students didn't see the relevance of doing this type of course within their degrees and there was a worry that students would revert to social norms within their subject area and reject anything new, or new ways of learning –

"*I believe for some it may have been difficult to understand why we were taking this unit and what relation it has to our degree, although this may be at the discretion of the School of EEE*"

Some didn't understand the need to apply the knowledge learned e.g. "*why are we looking at X when the assignment is about Y*" when learning how to apply models in different situations.

The marks achieved by the students seem to show however that they performed well in the assignment (Table 1) and marks were at least as good as those achieved in other units. Table 1 also shows that there is little difference between the marks obtained by students on the separate courses from Computer Science, Electrical Engineering, and mixed classes of Chemical Engineering and Biotechnology.

Table 1: Average marks (%) and number of students on each course (in brackets)

Subject Area	2018-19	2017-18	2016-17
Computer Science (Semester Two)	67.04 (47)	66.18 (64)	66.17 (67)
Engineering/Biotechnology (Semester One)	70.79 (56)	69.69 (42)	66.63 (44)
Engineering/Biotechnology (Semester Two)	69.69 (55)	69.41 (37)	66.35 (40)
Electronic Engineering (Semester One)	71.81 (60)	68.62 (76)	68.61 (76)

Data obtained from the Unit Evaluation Questionnaire survey at the end of the course shows above average feedback from students compared to departmental and faculty norms (Table 2). Feedback, in terms of satisfaction, was high from all classes and similar to departmental norms. Fears that science students would revert to social identity where anything different was rejected seemed unfounded. Others within the university have found that with compulsory units where students feel they are forced to do something they are not interested in some students give negative feedback automatically, however the feedback for all courses is above school and faculty average, suggesting students were happy with the course. We found also that there were no individual students that gave significant negative feedback.

Table 2: Data shows student feedback data (marked out of 5) for each course, brackets are school average scores

Subject Area	2018-19	2017-18	2016-17
Computer Science (Semester Two)	4.33 (4.16)	3.80 (4.09)	4.29 (4.06)
Engineering/Biotechnology (Semester One)	3.93 (4.16)	4.80 (4.09)	4.00 (4.06)
Engineering/Biotechnology (Semester Two)	4.40 (4.16)	3.93 (4.09)	4.25 (4.06)
Electronic Engineering (Semester One)	4.17 (4.16)	3.82 (4.09)	4.20 (4.06)

Qualitative comments suggest that many students in fact valued the course in terms of it being applicable to industry and were challenged positively by the different methods of assessment. Many more students commented on the usefulness of the course and appeared to understand the reasoning behind the course and what they would take away from the unit;

"*This assignment was challenging, it required having to do quite a few things I was unsure about e.g. finding the probability of a risk, what product change to choose (the cost of this, the sales of this), however due to the great feedback it was achievable and a lot simpler than I was making it for myself. Despite it being challenging, I am now really glad I did this module, as it involved a lot of analyses which I feel will come in use later on in my work*

career. This module was good because it also helped me think about what I might like to do after university. Overall, I'm really happy with this module"

"*A content that will actually be useful for the future. An assessment that has meaning and is enjoyable. The independence of the coursework task*"

"*Real world examples a good level for non- business students*"

"*I really enjoyed how feasible and practical the module was. -Has a good mixture between theory and practice where we can use our knowledge of the theory learned in class into our assignments*"

"*The assignments were fun, and different to anything I've done before*"

It was observed anecdotally that in each year Computer Science students had a much lower attendance than other groups, and made less use of the consultancy sessions, but those that engaged were very engaged – attending every session and consultancy, with many emails and discussions after the lectures. Some students however attended no lectures, it was found to be normal in Computer Science that some students didn't attend lectures. The computer science average results seemed slightly lower overall – although there was a broader spread of marks with some very high and very low marks. Survey showed that many computer science students prefer to work off podcasts rather than attend lectures (voice and slides podcast were available for all lectures).

4. Conclusions / Discussion

Despite initial worries from some students, that they were doing something new – that they hadn't written a report before, and often referred to the coursework as an "essay", marks were comparable to other units they were doing elsewhere. It seems that the students adapted quickly to different forms of assessment. Many students particularly valued the individual meetings and consultancy to get help on the coursework which helped bridge the gap. The students who filled in the UEQ seemed happy with the course and the teaching, despite it being compulsory for some. The feedback was similar or above the school average in most cases. Key to gaining acceptance from students seems to be to explain and show how enterprise applied to their subject, give examples from their subject area to show relevance early on. Allowing the assignment to be on a company of their choice in their subject area was helpful – they feel like its aimed at them and gives them a chance to apply knowledge from their subject area. This compares with generic enterprise courses which often get lower feedback as students don't feel like it's aimed at them. It is important to reflect on feedback previously obtained from employers and alumni entrepreneurs who value the more practical approach and allow students working in industry to apply their knowledge to problems of commercial value as soon as they begin their careers rather than be stuck in an academic

mindset which requires extensive training to allow them to make use of their subject knowledge. The study was limited by the numbers of students filling in the UEQ which tends to be about 50%, so some student views are not accounted for. For further work, we plan to investigate any specific groups of students who might do well in their subject area, but poorly in enterprise to identify any particular issues. We also plan to look at arts and humanities subjects as well as science and engineering. Anecdotally, employers have said they like the course and more practical assessment but this could be followed up more formally by interviewing students after they have begun employment.

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Escape room in education: a bibliometric study

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Abstract

The impact of technologies in all areas is one of the main points that characterize the current society. In the educational context, recently, great efforts are being made to adapt the system to characteristics and needs of the students of the 21st century. Gamification in education consist on the use of structures, characteristics, dynamics and aesthetics of games for educational purposes, to increase students participation and motivation. The escape room is a gamified activity in which one or more teams must leave a place during a limited time solving a challenge whose goal is learning. This study pretends to analyze research trends through a bibliometric study of scientific production deposited in Scopus. 32 articles were obtained for the analysis. The results indicate an increase in scientific publications in last decade, and the main mean of dissemination are journals, specially in Social Sciences field. In addition, data shows the low impact and the absence of medium and large producers. Finally, the weight of Spain highlights and the implementation of escape rooms in the Higher Education stage stands ou too.

Keywords: *Bibliometrics; Gamification; Escape room, Education, Motivation, Breakout.*

1. Introduction

One of the main changes of recent times has been the introduction of technologies in classrooms. This reality has led changes in teaching practices, leading to different methodologies. Gamification is one of them. According to Deterding, Khaled, Nacke & Dixon (2011) is not a term on which there is consensus, although it is accepted that it involves the introduction of gaming elements to motivate students and get implication in their learning. In recent times, gamification has been applied in different educational contexts and stages (Corchuelo, 2018; Fernández, Prieto, Alcaraz, Sánchez & Grimaldi, 2018; Manzano & Baeza, 2018; Martínez, 2017; Pintor, 2017) and in students with functional diversity, specifically in intellectual disability (Vidal, López, Marín & Peirats, 2018), obtaining the improvement of autonomy and inclusion, and the development of communicative and social skills, as a result. Within this framework, in recent years, escape room activities have begun to be applied in the educational field, and in order to know the real impact obtained from its use, we carried out the following research.

In order to study this issue, a bibliometric analysis of the trends of scientific production has been carried out. Some of the questions that are intended to be answered are: Is there scientific research on the implementation of escape room in education? What bibliometric behaviour do these publications have? What countries stand out in the literature? What place does Spain occupy? And what is the impact of these publications?

The starting hypothesis is that gamified strategies applied to education from playful activities such as escape rooms, allow the achievement of learning and the adjustment to the characteristics of students of the 21st century.

2. Method

Bibliometry allows quantifying scientific activity on an object of study (Tomás & Tomás, 2018), in this case, on the applications of the escape room to the educational field.

The scientific production deposited in the Scopus database was used, for being the most complete in temporary coverage, for the number of documents (Hernández, Sans, Jové & Reverter, 2016) and for its scientific prestige.

For the search of the documents to analysis, the words: *escape room* OR *breakout* AND *school* OR *education* were used as keywords in title or summary. No time or language limits were used an the 32 documents obtained in the search were relevant for this study.

The data analysis was performed according to productivity variables and thematic relational nodes. For the graphical representation of the results, co-occurrence maps were made with fractional counting through Vosviewer tool (Van Eck & Waltman, 2010).

3. Results

The results of this bibliometric study are grouped around productivity and content analysis.

Regarding the variables involved in productivity, the data are differentiated according to typologies, area of knowledge and temporality; authors and countries; and impact.

3.1. Analysis of the type of documents, area and temporality

First, according to the number of documents resulting in the search, low figures stand out, despite we don't have applied any temporary filters.

Regarding the type of documents of the 32 resulting documents analyzed, the majority (75%) are scientific articles, followed by conferences (19%), and book chapters or notes (3% respectively).

In regard to the area from which these works are carried out, Social Sciences (33%) stand out, followed by others as chemistry (9%), engineering (7%), nursing (7%) or mathematics (3%), among others.

Regarding temporal distribution of scientific productivity, we present the data of documents published per year, it allows to know the frequency of publication on this issue, the interest in this object of study, and the diachronic tendency; and in this case, results only appear stands out only in the last decade. In Figure 1, the number of documents published between 2011 and 2019 is presented, although it is considered that it was in 2016 when the use of this term began in Europe. As it can be seen, the number of publications has increased in recent years, especially since 2017.

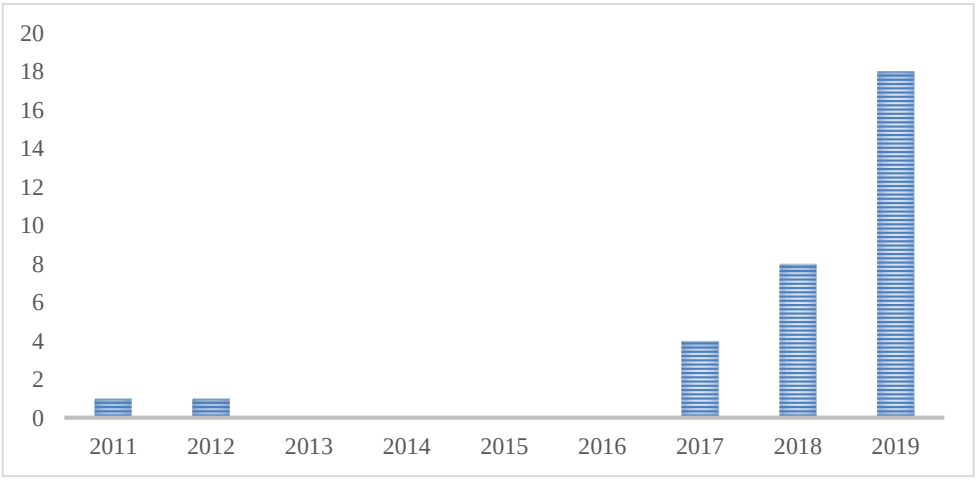

Figure 1. Number of items per year. Source: Own elaboration from Scopus.

3.2. Analysis of authors and countries

In regard to collaboration and co-authorship, there are an amount of 119 signatory authors of the 32 selected articles, therefore, in this field the rate of collaboration is high. Table 1 shows the results according to the number of signatory authors in each article, which allows us to know the collaboration networks generated in the scientific community regarding the use of escape rooms in education.

Table 1. Collaboration and co-authorship

Authors	N	%
One	5	15%
Two	5	15%
Three	6	19%
Four	7	22%
Five	3	9%
More than 5	6	19%

Source: Own elaboration.

On the one hand, as observed, most articles were written in collaboration (85%). Half of the documents were written by more than four authors, highlighting the work of Ferreiro-González, Amores-Arrocha, Espada-Bellido, Aliano-Gonzalez, Vázquez-Espinosa, González De Peredo, ... & Cejudo-Bastante (2019) with a total of 10 authors. On the other hand, the distribution of the production is described based on the number of works signed by the same author, based on Lotka's scientific productivity law. Compared to other recent studies focused on the analysis of gamification (Peirats, Marín & Vidal, 2019), on the digitalization of curricular contents (Marín, Pardo & Vidal, 2019) or on the impact of technologies on attention to diversity (Vidal, Marín, Peirats & Pardo, 2019), only occasional producers (119 authors) are found in this case, with only one document in the field.

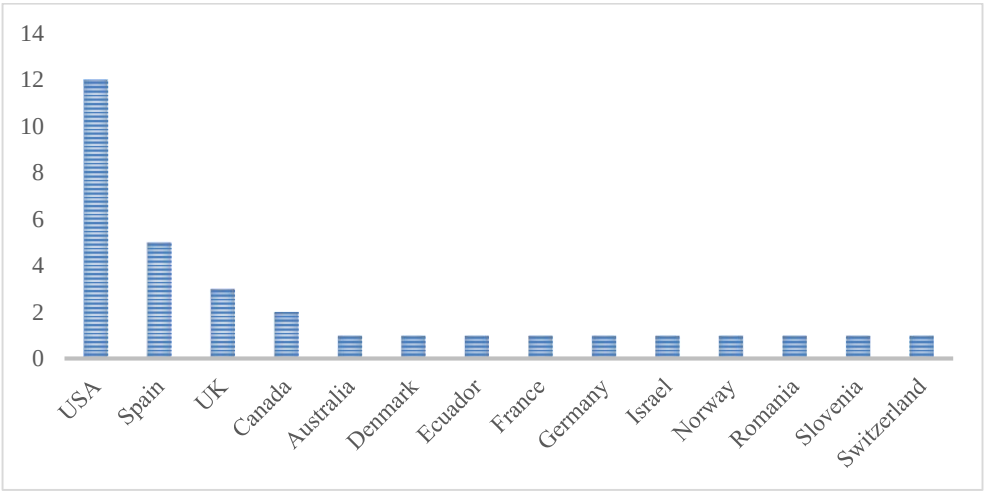

Figure 2. Publications by country. Source: Own elaboration from Scopus.

Furthermore, regarding the bibliometric size of each country (Figure 2), there are great differences, highlighting the United States with 12 documents; Spain with 5 documents (Borrego, Fernández, Blanes & Robles, 2017; Ferreiro-González, et al., 2019; Gómez-Urquiza, Gómez-Salgado, Albendín-García, Correa-Rodríguez, González-Jiménez & Cañadas-De la Fuente, 2019; Lopez-Pernas, Gordillo, Barra & Quemada, 2019; Santos, Miguel, Queiruga-Dios & Encinas, 2019), United Kingdom with 3 and Canada with 2, in addition, a total of 10 countries only have one article.

3.3. Impact analysis

Regarding the impact of the articles analyzed, counted through the number of citations received, it stand out that 34% do not have any citation and 47% have between one and five citations. These data reflects the low impact of most jobs among the scientific community. However, there are three articles with more than ten citations (Borrego, Fernández, Blanes & Robles, 2017; Dietrich, 2018; Eukel, Frenzel & Cernusca, 2017).

3.4. Content Analysis

According to the stages in which each investigation is carried out, more than 80% of the studies analyzed were focus on Higher Education, mainly in the area of future health personnel training, such as in the works from Guckian, Sridhar & Meggitt (2019), Rosenkrantz, Jensen, Sarmasoglu, Madsen, Eberhard, Ersbøll & Dieckmann (2019), or Gómez-Urquiza, et al. (2019).

In terms of benefits obtained by the participating students, we can highlight the promotion of communication and group dynamics, the increase in commitment and attention or problem-solving skills (Ross & Bell, 2019), the improvement of learning (Berthod,

Bouchoud, Grossrieder, Falaschi, Senhaji & Bonnabry, 2019; Franco & DeLuca, 2019; Novak, Lozos & Spear, 2019) or student motivation too (Kinio, Dufresne, Brandys & Jetty, 2019). Likewise, the potential of this activity is affirmed as an innovative educational tool (Ferreiro-González, et al., 2019).

Finally, regarding the content, we have analyze the most frequent keywords and we have group toghether them into categories that emerge from the reading. Analysing the keywords, the high diversity of them stands out, we could find 160 different keywords in only 32 documents. The most frequent keywords in the articles analyzed are: learning, gamification, followed by terms such as students, teaching or curriculum. Figure 3 shows the co-occurrence map of the keywords that reflects the relationships between the terms and the tendency to appear together. Three clusters or thematic relational nodes were distinguished.

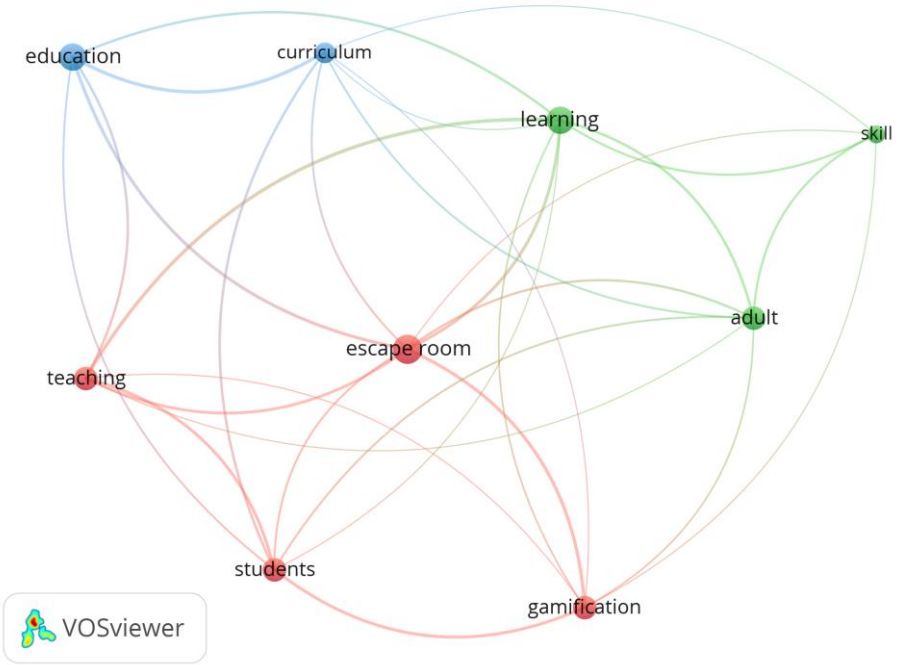

Figure 3. Co-occurrence map of terms. Source: VOSviewer

4. Conclusions

The aim of this study was to analyze trends in research regarding the use of escape room activities in educational field. To achieve this objective, a bibliometric analysis of the scientific production available in the Scopus database was carried out, considering the productivity and the content of selected documents.

We can conclude that many are the possibilities of this activity, because in recent times, despite the small number of publications found, promising results have been obtained for the improvement of education from a paradigm in which the main characters are the students, and the focus, the development of life skills.

Finally, in regard to the lines of future research, it is necessary to reflect on the application of escape room in other educational stages, on the implications that the introduction of this resource will have on teacher training, and finally to compare the results of this analysis with those obtained through other databases such as JCR or WOS.

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Assessing Community Impact after Service-Learning: A Conceptual Framework

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Abstract

Service-learning integrates experiential learning with community service, yet its community impacts have not been systematically studied. This may reflect the lack of a conceptual model for impact assessment, and failure to investigate the end-beneficiary's perspective. This study proposes a tripartite model, in which the community impact of service-learning is analyzed from three perspectives: that of the community partner, the end-beneficiary, and the service-learning intervention itself. The model identifies three impact domains salient for the community partner: the level of capacity for service; goals and value achieved; and new knowledge and insights gained. For impact domains salient for the end-beneficiary, the model utilises the needs fulfilment matrix developed by Max-Neef (1991), along with the concept of quality of life. It is argued that the model can accommodate the community impact generated from the community partner, the end-beneficiary and their interactions.

Keywords: *Service-learning; community impacts; the community partner, the end-beneficiary, needs fulfilment.*

1. Introduction

1.1. Service-Learning as a Developmental Pedagogy

Service-learning is a form of experiential education in which students engage in activities that address human and community needs, together with structured opportunities for reflection, intentionally designed to promote student learning and development" (Jacoby, 1996, p. 5). McCarthy et al. (2002) viewed the community as an important part in the service-learning equation. Eyler and Giles (1999) concluded that whether service-learning addresses needs identified by the community, predicts students' personal development. This view has been widely shared (e.g. Geschwind et al., 1997; Holland & Gelmon, 1998; Jacoby, 1996). In order to make service-learning successful, arranging for the involvement of community stakeholders in setting up the projects and evaluating the community impacts (both positive and negative) appears essential.

1.2. Limited Prior Research into Community Impact and Obstacles to Researching It

There is evidence that service-learning programs can deliver positive impacts for the community (Schmidt & Robby, 2002; Bringle & Kremer, 1993; Chan et al., 2016). There nonetheless remains a dearth of research (see Cruz & Giles, 2000; Farahmandpour & Shodjaee-Zrudlo, 2015; Sandy & Holland, 2006; Ward & Wolf-Wendel, 2000), despite a long-standing call for such research (Giles & Eyler, 1998). This absence may reflect universities' preoccupation with academic outcomes (Cruz & Giles, 2000), along with methodological challenges such as defining "community", and determining target impact domains and assessment methods, and the lack of an adequate conceptual framework. Significant weaknesses of extant studies is that they have focused on short-term impacts and have not solicited the perceptions of end-beneficiaries, possibly because of communication difficulties and vulnerabilities among some of the latter.

1.3. The Current Research

This paper proposes a conceptual framework for systematic measurement of the community impact in service-learning. Some theoretical frameworks or models addressing the perspective of the community partner already exist (e.g. Clarke, 2003; Gelmon, 2003) but directly measuring impacts on end-beneficiaries remains a challenge. The framework developed here comprises three components that drive community impact, namely the community partner, the end-beneficiary, and the service-learning intervention. For the community partner component, we reviewed previous models. For the end-beneficiary component, we derived insights from human needs research. The relationships between the three components will also be postulated.

2. Conceptualisation of Community Impact

2.1. From the Community Partner's Perspective

Some theoretical frameworks have already been developed for the community impact of service-learning. Driscoll et al.'s (1996) model sought to measure impact on students, faculty, community and institution. Clarke's (2003) 3-I model features the three following factors. First, Initiators of the service plan the projects and set the goals. Second, the community service Initiative denotes the activities or content of the projects from the perspectives of the community partners and the university. Third, the community Impact of the service comprises the results achieved for the community as viewed by the community partners and the university. Clarke (2003) designed different indicators and measurements for the three Is. Gelmon (2003) offered a theoretical framework from an inter-institutional perspective.

Table 1 summarises these three frameworks. For our own framework, we shall include the following impact domains within the community partners' perspective: perceived capacity; benefits in terms of furthering mission and values; and new operational insights.

2.2. From the End-beneficiary's Perspective

We propose that the end-beneficiaries' perspectives on their needs fulfilment and quality of life enhancement arising from the service-learning should be assessed. This need-fulfilment approach has also been proposed and accepted in the past, as in Maslow's hierarchy of needs (Maslow, 1970).

For this purpose, we have adopted the theoretical framework developed by Max-Neef (1991) for classifying human needs. In this framework, needs include aspects of deprivation and aspects of potential, reflecting axiological and existential needs, respectively. Nine types of axiological needs are identified: Subsistence, Protection, Affection, Understanding, Participation, Leisure, Creation, Identity and Freedom. People fulfil axiological needs through various means called "satisfiers", which are individual or collective forms of existential needs: Being, Having, Doing and Interacting, resulting in 36 specific needs (see Table 2). For example, in order to fulfil Subsistence needs, one must remain healthy (Being), have food and shelter (Having), maintain one's life by feeding, resting and working (Doing), and reside in a good social setting and living environment (Interacting) (32). Max-Neef claimed that this classification of needs is understandable, specific, operational, critical, and propositional, and may serve as an instrument for policy-making and action. Table 2 depicts the overall classification system.

Table 1. The Comparison of Domains of Community Impact from the Community Partner's Perspective.

No	Driscoll et al. (1996)	Items of Clarke (2003)	Gelmon (2003)
1	Nature of partnership	Helped relationships with university	Nature of community-university interaction
2	Community involvement	Community participates	
3		Project serves community	
4	Perceived capacity to serve clients	Community gained access to resources	Capacity to fulfil organisational mission
5	Economic benefits	Community was served	Economic benefits
6	Social benefits	Community was served	Social benefits
7		Helped me be active	
8		Helped residents with control	
9	New operational insights		
10		Project worked well	
11	Awareness of the university	University source of help	Nature of community-university partnership
12	Establish relationships	Partnership improved	Sustainability of partnership
13	Identification of prospective employees		
14	Satisfaction with the university interaction		Satisfaction with partnership
15		Community satisfied	
16		Additional student projects	

Source: Driscoll et al. (1996); Clarke (2003); Gelmon (2003).

Service-learning can be regarded as providing a choice of means for the end-beneficiary, i.e. satisfiers, to meet their needs. By meeting those needs, the quality of life of the end-beneficiary will be enhanced. For example, a service-learning project, in which students utilise their gerontological knowledge and interview skills learnt in class to assist in interviewing the community elderly to produce a memoir for each interviewee, covers the fulfilment of the needs for affection, understanding, creation, leisure, and identity. This occurs through various satisfiers, such as helping the elderly to recall their old times (Leisure, Doing) which results in a state of tranquility as emotion can be expressed (Leisure, Being); and through involvement in creating their own memoir (Creation, Doing) in a productive setting (Creation, Interacting), which results in their memoirs being created (Creation, Having). Table 3 illustrates how the conceptual framework fits in the example.

Table 2. The Matrix of Needs and Satisfiers

	Being	**Having**	**Doing**	**Interacting**
Subsistence	1. Health	2. Food, shelter, work	3. Feed, procreate, rest, work	4. Living & social setting
Protection	5. Care, autonomy	6. Social security, health systems, rights, work	7. Co-operate, take care of	8. Living and social space
Affection	9. Self-esteem, respect, passion	10. Partnerships, family	11. Take care of, express emotions, share, cultivate	12. Privacy, intimacy, space of togetherness
Understanding	13. Curiosity, rationality	14. Education, communication	15. Investigate, educate, analyse	16. Interaction setting, schools
Participation	17. Adaptability, willingness,	18. Duties, rights	19. Co-operate, interact	20. Participation setting
Leisure	21. Imagination, humour, sensuality, tranquility	22. Games, peace of mind	23. Memories, fantasies, fun	24. Privacy, free time, space of closeness
Creation	25. Passion, imagination, inventiveness	26. Abilities, skills, methods	27. Invent, build, design	28. Productive and feedback settings
Identity	29. Sense of belonging, consistency, differentiation	30. Language, religions, habits, reference groups, values	31. Integrate, know oneself, grow	32. Settings which one belongs to
Freedom	33. Autonomy, open-mindedness	34. Equal rights	35. Dissent, choose, disobey	36. Plasticity

Source: Max-Neef (1991).

Table 3. An Example of Service-Learning Creating Impact on Needs Fulfilment.

	Being	**Having**	**Doing**	**Interacting**
Affection	Self-esteem, respect	Relationships with students	Sharing	Spaces of togetherness
Leisure	Tranquility	Peace of mind	Recall old times	Spaces of closeness
Creation	NA	Memoirs	Build, design	Productive setting
Identity	Sense of belonging	Values, historical memory	Get to know, recognise themselves	NA

Capturing community impact from the end-beneficiary's perspective by employing this conceptual framework carries several advantages. First, it is the most direct, understandable, and intuitive way to access the perspective of service recipients. Second, classifying the needs and satisfiers into operational types makes direct measurement more systematic. Third, the identification of multiple types of needs and satisfiers can enable the measurement of community impact to transcend monetary terms, i.e. going beyond the issue of how efficiently the funds for service-learning projects are being spent, from the institutional (e.g. the university and community partner) perspectives. Fourth, this classification also allows the assessment of community impact to go beyond the direct service type of service-learning. For example, the needs for Creation can be applicable to many innovative service-learning projects, whereas the outcomes arising from addressing the needs for Understanding can be assessed when evaluating the impact of advocacy-based service-learning projects.

3. Putting it Together: A Tripartite Model

The perspectives of the community partner and the end-beneficiary, along with the service-learning intervention, produce a tripartite model shown in Figure 1. The model regards both community partners and end-beneficiaries as recipients of the community impacts created by service-learning. The model also subsumes the role of community partners as mediators between service-learning interventions and their impact on end-beneficiaries. On the operational level, we propose to measure impact on the community partners across three categories of outcome: capacity level, knowledge and insights gained, and contribution to their goals and values realisation. We propose to measure impact on end-beneficiaries according to the fulfilment of targeted needs within the Max-Neff's framework, and we will also ask an overall question about the enhancement of quality of life for the end-beneficiary.

Given likely variety of targeted impacts for different sets of end-beneficiaries, this model envisages the use of multiple measurement methods for assessment, including surveys, focus groups, interviews, on-site observation, and analysis of extant data, depending on the context. The first phase of the assessment sequence is an initial qualitative study to identify the apparent intended outcomes. The second phase involves using the conceptual framework, adapted if necessary, to guide the creation of a quantitative measurement instrument for surveying and clarifying stakeholders' expectations. The resulting instrument will provide a concrete framework and set of guidelines to be employed in subsequent phases of interim and post-service evaluation.

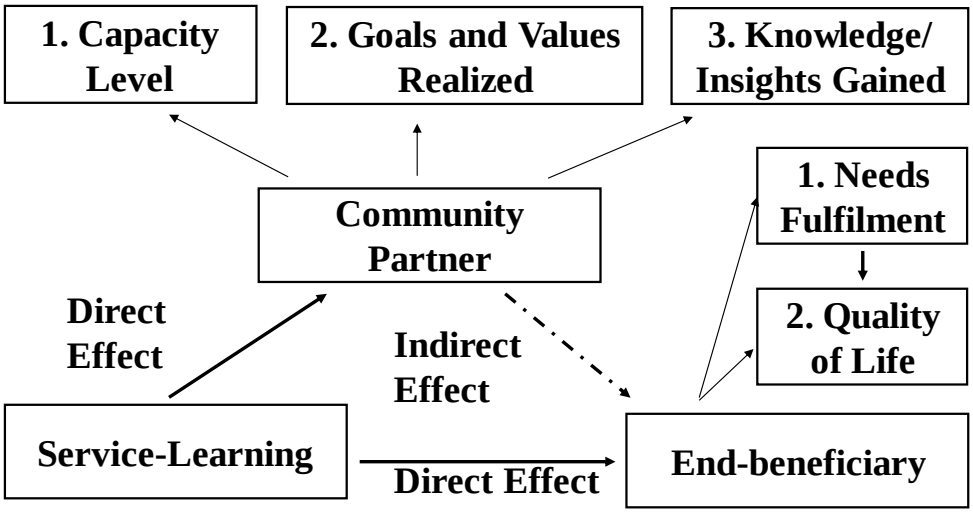

Figure 1. The Proposed Tripartite Model for Assessing Community Impact.

4. Conclusions

This paper outlines the importance of measuring the community impacts of service-learning. We have proposed a tripartite framework that encompasses the service-learning intervention, the community partner, and the end-beneficiaries for developing assessment tools for measuring community impacts of service-learning from both the community partner's and the end-beneficiary's perspectives. The model assesses the impact on a community partner in terms of enhancement of capacity, new knowledge and insights gained, and whether the service-learning project assists in advancing the community partner's goals and values. The model employs the concept of needs fulfilment of Max-Neef (1991), to indicate the nature and extent of the community impact for the end-beneficiary arising from service-learning projects, which we envisage can be effectively captured by customising a set of survey items for measuring need fulfilment.

Since service-learning projects and their intended community impacts are tailored, we have proposed a two-phase approach for designing impact assessment methods. We have recommended a pre-service qualitative study for identifying intended community impacts through focus groups, interviews, and extant data analysis. To this end, a qualitative study investigating whether the model proposed in this paper corresponds to the desired outcomes opined by community partners in service-learning, is underway. Thereafter, drawing on the conceptual framework, potentially modified in light of the qualitative study, tailored sets of survey items and focus group guidelines can be developed for interim and post-service evaluation.

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Staff Experiences of Victoria University's First Year College During the Implementation of Block Mode Teaching

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Abstract

This report reviews the findings of staff satisfaction surveys conducted in 2018 and 2019 following the creation of a transformative and revolutionary approach to tertiary education in Australia, namely the creation of a new First Year College at Victoria University. Lectures were abolished from all units; class sizes were reduced; class timetabling was dramatically changed to allow for greater student study flexibility and accessibility; learning and teaching professional staff numbers were increased and facilities were built and repurposed. This report discusses the staff satisfaction and challenges encountered by staff in 2018 and 2019 providing quantitative and qualitative data. This data revealed high levels of satisfaction along with concerns about workload and related issues. Variations between 2018 and 2019 indicate that despite an increase in overall satisfaction, staff were concerned about awards and recognition, involvement in decisions that affected them, and receiving support to conduct their roles. The First Year College implemented a series of measures to address the issues raised in the 2018 survey. Further measures are recommended following the 2019 survey as well as future surveys that include stress levels and other psychological markers.

Keywords: *Staff Satisfaction; Tertiary Education; Academic Transformation; Staff Challenges.*

1. Introduction

In 2018 Victoria University (VU) embarked upon a transformative and innovative approach to delivering tertiary education in Australia (Victoria University, 2017). VU set about developing and implementing the VU First Year Model (FYM), and this was supported by the creation of a First Year College (FYC). During 2018, the FYC delivered 160 units using block mode (intensive, one unit at a time condensed form of teaching), supported by student-centered learning and three highly engaging three-hour workshops per week. The workshops were based in active learning principles (Kift, 2015) and replaced the traditional lecture/tutorial delivery. All assessment and feedback is completed during the four-week block. Each unit was underpinned by transitions pedagogies (Kift, & Field 2009; Kift, 2015).

The success of the First Year Model (FYM) has led to its further implementation across all years of undergraduate courses at VU, beginning with second year courses in 2019. FYC staff from all disciplines supported and collaborated with each other in the planning of units, assessments and student-centered engagement activities (McCluskey, Weldon, & Smallridge, 2018). As the staff survey results indicate, there was a sense of belonging and collegiality that was deemed important to most staff.

Research on university staff has found consistent levels of distress amongs academics. A Malaysian study measured six dimensions of satisfaction on university teaching staff: leadership, staff involvement, workload, self-development, working environment and communication. Findings indicated a moderate level of satisfaction (Sidik, Ab Hamid, & Ibrahim, 2017). University staff may suffer from high levels of anxiety, depression, and stress related illness compared to general population samples (Winefield, & Jarrett, 2001; Mark, & Smith, 2012). Winefield, Gillespie, Stough , Dua, Hapuarachchi, and Boyd (2003) found that work overload, time pressure, lack of prospects, poor levels of reward and recognition, fluctuating roles, poor management, poor resources and funding, and student interactions, expectations, low job security, lack of communication, inequality, and lack of feedback were associated with stress in universities in the UK. Winefield and Jarret (2001) reported that 43.7% of university staff had high levels of anxiety and depression in a sample of over 2000 Australian university employees. In addition, these authors found strong associations between efforts, demands, control, supports, and rewards, and depression, anxiety, and job satisfaction and also between coping and attributional style. Rewards, social support, job control, and positive coping and attributional behaviours were associated with lower levels of depression and anxiety and high job satisfaction it was also found that university staff were more likely to claim that workplace conditions had caused or made an illness worse and were twice as likely to complain of stress or anxiety and depression-related illness (Winefield & Jarret).

Mark and Smith (2010) found strong associations between the traditional variables of efforts, demands, control, supports, and rewards, and depression, anxiety, and job satisfaction and also between coping and attributional style and these outcomes. In a 2003 study university staff reported concerns with excessive workloads, unbalanced rewards systems and lack of support. However, staff appeared to be satisfied overall and willing to continue working for the university (Houston, Meyer, & Paewai, 2006).

2. Methods

2.1. Participants

In March 2018 and 2019, First Year College staff were surveyed about their experiences in the newly implemented First Year College (FYC). The staff of the FYC consist of 76% fulltime and 24% part-time academics. Academic teaching researchers (ATRs, research and teaching focussed) make up 45% of this cohort , academic teaching scholars (ATSs, teaching focussed) the other 55%. There was a 30% participation rate in 2018 and 29% in 2019 from total of a 106 staff members.

2.2. Materials

The First Year College devised a survey that sought to identify what had worked well for teaching staff, together with the key challenges faced in delivering the revolutionary FYM. The survey consisted of 18 questions including three open-ended questions that allowed staff to respond in their own words about their work environment, successes and challenges. There were two demographic questions; “What is your role? and What is your enrolment status?” and 13 quantitative questions to answer on a Likert 4-point scale from strongly disagree (0) to strongly agree (4) (see table 1).

2.3. Procedure

Every ongoing (full & part-time) member of staff was contacted by email by the Dean and invited to participate in the survey via a link. Staff were advised of the voluntary and confidential nature of the survey as well as the approximate time it would take to complete (20 minutes). The Human Resources department at VU were responsible for the collection and collation of the data and the reporting of this to the FYC Dean. A general overview of de-identified results was reported to the FYC leadership group. Researchers obtained a full copy and transcript of the findings of the two surveys following a request to the Dean of the FYC.

3. Results

Quantitative Responses Staff responses to a set of 13 questions about the FYC and work environment are listed in Table 1.

Table 1. Staff Responses Relating to the FYC and Work Environment Comparison between 2018 and 2019.

Agree – Strongly Agree Answer	2018	2019	Variation
I am proud to tell people where I work	86.21	91.49	5.28
The FYC motivates me to go above and beyond in my role	86.21	85.10	-1.11
I can see myself working in the FYC in 2 years' time	82.76	89.36	6.60
I am very satisfied with my current job	72.41	87.23	14.82
I have confidence in the FYC leadership team	93.10	87.23	5.87
I know what is expected of me at work	93.10	91.70	-2.40
I have the materials and equipment I need to do my work right	93.10	87.24	-8.86
I find my day to day work challenging and interesting	100	91.49	-8.51
In the last ten days, I have received recognition or praise for doing good work	96.20	65.95	-26.25
I am given the opportunity to be involved in decisions that affect me	82.76	65.95	-16.81
At work, all my colleagues are treated with respect	96.35	87.23	-9.12
I feel that I have the necessary support I need to perform successfully in my role	88.89	82.22	-6.61
I feel I am coping with the new block model	86.21	84.45	-1.76

Table 1 shows positive and negative variation with a particularly large negative variation in relation to recognition and praise. However, there was a marked increase in job satisfaction levels.

In an inductive content analysis process recommended by Nowell et al. (207) three open questions were formulated. Firstly, provide "General comments about the environment". Key themes identified were high satisfaction levels, elevated motivation and good opportunities

for personal growth which were consistent across both years. Secondly, staff were asked "What Worked Well for Teaching Staff within their Immediate Work Area?" and identified "team work and collegiality", "student focused approach" and " critical support for teachers" as strength and positive elements consistently over 2018 and 2019. Finally, in relation to the question: " Tell us about some things that could be changed or improved." there was a bigger range of themes and noticeable differences between both years. One of the main themes was: "Review excessive workloads" which appear to be a bigger concern in 2019 with a large of comments regarding this issue. There were further comments related to class and room allocations, office spaces, breaks between classes, breaks between blocks and other challenges for academics.

4. Discusssion

Results indicated that the primary challenge for all staff were related to increases in workload, with longer teaching hours, faster turnarounds required for marking and continual updating of the learning management system online spaces compared to "traditional" university teaching. Using these principles in conjunction with developing engaging three-hour workshops was certainly a challenge and many staff worked on unit development until day one of the semester. It was a time of great innovation in the areas of pedagogy, engagement and assessment. While many Australian academics and institutions support the concepts and philosophy of transitional pedagogy, only VU has adopted institution-wide reforms and transformation in this area (Victoria University's Transformational Agenda, 2017). A strategic whole of institution suite of transition activities including curricular, co-curricular and administrative support functions are mediated through "the organizing device of curriculum" (Kift, & Nelson, 2005, p. 232). The results are consistent with those of Kiplangat, Momanyi and Kangethe (2017) as high level of staff satisfaction were reported despite concerns about workloads and other class allocations. The high level of approval of managerial leadership practices may influence satisfaction levels. The staff responses revealed high scores for leadership, staff involvement and working environmentand communication leading to higher levels of satisfaction and desire to continue to work at the FYC (Sidik, Hamid, & Ibrahim, 2017).

There were many successes in the implementation of the FYC and the FYM, there were also many challenges. Major organisational change operates at many levels including process, structures, systems and institution wide obstacles (Marshall, 2012). While the primary focus of the FYC and the FYM was to make the curriculum student-centered and engaging, the shift to block mode-teaching delivery had wide reaching effects. VU's Transformation Change paper (Victoria University, November 2017), as part of the organisational and revolutionary transformation recommended the implementation a First Year College, a separate entity that has dramatically changed (revolutionized) tertiary education with a

complete overhaul of the teaching strategies and content delivery. In addition, themes and concerns are consistent with previous literature in relation to poor levels of reward and recognition, work overload and time pressure which may cause stress and anxiety amongst staff (Mark, & Smith, 2010; Winefiled, & Jarred, 2001: Winefield et al., 2003). The results also indicated that social support may also influence levels of satisfaction (Mark, & Smith, 2010).

Despite this, the results from the FYC Survey are most encouraging. They suggest the teaching staff have, in the main, embraced, endorsed and appreciated their involvement in the block-teaching model. Results indicated an increase in overall staff satisfaction, staff confidence in the leadership and very high likehood that staff would be working for the FYC in the two years. The quantitative and qualitative results appear to be consistent and congruent indicating a desire for recognition and inclusion in decision making as well as a need for technical support. However, the generasibility of the findings appears limited given a relatively low participation rates. A follow-up survey in 2020 may be useful to monitor the reaction to changes implemented as results of this research and may include measures of stress and ability to cope.

In response to the surveys conducted so far a number of initiatives have been implemented to minimize staff burn-out. These include: A FYC Wellness committee, Women in First Year College group, review of roles and responsibilities of ATS and ATR staff, review of workload allocation across the year, access to professional development to support teaching staff and one-on-one meetings with the Dean for each teaching staff member. Improvements and enhancement in staff satisfaction levels as a result of the surveys validate these instruments as efficient evaluation tools.

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Conceptual Framework for Assessing Process Variables Salient for Service-Learning Experience

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Abstract

Service-learning is an established pedagogy which integrates experiential learning with community service. It has been widely adopted in higher education around the world including in Hong Kong, yet the key ingredients that determine its successful impacts for its stakeholders have not been fully assessed. This study reviewed the past literature, which indicates the key ingredients that may be found in successful service-learning programmes. We identify six key ingredients: students provide meaningful service; the community partner representative plays a positive role; effective preparation and support for students; effective reflection by students; effective integration of service-learning within the course design; and stakeholder synergy in terms of collaboration, communication and co-ownership. In order to obtain an inter-subjectively fair and trustworthy data set, reflecting the extent to which those key ingredients are perceived to have been achieved, we propose a multi-stakeholder approach for data collection, involving students, instructors and community partner representatives.

Keywords: *Service-learning; process variables; assessment; outcome; multi-stakeholder approach.*

1. Introduction

1.1. The Need to Assess Key Ingredients That Drive Benefits in Service-Learning

Service-learning, a form of experiential learning which aims to enable and empower students to apply knowledge learnt in class to serve people and or organizations in a community setting, has been adopted by a number of higher educational institutions in Hong Kong over the past decade (Snell & Lau, 2020). In adopting service-learning pedagogy, these institutions appear to adhere to the original objective of service-learning, defined as "a form of experiential education, in which students engage in activities that address human and community needs together with structured opportunities for reflection, intentionally designed to promote student learning and development" (Jacoby, 1996, p. 5).

A broad range of intended developmental outcomes for students have been invoked. For example, Lingnan University's service-learning programme aims to enhance seven graduate attributes, including problem-solving skills, critical thinking skills and social competency (Ma & Chan, 2013). The Hong Kong Polytechnic University launched its service-learning programme in 2010 to facilitate four developmental outcomes: a) knowledge and skill application; b) empathy, civic engagement and responsibility; c) becoming professional and responsible citizens; and d) connecting between the academic content and the need of society (Chan & Ngai, 2014).

As a rigorous pedagogy that has received much attention and development over the last two decades, the learning outcomes of service-learning have been extensively researched and documented (e.g. Celio et al., 2011; Conway et al., 2009; Warren, 2012; Yorio & Ye, 2012). However, the key ingredients regarding how to implement successful service-learning projects, which lead to positive outcomes, have not been as systematically investigated as the outcomes themselves, particularly in Hong Kong. The current paper therefore builds an analytical framework based on the past literature, and goes on to propose a measurement instrument based on the key ingredients associated with successful service-learning projects, so as to complete a missing link in service-learning research in Hong Kong and beyond.

1.2. The Key Ingredients Proposed for Successful Service-Learning in Past Literature

In his book, "Service-Learning in Higher Education", Jacoby (1996) listed a series of good practices in service-learning. These comprise five ingredients: a) make sure that community voices are included in developing the service-learning programme; b) sufficient orientation and training for students to engage in and learn from their service-learning experience; c) meaningful action, which means that the service components of the service-learning are necessary and valuable for the community; d) effective reflective activities for students to

consolidate their learning after service-learning experience; and e) effective evaluation that measures the impacts of the service-learning on students and on the community.

Jacoby (1996) also stressed other important principles, derived from previous studies, including: continuous improvement of service-learning programmes; provision of sufficient support and coordinating mechanisms; minimizing the distinction between the student's learning roles in the community and in the classroom; maximizing the orientation of the respective courses toward encouraging responsibility for the community; not compromising academic rigor for service contribution; and crediting students for demonstrating their learning and not for providing the service.

In addition, Jacoby (1996) proposed a service-learning 'kaleidoscope' as a means to assess the extent to which the above principles have been put into practice for a given service-learning project. The kaleidoscope encompasses three aspects of stakeholder collaboration. The first aspect involves common goals and purposes, including shared responsibility and authority, sharing of resources, regular exchange of information, mutual adjustment, mutual capacity enhancement, and mutual trust. The second aspect is reciprocity, under which every stakeholder functions as both learner and educator, thereby avoiding exploitation. The third aspect is diversity in the service-learning context, which enables participants to appreciate and respect human differences and not be confined by one's own perspective.

Around the same time, Eyler & Giles (1999) reported findings from a research study that gathered data from interviews with students regarding what made their service-learning effective. Eyler & Giles (1999) distinguished five programme characteristics that are predictors of effective service-learning outcomes. They are: a) placement (or service) quality; b) quality of knowledge application; c) inducement of effective student reflection; d) exposure for students to diverse groups; and e) influence of community voices.

Although Eyler & Giles (1999) found that the above five characteristics were in most cases positive predictors of students' development, there were sometimes exceptions regarding diversity and community voices. Sometimes these were negative predictors, due to tensions arising from differences between the expectations and interests of different stakeholders. Furthermore, Eyler & Giles (1999) invoked the Five C's principles for effective service-learning reflection: Connection, Continuity, Context, Challenge, and Coaching.

Godfrey et al. (2005) identified three critical ingredients for successful service-learning and have characterized them as the 3 Rs. The first of these is Reality, in terms of how service-learning can connect real situations with academic content. The second is Reflection, which enables students to think deeply about their service-learning experience and its personal impact on themselves. The third is Reciprocity, which involves the students and the community contributing and combining their different bodies of knowledge and working together so that synergy occurs as both parties gain from their collaboration.

Hong Kong based researchers, Chen et al. (2018) identified three interrelated variables in addition to the above-mentioned 3 Rs, which help distinguish between service-learning project experience and non-service-learning project experience. The first variable is project experiences. These are primarily set up by a centralized office of service-learning, in order that there is an effective communication network that connects the salient university and community stakeholders. The second variable comprises partner organization representative responsiveness, i.e. POR responsiveness, the extent to which PORs offer open access for students to people, resources and information that are essential to furthering the project. The third variable is project efficacy belief, which represents the students' perceptions that their projects will make a positive difference, and derives from the 3Rs, plus a sense of mastery experience, perceptions of enacting effective social persuasion, and positive role modeling by other students engaged in the same service-learning project.

The findings of Chen at al. (2018) resonate with an earlier paper by Snell et al. (2015), which derived a set of ten principles for service-learning based on a qualitative study in Hong Kong. The first of these is that service-learning projects should address authentic problems or needs. Second, PORs should commit to their ongoing availability for consultation. Third, students should receive a complete orientation to service-learning. Fourth, project themes should align with the course curriculum. Fifth, there should be a foundation of inter-institutional commitment and trust. Sixth, there should be initial site visits by students prior to the main project phase. Seventh, there should be in-class project consultations during the service-learning phase. Eighth, there should be shared and supportive leadership within the student project team. Ninth, instructors should provide templates to help students to reflect on the processes and outcomes of their personal development. Tenth, project reports and reflective reports should be included among the graded coursework assessment requirements.

1.3. Operational Process Variables for Successful Service-Learning Experiences

Based on the above discussion about the past literature, the key ingredients that contribute to successful service-learning experiences and outcomes can be analyzed into six overall ingredients. The first of these is *meaningful service*, comprising significant action, inclusion of community voices in establishing service needs, and the experience for students of encountering social diversity during the service. The second is that the *POR plays a constructive role* by, for example, being readily available for and responsive to questions. The third is that the students receive *effective preparation and support*, including domain-specific training, orientation, consultation during the service-learning project, and logistical support. The fourth is engagement in *effective reflection* as a means for connecting the student's experiential learning during service to the course curriculum. The fifth is *effective course design*, such that project themes are closely linked to the course curriculum, and that student's project reports and reflections an integral part of the assessment requirements for

the course. The sixth is *stakeholder synergy*, based on effective collaboration, co-ownership, and communication, along with reciprocity in terms of resource commitments and derived benefits. Table 1 summarizes how the six key ingredients proposed in the current paper correspond to the literature reviewed in the previous section.

Table 1. Summary of the Proposed Key Six Ingredients.

Key Ingredients	Reference Sources
1. Meaningful service	a. Meaningful action (Jacoby, 1996)
	b. Addressing authentic problems (Snell et al., 2015)
	c. Reality (Godfrey et al., 2005)
	d. Project efficacy belief (Chen et al., 2018)
	e. Community voices are included (Jacoby, 1996)
	f. Influence of community voices (Eyler & Giles, 1999)
	g. Service quality, diversity in service (Eyler & Giles, 1999)
2. POR plays a constructive role	a. POR responsiveness (Chen et al., 2018)
	b. POR commitment (Snell et al., 2015)
3. Effective preparation and support	a. Sufficient support, coordination, orientation & training (Jacoby, 1996)
	b. Project experiences (Chen et al., 2018)
	c. In-class project consultation (Snell et al., 2015)
4. Effective reflection	a. Effective reflective activities (Jacoby, 1996)
	b. Effective student reflection (Eyler & Giles, 1999)
	c. Reflection (Godfrey et al., 2005)
	d. Measures to enhance student reflection (Snell et al., 2015)
5. Effective course design	a. Service aligning with course curriculum (Snell et al., 2015)
	b. Quality of knowledge application (Eyler & Giles, 1999)
	c. Effective evaluation (Jacoby, 1996)
	d. Crediting students for demonstrating their learning (Jacoby, 1996)
	e. Grading service project results (Snell et al., 2015)
6. Stakeholder synergy	a. Common goals, purposes, responsibility & resources (Jacoby, 1996)
	b. Reciprocity (Godfrey et al., 2005)
	c. Inter-institutional commitment and trust (Snell et al., 2015)

2. A Multi-stakeholder Approach for Assessing the Key Ingredients

Success in service-learning requires collaboration between the stakeholders, who comprise students, instructors, PORs, end-beneficiaries of the service, and the coordinating centre, which is typically an office of service-learning (Wade, 1997). Accordingly, for assessing the extent to which the aforementioned key ingredients are present, we propose a multi-stakeholder approach, using mainly quantitative data collection methods, supplemented where appropriate by qualitative methods, with questions about particular key ingredients addressed to the salient stakeholders. For example, ingredients related to the constructive role of the POR will be answered by instructors and students, whereas whether students engage in effective reflection will be assessed by instructors and PORs. Although the experiences of end-beneficiaries are important in service-learning, for various reasons (e.g., time availability, contactability) it may not be feasible to collect data directly from them about their perceptions. As a pragmatic approach, we suggest that the perceptions of end-beneficiaries can be reflected through the observations of the POR as a proxy.

Table 2 lists the proposed items for measuring key ingredients in the process of service-learning that were synthesized from the literature presented in the previous chapter and according to the above multi-stakeholder framework.

Table 2. The Proposed Conceptual Framework for Assessing Key Ingredients in Driving Service-Learning Success with Sample Survey Questions for Stakeholders.

Process Aspect/ Variable	Sample Items	Answered by*		
		I	S	C
1. Meaningful service				
a. Significant action	i) The service was aligned with the real needs of our service recipients ii) The service providers (students) were able to address the concerns of our service recipients iii) The service providers (students) were able to make a positive contribution for our service recipients iv) The service providers (students) were able to help the partner organization to improve its service	Y	Y	Y
b. Inclusion of community voices	i) The planning of the service was informed by community voices ii) The execution of the service involved community voices (such as in adjustment)	Y	Y	Y
c. Diversity being experienced in service	i) The service enabled students to interact with people from different backgrounds	Y	Y	Y

2. POR plays a constructive role, i.e., whether they are:				
a. Responsive	i) responded helpfully to my/our questions and enquiries	Y	Y	
b. Available	ii) were available when needed	Y	Y	
c. Taking up a positive role	iii) provided constructive feedback on my/our ideas and suggestions	Y	Y	
3. Effective preparation and support provided to students, including:				
a. Training	i) training for providing the service	Y	Y	Y
b. Orientation	ii) orientation about service-learning iii) orientation about the community partner(s)	Y	Y	Y
c. Consultation in the Process	iv) consultation in the process when difficulties arose	Y	Y	Y
d. Support by the Instructor	v) support by the instructor		Y	Y
e. Support by the School	i) support by the school (such as Office of Service-Learning) vii) support to prevent or resolve any problem of free riding in the student team	Y	Y	Y
4. Effective reflection	i) The students conducting the service were able to perform effective reflection on their service-learning experience	Y		Y
5. Effective course design				
a. Project themes integrating with course curricula without compromise	i) The service was well-matched with the course curriculum ii) The service was closely aligned with the academic goals and topics of the course	Y	Y	
b. Making student's service outcomes as part of assessment	iIi) The course made the student's service project reports and reflections an integral of the assessment	Y	Y	
6. Stakeholder synergy				
a. Collaboration, communication and co-ownership	i) All stakeholders collaborated well during the service ii) All stakeholders communicated well with each other during the service iii) All stakeholders shared ownership of the desired project outcomes iv) All stakeholders were committed to achieving the desired project outcomes	Y	Y	Y

	v) All stakeholders were willing to go the "extra mile" for the project vi) All stakeholders were able to think "outside the box," and apply questioning insight			
b. Reciprocity	i) During the service, the end-beneficiary or beneficiaries was/were able to learn from other stakeholders, such as the student, the instructor and the community partner(s) ii) During the service, the students were able to learn from other stakeholders, such as the end-beneficiaries, the instructor and the community partner(s) iii) During the service, the instructor was able to learn from other stakeholders, such as the students, the end-beneficiaries and the community partner(s) iv) During the service, the community partner(s) was/were able to learn from other stakeholders, such as the student, the end-beneficiaries and the instructor	Y	Y	Y

Remark * I: Instructors; S: Students; C: PORs.

In addition to gathering data about the above process variables, we also consider that it is important to obtain the POR's perspective on three broad community impact domains, namely, perceived capacity enhancement; perceived benefits from furthering the mission and values of the partner organization; and new operational insights for the POR.

3. Conclusions

Based on a review of prior literature, this paper has identified the importance of assessing the extent to which six key ingredients of successful service-learning projects are present. Among these six ingredients, it is important that students provide meaningful service, and that the POR plays a constructive role. The preparation and support provided to students, the reflection activities in which they engage, and the integration of the service-learning project within the course design should all be effective. In addition, there should be stakeholder synergy in terms of collaboration, communication and co-ownership. For data collection, it is proposed to solicit the perceptions of students, instructors and PORs about salient ingredients, treating the POR as a proxy for the end-beneficiaries. We have proposed some sample survey items for the key ingredients.

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International attractiveness of undergraduate and postgraduate studies: is scientific production a determining factor?

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Abstract

The main objective of this research is to identify the influence of the scientific production of universities on their international demand. Specifically, we study whether the level of international demand, and the origin of this demand, is conditioned by the volume and quality of the scientific publications produced by Universities. In order to identify the influence of the volume of scientific production of the universities on their international demand, we have carried out various analyses of variance, using as a dependent variable the international demand and as an independent variable the volume of publications per professor and also the impact of these publications.

According to the results obtained, some international demand variables present significant differences depending on the number of scientific publications per university professor. Furthermore, these results show that there are no significant differences in the international attractiveness of postgraduate studies according to the impact of the scientific output of the universities. Given these results, we cannot conclude that the quality of scientific production of the Universities is a determining factor in attracting students from other countries. This first study points to a necessary reorientation of the requirements on university teaching staff if the international attractiveness of Spanish universities needs to be increased.

Keywords: *Higher education, International, Postgraduate, Scientific production.*

1. Introduction

The current environment shows a decrease in the demand for university studies due to demographic evolution and, otherwise, an increase in the supply of postgraduate studies. Student mobility is greater and, as a consequence, the university market needs to be broaden to foreign students.

The international arena and, in particular, the European Higher Education Area –EHEA- is a reference for all institutions. The increase in the international attractiveness of higher education institutions is highlighted in the report on the Strategy for the Internationalization of Spanish Universities 2015-2020. In this report it is emphasized that "*Universities must contribute to increasing Spain's* ***attractiveness*** *and* ***competitiveness*** *in a context of global competition for talent (students, professors, researchers, professionals, entrepreneurs*)". Specifically, a strategic axis is defined as *"increasing the international attractiveness of universities, improving the visibility and international recognition of university campuses as attractive environments"*.

The growing importance of scientific production in the University is well known in the teaching profession. Therefore, this requirement for scientific production is increased for teaching and research staff, and at the same time there is a need to deepen the knowledge of the international attractiveness of universities. Our focus is on how to relate these two factors. The data has been generated from the bibliographic records included in the data base of Scopus (owned by Elsevier B.V.), which currently contains more of 54 million documents with their Bibliographical references, from out of a total of about 30,000 Scientific journals from all fields. The amount of Scopus data doubles the number of Journals indexed with respect to the Web of Science (from Thomsom Reuters), which ensures a greater thematic and geographical coverage. It is absolute production, normalized impact, percentage of production in journals of the first quartile, for its impact and percentage of led documents that achieve scientific excellence.

The aim of this research is to identify the influence of the scientific production of universities on their international demand. Specifically, we study whether the level of international demand or the origin of this demand is conditioned by the volume or quality of the scientific publications of the universities. In short, the following research questions are intended to be answered.

- Does the volume of scientific production influence the international demand for higher education?
- Does the quality or impact of such scientific production affect the international demand for higher education?

Given the different nature of undergraduate and postgraduate studies, we have considered

that the behavior of their demand may be conditioned by different factors, and we have therefore analyzed it in a differentiated manner.

The article is structured in five parts. After this introductory section, the theoretical framework is presented. In the third and fourth sections, the results of the analysis of international demand for undergraduate and postgraduate studies are presented. The last section contains the main conclusions of the study.

2. Theoretical framework

Analyzing the data bases referring to academic articles, it can be seen that there is a shortage of articles focused on the analysis of the attractiveness of Universities according to their scientific publication indicators. A starting point might be the capability of the University for attracting international researchers -not students-. This issue can be explained taking into account the combined influence of the factors of each country and the research orientation of university institutions (Lepori, Seeber and Bonaccorsi, 2015). There is also evidence that research orientation influences the creation of international networks (Seeber et al, 2012); and that the possibility of developing a research career in the destination country facilitates the recruitment of foreign researchers (Ivancheva and Gourova, 2011). Furthermore, the internationalization of researchers is also positively related to the internationalization of students, especially in the case of doctoral students (Horta, 2009). As for the attractiveness of universities to students, the added value of studying abroad over studying in the home country arises as a result of a combination of the attractiveness of the host country and the appropriateness of academic programs (Tarrant, Rubin and Stoner, 2014). Most studies indicate that a combination of the desire to travel and the opportunity to have a different experience (Lewellyn-Smith andMcCabe, 2008; Novak, Slatinsek and Devetak, 2013) with other factors such as the cost of living, language, even the climate of the destination country (Rodríguez González, Bustillo Mesanza and Mariel, 2011), or the student's previous mobility trajectory are factors that drive mobility.

In Spain, we can highlight the study carried out for the Catalan Universities (Roselló Villalonga, 2013). In addition to the quality of the teaching staff -measured on the basis of the level of inbreeding, the success rate of the current research sections on potential sections, percentage of doctoral professors and number of students per professor-, the author also analyses the influence of the quality of the students and the resources of the University (expenditure per student) on the choice of the destination University. The quality of students is measured by the grade point average, the average number of students enrolled, the rate of achievement (credits passed over credits enrolled), and the dedication of the student body enrolled. A promising result of this analysis indicates that students do take into account the quality of the faculty when choosing a university.

Postgraduate studies in Spain are not yet as developed as in other European countries, due to the fact that incorporation into the EHEA has taken place later, and there is a lesser tradition of continuing to study once undergraduate studies have been completed. Besides, a change of trend is beginning to be observed in postgraduate studies: until now, universities have tried to differentiate themselves by offering a wider range of undergraduate degrees, but the search for differentiation in postgraduate studies is beginning to be observed, not by offering a greater diversity of postgraduate studies, but by seeking the specialization and quality of these studies. The main way to measure this quality is through research results (Pérez García and Serrano Martínez, 2012), highlighting articles published in reference journals or the achievement of competitive grants (Print and Hattie, 1997). In other words, two relevant variables appear here: scientific production (research results) and enrolment in postgraduate studies. For data relating to 2010, both variables are positively related, but one variable explains little about the behavior of the other (Pérez García and Serrano Martínez, 2012, p. 183).

3. International demand for undergraduate studies

In this section, the effect of scientific production on the international demand for higher education is presented. The level of international demand is given by the number or percentage of international undergraduate students in the different universities and the origin of said demand by the number or percentage of students from different origins. The information on demand variables has been extracted from the Statistics on University Students of the Ministry of Education, Culture and Sport for the academic year 2014-2015. These statistics provide definitive data on students enrolled in Spanish universities.

With respect to scientific production, we have considered the volume of scientific publications from universities and the relative quality of these publications measured through impact indicators. All the data related to the publications of the Spanish universities have been collected from the Knowledge and Development Report 2014 prepared by the Knowledge and Development Foundation. In the fifth chapter of this report Corera, Chinchilla, De Moya and Sanz (2014) present the main research results of Spanish higher education institutions during the period 2009-2013. In order to reflect these results, these authors show both the total volume of scientific publications of the universities and their impact. Data on the scientific output of universities have been generated from the bibliographic records included in the Scopus database. Using this information in this paper, we have created two variables to classify universities according to their volume of scientific production and according to the quality of that scientific production.

Firstly, taking into account the number of documents published by each university during the 2009-2013 period, included in the Knowledge and Development Report 2014, and the total

number of professors from each university, included in the Universities Personnel Statistics for the 2014-2015 academic year published by the Ministry of Education, Culture and Sport, we have calculated the volume of scientific production per professor of each institution. Considering this information, the variable built indicates if the volume of scientific production of a university is high or low depending on whether or not it exceeds the average of publications per professor of all universities.

On the other hand, to measure the quality of the research results of the universities we have considered the impact of their publications. Corera, Chinchilla, De Moya and Sanz (2014) in the aforementioned report present a normalized impact index for the different Spanish higher education institutions. This index tries to reflect the quality of the scientific production of the universities so that the institutions with a normalized impact in the world average have an index equal to 1. This means that the works of this institution have been published in journals that are in the average impact of their category. Taking into account the normalized impact index, we have created a variable that distinguishes between universities with high and low impact scientific production according to whether this index is greater than 1 or not.

Through various analyses of the variance of one factor, the effect of the volume and quality of scientific production on the international demand of Spanish universities is studied in this paper. This technique is based on a contrast of equality of means and makes it possible to detect significant differences in the values of a dependent variable according to the categories of an independent variable. In the following paragraphs the main results obtained are presented.

3.1. Volume of Scientific Production

In order to identify the influence of the volume of scientific production of the universities on their international demand, we have carried out various analyses of variance using as a dependent variable some international demand variables and as an independent variable the volume of publications per professor. The total enrolment of the institutions according to their volume of scientific production has also been studied. According to the results obtained, it can be seen that some international demand variables present significant differences depending on the number of scientific publications per professor.

In the following table the mean values of the significant variables identified for both universities with a high volume of scientific production and those with a low volume of production are presented.

Table 1. International Grade Demand by Scientific Output Volume (2014-2015)

	SCIENTIFIC OUTPUT VOLUME				Global mean	F
	LOW		HIGH			
	M	SD	M	SD		
Level of the international demand						
International students (%)	7.55	11.79	3.65	2.13	5.20	4.938*
International students	323.97	464.86	904.60	914.07	673.83	10.655**
Origin of the international demand						
EU (%)	55.54	19.02	38.44	12.26	45.24	23.374***
Rest of Europe (%)	6.96	7.70	9.93	5.74	8.75	3.812
United States and Canada (%)	3.53	6.72	1.02	2.79	2.02	5.261*
Latin America (%)	22.37	15.39	26.34	12.20	24.77	1.601
Northern Africa (%)	3.55	5.34	10.72	8.71	7.87	16.769***
Rest of Africa (%)	3.25	4.73	3.71	3.17	3.53	.265
Asia and Oceania (%)	4.79	5.21	9.84	8.11	7.83	9.446**
Total enrolment						
Total Enrolment	5,797.71	4,917.78	25,190.47	23,021.26	17,483.09	21.267***

ANOVA's significance values: * p<.05; ** p<.01; *** p<.001

Regarding the level of international demand for undergraduate degrees, it can be seen that although the number of international students is higher in universities with a higher average volume of scientific production, the percentage of international students is significantly higher in universities with a lower volume of scientific publications per professor. Many of the universities with the highest scientific output are public and, as can be seen in the table above, their total enrolment is significantly higher.

Therefore, it can be said that universities less focused on scientific production, although they have fewer foreign students linked to their smaller size, in relative terms, seem to be more internationally attractive for undergraduate students.

There are also differences in the origin of international demand between institutions with different volumes of scientific production. While the universities with the fewest publications appear to be geared towards students from the European Union, the United States and Canada, the most scientifically productive institutions focus on students from North Africa and Asia and Oceania.

3.2. Quality of Scientific Production

The effect of the quality of scientific production on international demand for grade has also been studied using various analyses of the variance of one factor. In each of these analyses, an international demand variable is used as a dependent variable and a variable reflecting the impact of university scientific publications is used as an independent factor or variable. In this way, the aim is to analyze the international demand of universities according to the quality of their scientific production. Quality is measured by the impact of publications, as it´s said before by Corera, Chinchilla, De Moya and Sanz (2014), who present a standardized impact index for different higher education institutions. Institutions with normalized impact on the "world average" have an index equal to 1. A variable is created to distinguish between universities with an index greater than 1 and universities with an index less than 1.

Table 2 reflects the differences in international demand from universities according to the impact of their scientific publications.

The results reflect that, in relative terms, there are no significant differences in the level of international demand for degree from universities with scientific publications of different impact. Most universities with impact publications are public and total and international enrolment in these is higher. However, the percentage of international undergraduate students is not significantly different in universities with higher and lower impact research.

With respect to the origin of the international demand of the universities, there are differences depending on the quality of their scientific production. The institutions most focused on impact publications seem to be more oriented towards students from North Africa, Asia and Oceania as well as from European countries not participating in the European Union. Universities with less impact on their scientific publications, on the other hand, receive a higher percentage of international students from the European Union, the United States and Canada.

Table 2. International demand of degree according to the impact of scientific production (2014-2015).

	IMPACT OF SCIENTIFIC PRODUCTION				Global mean	F
	LOW		HIGH			
	M	SD	M	SD		
Level of the international demand						
International students (%)	7.18	11.86	3.89	2.29	5.20	3.440
International students	450.52	914.21	821.13	715.89	673.83	4.008*
Origin of the international demand						
EU (%)	53.76	20.07	39.62	12.69	45.24	14.556***
Rest of Europe (%)	6.78	7.14	10.05	6.14	8.75	4.657*
United States and Canada (%)	3.48	6.74	1.05	2.79	2.02	4.850*
Latin America (%)	24.50	15.77	24.94	12.14	24.77	.019
Northern Africa (%)	3.26	4.85	10.91	8.72	7.87	19.782***
Rest of Africa (%)	3.52	4.68	3.53	3.23	3.53	.000
Asia and Oceania (%)	4.71	5.23	9.90	8.07	7.83	9.999**
Total enrolment						
Total Enrolment	11,195.03	26,733.03	21,630.53	13,717.39	17,483.09	5.137*

ANOVA's significance values: * p<.05; ** p<.01; *** p<.001

4. International demand for Postgraduate Studies

In this section the international demand for postgraduate studies from universities according to the volume and quality of their scientific publications is analyzed. As in the previous section, the information on the level and origin of the international demand for postgraduate studies has been obtained from the Statistics on University Students of the Ministry of Education, Culture and Sport for the academic year 2014-2015.

In each of these analyses, we have used as a dependent variable some international postgraduate demand variable and as an independent variable or factor a variable that reflects the volume of scientific production of the universities or the quality of said production. In the following lines we show the main results obtained.

4.1. Volume of Scientific Production

As indicated above, we intend to study the international demand for postgraduate studies according to the volume of scientific publications of the universities. The objective is to determine whether or not there are differences in the foreign demand for postgraduate studies of universities according to the average number of publications per professor. In the following table we present the international demand for postgraduate studies of universities with different volumes of scientific production.

Table 3. International postgraduate demand according to the volume of scientific production (2014-2015)

	SCIENTIFIC OUTPUT VOLUME				**Global mean**	**F**
	LOW		**HIGH**			
	M	**SD**	**M**	**SD**		
Level of the international demand						
International students (%)	18.57	14.75	15.18	9.86	16.58	1.522
International students	300.58	470.38	342.32	327.47	325.10	.219
Origin of the international demand						
EU (%)	24.57	20.07	24.19	11.00	24.35	.012
Rest of Europe (%)	4.27	5.23	5.13	3.57	4.77	.768
United States & Canada (%)	2.75	4.38	2.37	2.07	2.53	.267
Latin America (%)	57.05	26.34	48.46	15.63	52.00	3.338
Northern Africa (%)	1.59	3.32	3.81	4.22	2.90	6.354*
Rest of Africa (%)	1.32	2.37	2.31	2.65	1.90	2.972
Asia and Oceania (%)	8.12	10.38	13.73	12.21	11.41	4.613*
Total enrolment						
Total Enrolment	1,249.15	1,259.36	2,140.51	1,568.37	1,772.83	7.331**

ANOVA's significance values: * p<.05; ** p<.01; *** p<.001

In the case of the international demand for postgraduate studies, the differences between universities with higher and lower volumes of scientific production decrease considerably. The behavior of international demand for postgraduate studies is similar for both types of universities. According to the results obtained, there are only significant differences in the students from North Africa and from Asia and Oceania, whose importance is greater in the universities with the highest volume of publications per professor.

4.2. Quality of Scientific Production

We have also analyzed the international demand for postgraduate studies from universities according to the quality of their publications. In this case, the objective is to analyze the differences in international demand for postgraduate studies depending on whether the universities have a higher or lower impact scientific output. The following table reflects the average values in the variables of international postgraduate demand both in universities with high-impact publications and in universities with low- impact publications.

The results of the analysis show that there are no significant differences in the international attractiveness of postgraduate studies according to the impact of the scientific output of the universities. Taking the percentage of foreign students as an indicator of the capacity to attract international postgraduate students, it can be said that this capacity is practically identical in universities with scientific publications of different impact.

The origin of the international demand for postgraduate studies, on the other hand, is different according to the quality of scientific production. Institutions less focused on high-impact scientific publications seem to be more oriented towards Latin American students. However, universities with high quality research have a higher percentage of postgraduate students from North Africa and Asia and Oceania.

5. Conclusions

The situation in Spanish universities shows us postgraduate studies with a higher rate of mobility than undergraduate studies. In addition, the postgraduate course offers are more specialized, seeking differentiation via quality measured according to the scientific production of teaching and research staff.

We cannot conclude that the scientific production of the Universities nor the quality of it is a determining factor in attracting students from other countries. In the case of undergraduate students, it even seems that international students go to universities with less research orientation and a greater focus on teaching.

Table 4. International postgraduate demand according to the impact of scientific production (2014-2015)

	IMPACT OF SCIENTIFIC PRODUCTION				Global mean	F
	LOW		HIGH			
	M	SD	M	SD		
Level of the international demand						
International students (%)	16.95	13.42	16.31	11.31	16.58	.053
International students	295.91	455.48	345.60	341.36	325.10	.311
Origin of the international demand						
EU (%)	24.47	20.53	24.26	10.39	24.35	.003
Rest of Europe (%)	3.81	5.34	5.45	3.34	4.77	2.841
United States & Canada (%)	2.71	4.30	2.40	2.19	2.53	.187
Latin America (%)	60.43	24.81	46.08	15.60	52.00	10.071**
Northern Africa (%)	.84	1.46	4.34	4.57	2.90	17.936***
Rest of Africa (%)	1.25	2.43	2.36	2.59	1.90	3.753
Asia and Oceania (%)	6.10	9.80	15.14	11.67	11.41	13.251***
Total enrolment						
Total Enrolment	1,587.18	1,835.75	1,903.17	1,229.44	1,772.83	.851

ANOVA's significance values: * p<.05; ** p<.01; *** p<.001

We are aware that more in-depth statistical analysis is needed, but this first study points to a necessary reorientation of the requirements on university teaching staff if the international attractiveness of Spanish universities is to be increased. Perhaps scientific articles should be more widely disseminated or extended to a wider audience, rather than often remaining within the university itself. Re-awarding quality teaching, without neglecting research, can be an important factor if national universities aspire to place themselves on the international map. This aspect becomes more visible in public universities, since in theory they should attract a higher percentage of foreign students because they have a higher scientific production and of higher quality than private ones. However, our results do not corroborate this appreciation.

Finally, we must not forget the projection of universities in society. Perhaps we should go further and talk about the University-Society relationship in a much more globalized environment than is currently contemplated.

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The use of EduBlog in initial teachers training: an experience of a teaching innovation project

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Abstract

Digital technologies are central elements of today's society. In this context to achieve an adequate degree of development of Digital Competence for professional performance is essential, as well as for life in society and the exercise of citizenship. Higher Education must actively contribute to develop Digital Competence, training students to effectively use digital technologies. That need is exacerbated in the case of initial teacher training, not only because of the progress towards a digitalized school, but also because of the fundamental role in the training of future generations. With the aim of promoting the development of Digital Teaching Competence, this paper presents an innovation project implemented in the Degree of Teacher of Nursery and Primary Education of the University of Valencia that is based on the didactic use of EduBlog. The selection of this digital tool responds to its multiple benefits on the work of curricular content, the development of digital skills and the creation of a positive climate in the classroom. The project developed with a total of 131 second-year students demonstrates that the use of EduBlog has a positive impact on the learning process and on the increase in student engagement and motivation.

Keywords: *Digital Competence; teacher education; higher education; EduBlog; student engagement; learning community.*

1. Introduction

In today's society, digital technologies play a fundamental role, since they are present in all their dimensions, from political and economic to the private sphere, so they have become elements of great importance in our daily lives (Castells, 2017). In this context, citizens need to be digitally competent to be able to perform their professions properly, to interact in the virtual framework and even to exercise active use of citizenship. Therefore, it is vital to offer an education capable of harnessing the potential of digital technologies, incorporating them as active elements of the student learning process (Area, 2019).

In this sense, it is essential to introduce digital technologies in Higher Education to enable students to exercise an effective and critical use of them, not only in their future professional development, but also in their daily lives (Pittinsky, 2006). This situation becomes even more important and necessary in the case of initial teacher training, because these will be responsible for training future generations in the development of Digital Competence (Marín, Vidal, Peirats & San Martín, 2019). This phenomenon, together with the growing demand for the use of technological devices and digital platforms in nursery and primary education classrooms and the transformation of pedagogical work following the use of digital artifacts, require a training process that allows future teachers to use effectively the technologies and ponder about their use to apply them correctly with their students (Pardo, Waliño & San Martín, 2018a). This need is reflected in the emergence of initiatives and regulations such as the Digital Agenda for Europe or the Strategic Framework: Education and Training 2020 (ET2020), and in the Spanish context the Agenda Digital para España and the Marco Común de Competencia Digital Docente designed by the Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF, 2017).

Achieving this objective is a challenge for teachers of Higher Education in general, and for the initial training of teachers in particular, since they must be concerned with offering training that links digital technologies with the vital reality of students, generating significant learning experiences that are not limited to the mere introduction of technologies, but that they affect the dynamic and live use of pampering, generating spaces for reflection and learning communities (Beetham & Sharpe, 2013). Based on this scenario, we will now present an innovation experience developed in the *Facultat de Magisteri* of *Universitat de València* and that pursues the objective of facilitating the development of Digital Competence in future teachers through the use of EduBlog as a tool for learning.

2. Using EduBlog as a tool for engage students in the learning process

Currently, the catalog of artifacts and digital tools that can be incorporated into the classroom is very rich and varied, because technological development is growing at a dizzying pace (Bruillard, 2019). Therefore, one of the main issues that teachers must attend to is to properly

select those digital resources that can contribute most to enrich the learning process of their students and, especially, that can facilitate the development of the Teaching Digital Competence, given the importance of it (Pardo, Waliño & San Martín, 2018b).

Among the wide range of possibilities, in this experience the use of the Educational Blog or EduBlog as a didactic tool has been selected, given its potential to expand learning, motivate and favor the commitment of students in the process, in addition to energizing relationships in the classroom (Cabrera, 2019).

The EduBlog is an upward trend tool in Higher Education, especially in the initial training of teachers, due to the multiple benefits that its use can have in different spheres, both in relation to curricular contents, as well as to the development of digital skills and interpersonal relationships between those involved (Durán, 2010).

After the bibliographic study and the multiple advantages that recent research points to the use of EduBlog, it was decided to implement this resource based on the belief that using it in the university classrooms of initial teacher training allows the work in depth of the contents, favoring a positive attitude towards them and promoting reflection and critical analysis, by creating a learning community that manages to transcend the formal classroom scheme, taking root in the student's life and giving meaning to the contents (Marín & Sampedro, 2016).

3. The use of the EduBlog in initial teacher training: description of an experience

With the objective of promoting the development of the Teaching Digital Competence in future teachers and preparing them for the correct exercise of their profession in the digital school (Waliño, Pardo & San Martín, 2018), it was carried out during the 2018-2019 school year a teaching innovation project that starts from the use of EduBlog as a teaching tool.

3.1. Participants

An amount of 131 students of the second year of the Master's Degree in Nursery Education and Primary Education, of Special Education Needs subject of the University of Valencia, participated in this experience.

Table 1 shows the main characteristics of the students that compose each of the participating groups.

Table 1. Participant Characteristics

Variables		Group D	Group H	Group 21R
Gender	Man	16%	16%	49%
	Woman	84%	84%	51%
Age	Mode	20	20	22
Provenance	Valencia	39%	60%	36%
	Rest of Valencian Community	53%	30%	61%
	Rest of Spain	8%	7%	3%
	Other Countries	-	2%	-
Times enrolled	Once	100%	98%	15%
	Twice	-	2%	59%
	More than 2 times	-	-	26%
Combined with a paid job	No	88%	77%	56%
	Sporadic	4%	12%	5%
	Part Time	6%	12%	31%
	Full Time	2%	-	8%

Source: Own elaboration from university database.

3.2. Process phases

The project implementation process was developed in 6 different phases that covered the entire course and aimed at familiarization with the tool, the work and internalization of the contents and the generation of a learning community through EduBlog. The phases were as follows:

1. WordPress tool selection: After an informed search, WordPress was selected as the tool from which to build the EduBlog, given its ease of use.
2. Creation of the classroom blog: teachers created the blog and presented it to students, highlighting its benefits for the learning process.
3. Publication of entries: periodically published entries about the curricular contents that were being worked on in the subject, encouraging the active participation of students.

4. Comments of the students: the students commented and provided feedback to the entries, reworking and reflecting on the contents worked in the classroom, which contributed to energizing the learning process lived.
5. Peer feedback: the information available in the EduBlog was growing progressively, facilitating the creation of a good classroom climate and enabling the generation of a true learning community that crossed the spatial and temporal barriers of the classroom, maximizing the benefits of learning.
6. Assessment of the experience: finally, after the application of the project, a space for reflective assessment by those involved, both students and teachers, was allocated. It was a formative evaluation aimed at making decisions for the improvement of the project in future applications.

These phases allowed the use of EduBlog to consolidate throughout the course and for students to see it as a tool with great potential for learning, increasing their commitment.

4. Evaluation of the experience

For the evaluation of the experience, three factors were taken into account. The first of them, the use of this tool during a four-month period. The second, the assessment of the experience by the participating students, and, finally, the third was the vision of the teachers involved.

Regarding the data that the application itself (WordPress) offers, the data referring to the number of visitors and tickets seen per month stand out.

Table 2. Number of visitors and entries

	February	**March**	**April**	**May**
Num. Visitors	257	154	78	145
Num. Visits	2812	898	1345	2004

Source: Own elaboration from WordPress data

As for the countries from which EduBlog has been accessed, as can be seen in Figure 1, it highlights access from different countries, both Spanish-speaking and other languages, from countries geographically close to Spain and also distant. Especially from the American continent.

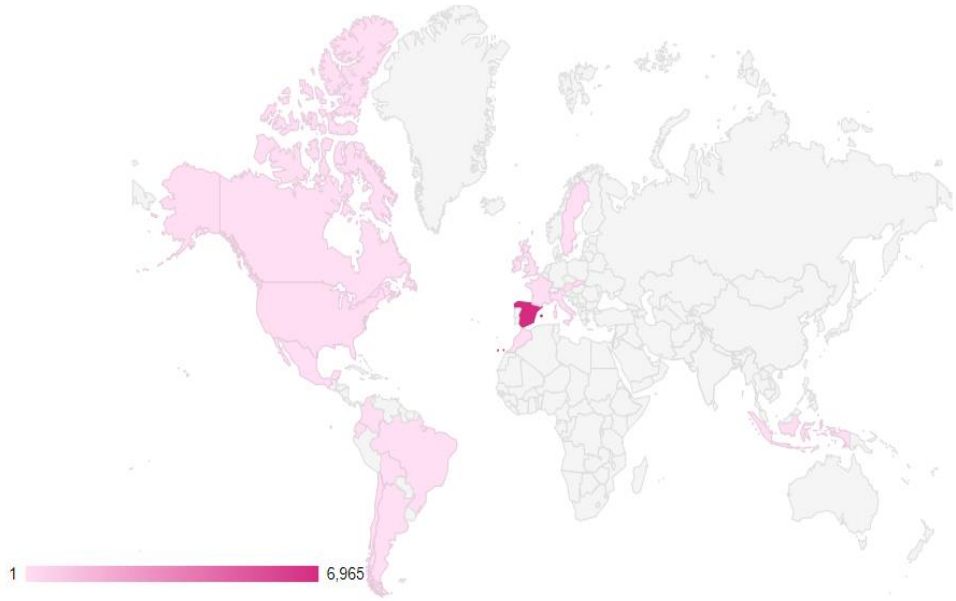

Figure 1. Distribution of visits per countries (15-05-2019)

Regarding the assessment of the experience carried out by the students, the information was collected through a questionnaire prepared *ad hoc* with the *Google questionnaires* tool. The link was sent to the participants through the News section of the Virtual Classroom of the subject. The positive assessment made stands out, with an average score of 8'2. The positive aspects mentioned outweigh the negative aspects after the assessment of the introduction of this tool during a four-month period in Higher Education. They point out from EduBlog the possibility of sharing resources, which they can also use in their professional future, and the opportunities it offers to transmit information and learn about other points of view. As negative aspects, they point out the initial difficulty of using the tool and the repetition of comments. It is interesting that as proposals for improvement students highlight the need for easier access to the blog and that it was the student himself who made the proposals on which to deepen. The 80% of the participants would recommend its use in teacher training and the 60% had never made an educational use of this tool before.

Finally, teachers involved value the introduction of this tool very positively, because it has made possible the motivation of the students, the exchange of knowledge, the development of different competences, such as communicative and digital, the dissemination of knowledge beyond the limits of the classroom, the exchange of information with students from different groups and the promotion of the inclusive school, which is one of the fundamental objectives of the subject involved.

5. Conclusion

As has been proven throughout the study, EduBlog is a tool that offers the opportunity to increase dialogic interactions between equals through a more relaxed and uninhibited space. And, in addition, its use favors sharing cultural, critical and diverse affinities around the issues that arise that, otherwise, in more conventional and formal environments, could go unnoticed. Therefore, as Cortés (2019) points out, collaborative learning and creativity development, promoting distance learning in which the research function and knowledge transfer are facilitated (Gonzalez-Hernando, Valdivieso & Velasco, 2020). His pedagogical strengths are based on good teaching practices focused on students as a center of learning, in the line of constructivism by Jean Piaget and Lev Vygotsky. According to Marco Común de Competencia Digital Docente, it is structured in five main areas: information and information literacy, communication and collaboration, creation of digital content, security and problem solving (INTEF, 2017); and there is no doubt that the dynamics through EduBlog can favor all of them.

Although the technical solution proposed in this experience is not a novelty, because it is based on the use of a blog, the study have shown that this is a tool whose use is not yet widespread in classrooms of these degree. These aspects could be observed, specially, for the several difficulties presented in the handling of the blog by the students at the beginning of the experiencie. These show that, despite the fact that this student generation is usually considered "digital natives" they still need to develop certain aspects of digital competence, and especially of digital teaching competence. Objectives pursued in that learning experience.

Consistent with the methodological line of this work, it was tried to verify if the implementation of EduBlog in university classrooms of initial teacher training allowed the in-depth work of the contents and promoted their reflection and critical analysis. As the results obtained in the different phases show, the use of EduBlog was consolidated throughout the course until it was valued as a tool of great potential by both teachers and students. Even so, it would be interesting to take into consideration the proposals for improvement made by the students, among which are, to provide them with greater prominence, offering them the freedom of being the ones who created the proposals on which to deepen, instead of teachers.

Finally, it should be noted that one of the main limitations of this study, and that it would be interesting to solve in future research, is the size of the sample, as well as its development in such a limited context, that of a single subject -which, however, it is shared by future teachers of Nursery and Primary Education- for this reason, the results only correspond to an approximation of reality, and it is considered necessary to continue research in this line in order to provide the future body of teachers of the digital skills necessary for the society of

the 21st century. To achieve this goal, the next course will expand the experience to increase the sample size and to develop more meaningful experiences.

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Practicing 21st Century Skills in the Classroom

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Abstract

In the midst of the current technological revolution, there is a thriving conversation about how society should adapt to the future of work taking place in the national media, universities, policy organizations, think tanks, consulting firms and companies. One such model for work and education under consideration is that of the role of higher education in workforce development. How well does a bachelor's degree prepare an individual for a career in this shifting landscape of work? What is the responsibility of the university to the student – to prepare them for a career? Or to help them build the intellectual framework to build a meaningful life? Incorporating the practice and development of 21st century skills into the higher education classroom does not necessarily require a great rethinking of the education model or content delivery. Rather, it could be as simple as encouraging faculty to use proven educational principles such as active learning and group-based learning into the classroom. This would allow students to practice some of the necessary skills such as communication, respect, teamwork, and problem solving into their higher education curriculum.

Keywords: *21st century skills, higher education, active learning.*

1. Introduction

In the midst of the current technological revolution, there is a thriving conversation about how society should adapt to the future of work taking place in the national media, universities, policy organizations, think tanks, consulting firms and companies. Models for work and education that were taken for granted in the 20th century are now under a microscope, as society attempts to determine what is suitable to keep and what needs to be changed and reframed for the 21st century. One such model under consideration is that of the role of higher education in workforce development. How well does a bachelor's degree prepare an individual for a career in this shifting landscape of work? What is the responsibility of the university to the student – to prepare them for a career? Or to help them build the intellectual framework to build a meaningful life?

This debate becomes more perplexing when factoring in the role of advanced artificial intelligence, robotics and other advanced information technologies, and how they will shape the future of work. What do humans bring to the table, and how can universities help sharpen those distinctly human capabilities like creativity, empathy, and critical thinking? Many groups, from the United Nations to Rand are proposing that universities focus on teaching these "21st century skills" in their classrooms, particularly in the Humanities, Arts, and Social Sciences. But others argue that the valuable class time is already spent learning important content matter, and that it is not the role of professors to teach these skills. Complicating matters is the dearth of research and consensus on how these skills could be best be taught, and how they could be assessed fairly (Herman, 2017). However, there is a growing consensus both in the business world and in higher education that 21st century skills are important and should be developed through the educational process. This paper will advocate for a middle ground, arguing that some 21st century skills are well suited to being practiced in traditional liberal arts departments, and that they can be more consciously and specifically incorporated into the curriculum in a way that enhances the learning of the subject matter, as well as helps the students develop the skills.

2. Framing 21st Century Skills

The concern about skills-based education is not new, but a part of an ongoing debate over the nature and value of higher education. In 1862 The United States government passed the Morrill Act providing federal support for post-secondary education focused specifically on agriculture and the mechanical arts through the land grant university system, in order to provide a more practical "industrial education" for the broader populace (Croft, 2019). Though higher education has evolved since to encompass a wide range of study in both industrial faculties as well as traditional liberal arts, there remains a great deal of anxiety and discussion about the value and expectations of a liberal arts education. The US Secretary of

Education in 1981 established a National Commission on Excellence in Education to review the quality of education in the country, and advocated for the inclusion of new skills into the curriculum such as "enthusiasm for learning", "critical thinking", and "technology" among other things (Gardner, 1983). In 1990 the US Secretary of Labor established the Commission on Achieving Necessary Skills, which built a national coalition called the Partnership for 21st Century Skills (P21) bringing together leading educational research and policy groups and public and private institutions. P21 has established a key rubric for 21st century skills under 3 themes "life and career skill", "learning and innovation skills", and "information, media, and technology skills". Many other groups from consulting firms such as McKinsey to the World Economic Forum have compiled their own lists of "21st century" or "future of work" skills, all of which include a wide blend of personal, professional, and technical skills. Below are two skills rubrics, one from the Partnership for 21st Century Skills, and the other a rubric deigned by the National Network of Business & Industry Associates (Figure 1).

National Network of Business & Industry Associates:	**Partnership for 21st Century Skills:**
PERSONAL SKILLS: • Integrity • Initiative • Dependability & Reliability • Adaptability • Professionalism APPLIED KNOWLEDGE: • Reading • Writing • Mathematics • Science • Technology • Critical Thinking WORKPLACE SKILLS: • Planning & Organizing • Problem Solving • Decision Making • Business Fundamentals • Customer Focus • Working with Tools & Technology PEOPLE SKILLS: • Teamwork • Communication • Respect	KEY COMPETENCIES: • Global Awareness • Financial, Economic, Business, and Entrepreneurial Literacy • Civic Literacy • Health Literacy • Environmental Literacy LEARNING AND INNOVATION SKILLS: • Creativity and Innovation • Critical Thinking and Problem Solving • Communication • Collaboration INFORMATION, MEDIA & TECHNOLOGY SKILLS • Information Literacy • Media Literacy • ICT (Information, Communications, Technology) Literacy LIFE & CAREER SKILLS • Flexibility and Adaptability • Initiative and Self-Direction • Social and Cross-Cultural Skills • Productivity and Accountability • Leadership and Responsibility

Figure 1. Rubrics of 21st Century Skills (Partnership for 21st Century Learning, 2019)(NNBIA, 2015)

Unsurprisingly, the rubric designed by the federal commission focuses more holistically on whole life of the individual as a citizen, prioritizing skills such as "health, civic and environmental literacy", whereas the rubric designed by the Business & Industry associates is more keyed in on specific workplace competencies. Both sets of rubrics emphasize the "human-based" skills that categorize the 21st century skills priorities such as social skills like teamwork and communication and respect, as well as intellectual skills like creativity and critical thinking. Meanwhile the domains traditionally thought of as the core competencies of educational institutions such as reading, writing, mathematics, and science take a smaller share of the priorities on the Business and Industry Associates rubric, and is only assumed on the Partnership for 21st Century Skills rubric.

3. Framing of ideas to teach 21st century skills in humanities & social sciences

Many proponents of the 21st century skill education model argue that traditional education systems are out of touch with the modern era, and do not adequately prepare learners for the challenges that they will face in their lives either personally or professionally. The Brookings Institute has commissioned several studies looking at the practice of 21st century skills education in schools around the globe, and found the uptake concerningly low, noting that "to participate effectively in the increasingly complex societies and globalized economy that characterizes today's world, students need to think critically, communicate effectively, collaborate with diverse peers, solve complex problems, adopt a global mindset, and engage with information and communications technology" (Vivekanandan, 2019). These advocates insist that teaching these skills is of primary importance, and that universities should adjust their curriculum to adapt to these new standards. A recent study conducted by the Association of American Colleges and Universities surveyed business executives and hiring managers across the United States, and found both groups reported a wide gap in the preparedness of recent college graduates on key outcomes needed to succeed in the business world, such as "critical thinking / analytical reasoning", communication and ability to work independently and on teams (Hart Research Associates, 2018).

Despite the widespread interest in a newly focused skills-based education, many in higher education remain skeptical of the incorporation of these skills into the classroom. They argue that traditional humanities, arts, and social sciences offer vitally important societal perspectives, and that students intrinsically gain intellectual rewards by participating in the study and research. In a panel at the Aspen Institute in 2016, cultural critic Leon Wieseltier and then president of Harvard University Drew Faust argued that the study and appreciation of the humanities is a value unto itself, that "the purpose of the humanities is primarily utilitarian, it is not primarily to get a job" but to "cultivate the individual"(Gilbert, 2016). These scholars are concerned that the focus on skills based education inherently undermines the value of the humanities and their scholarship as being irrelevant.

4. Advocate for a middle ground – A Specific Proposal

While it seems unlikely that universities will trade in time honored humanities and social science subjects in exchange for the new 21st century skills outright, there is a potential to bring in the practice of 21st century skills in a way that enhances the education of humanities and social science subjects. This could be done through using active learning principles to make classroom learning more interaction and group based, as well as through tweaking the assessment model of traditional humanities courses. Active learning is an approach to seeks to engage students as active participants in their knowledge acquisition, as opposed to passively receiving knowledge from the instructor (Meyers, 1993). Active learning activities

are often based around generating more discussion, group activities, and problem solving in order to get the students to engage more dynamically with the course material (Bonwell, 1991). A meta-analysis of 225 studies of active learning in the classroom showed the effectiveness of active learning techniques in increasing student performance and reducing failing grades across a wide variety of class types (Freeman et al, 2014).

Traditionally, most humanities and social sciences courses are either lecture based, where the professor presents a lecture during class time and students take notes, interspersed with some light discussion, or seminar based, in which the class is predominantly focused on discussing the course reading assignments. The final assessment of most courses is a research paper or other form of paper, in which the student presents an original idea for study and then pursues it with some guidance from the instructor. Most of the work the student will do for the class, reading, researching, writing, and note-taking, is a solo activity done with very little peer interaction and feedback. Students learn to work well independently, but much of the work in the professional world is done in a group or team setting, calling for a high degree of communication, empathy, patience, and teamwork skills. Indeed, even in the professional practice of the humanities and social sciences research is largely done in a collaborative or team-based manner, with many researchers working together on the same project. Arranging the class to prioritize siloed individual work is not done so because it is a superior and more authentic way to learn the content, it is done so because it is easier to assess, and because that is traditional way it has been taught. Team-based learning has been shown to be a powerful and effective teaching strategy according to a wide body of educational research, particularly in higher education (Michaelson, 2004)(Michaelson, 2011)(Koles, 2010). While incorporating team-based learning into higher education is certainly not new, and education experts have been advocating for its incorporation since the early 1980s, (Michaelson, 1982) few have framed it as a means to begin to bridge the gap in both incorporating and describing the workplace skills being developed in the classroom (Weise, 2018).

It must be observed that some of the 21st century skills like business and finance literacy or technology are not good fits for humanities and social science education, and would be better suited to other avenues of life and study to learn. However, there are many skills that could easily be integrated into the classroom in a way that produced a more authentic and engaging learning environment. Bringing 21st century skills into humanities and social science education could be as simple as altering the traditional assessments used in the classroom to bring in the principles of active learning, such as spending more course time on group-based projects and assignments, which could help improve educational outcomes and let the students practice building skills. While few higher educational faculty would or should be willing or capable of teaching 21st century skills in the classroom, reformulating the classroom to be more active could be a major step towards both educating students and preparing them for workplace environments.

Rather than a classroom of 20 students writing 20 research papers, an instructor could divide the students into writing teams and have them jointly produce larger research projects, or else figure out a way to weave their individual ideas together into a cohesive whole. Rather than assigning students to complete their readings each week on their own, students could be paired or put on reading teams and complete their readings on a shared annotatable platform where they could engage in discussion about the readings, ask questions, or clarify confusion. The simple transition from solo reading assignments or research papers to include as well group-based reading or research incorporates many new 21st century skills into the classroom, helping students practice working in teams, being a leader, adapting to each other's ideas and workflows, and solving problems and being accountable to produce their work on time and to specifications. Even if a research project is focusing on history or anthropology, the experience of working together to produce the final product is more closely aligned with the professional workplace setting than individual work or assignments, and does not require any sacrifice of focus on the subject matter being taught. The student would have the opportunity to do individual work in a group context, to see how their own work fits into the broader context of the whole, as well as being held accountable to a high quality by their peers. This is emphasized in the table below, which lists the skills being practiced in solo assignments and group assignments, and the skills being practiced in each experience.

Solo Reading Assignment	Group Reading Assignments
- Reading - Critical Thinking	- Reading - Critical Thinking - Communication (Hazel, 2013) - Teamwork (Hazel, 2013) - Productivity & Accountability (Powell, 2015) - Respect (Vasan, 2011)
Solo Research Paper	**Group Research Paper**
- Reading - Writing - Critical Thinking	- Reading - Writing - Critical Thinking - Communication (Hazel, 2013) - Teamwork (Hazel, 2013) - Productivity & Accountability (Powell, 2015) - Collaboration (Michaelson, 2004) - Leadership & Responsibility (Walters, 2011) - Respect (Vasan, 2011) - Professionalism (Sibley, 2008)

Figure 2. Comparison of skills practiced

While the professor would not explicitly be teaching these skills, the students would have the opportunity to be exposed to them and practice them in situations that replicate the ways they will be using them in their future work lives (Care, 2018). Professors could utilize peer grading techniques where students reported on each other's contributions across a rubric measuring communication, productivity, accountability, and so on which could be used as helpful feedback for the student as well as for formulating the students final grade. This new integration of skills practice into the classroom could also require spending more class time engaged in discussion or small group work, though lecture time could be supplemented with blended learning practices to move some of the lectures onto short videos or assignments which could be completed ahead of time. This could result in more active and engaging classes, which would tap into educational research showing that students learn material best and remember it longer when they actively participate with the material (Omelicheya, 2008)(Prince, 2004).

5. Conclusion

Incorporating the practice and development of 21st century skills into the higher education humanities classroom does not necessarily require a great rethinking of the education model or content delivery. Rather, it could be as simple as encouraging faculty to use proven educational principles such as active learning and group-based learning into the classroom. This would allow students to practice some of the necessary skills such as communication, respect, teamwork, and problem solving into their learning of topics like history, anthropology, and political science. Embracing this model for integrating the practice of these skills into the classroom could be a win-win for both humanities educators and the students.

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Planned Chaos in Electrical Engineering Education

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Abstract

This paper presents the idea to intentionally introduce planned chaos into electrical engineering lectures and lab courses to improve students' learning success. The reason to present this idea are several personal experiences in daily teaching. If students experience some uncertainty in their study program, it is seen that they have higher challenges and therefore higher learning success in managing uncertain situations. In these ways, students acquire methodical and social competences to deal with uncertainty and achieve productive results in an unstable working environment. If, however, the chaos is too large, students are over-strained with the situation, distracted from the actual learning targets and consequently learning results will be worse, drop-out rates will increase and they will be frustrated. The beneficial level of uncertainty depends on the student culture, academic progress and personality characteristics. The competence to deal with complex situations is essential for later professional life where unexpected circumstances occur regularly. Introducing planned chaos into lectures and lab courses has not to be confused with a missing didactic concept and is no justification for a bad preparation. Planned chaos is a demanding concept for professors to find the right implementation for an optimized learning outcome. These described findings are experienced from practical work and student evaluations.

Keywords: *Electrical Engineering Education, Active Learning, Planned Chaos.*

1. Introduction and Motivation

OTH Regensburg is a German University of Applied Sciences with a strong focus on the region of Eastern Bavaria but also with partnerships all over the world. The key area of this university is to educate young people mainly from the region of Eastern Bavaria to qualify them for work in companies and institutions. On top of this, the second emphasis is on applied research in connection with companies.

OTH Regensburg has many alumni who are very successful in their professional careers. They work on innovative topics in companies and institutions, do research and development, manage companies or start their own business. Not the grades on a diploma certificate but the success of the alumni in their later life is the outcome of a successful study program. Therefore, it is important to prepare students for their later professional life that is unforeseeable and maybe sometimes chaotic. This is the motivation for the idea to introduce planned chaos into the curricula which is presented in this article.

Section 2 shows requirements for engineering graduates using surveys among employers. In Section 3, the learning objectives for electrical engineering students are shown. Different curricular concepts are introduced in Section 4, and Section 5 describes the changes in courses when introducing planned chaos. Section 6 shows some first results, and Section 7 gives a summary with conclusion and outlook.

2. Professional Requirements for Electrical Engineers

It is obvious that employers expect good theoretical knowledge and first practical experience from graduates. Additional competences are expected depending on the job profile. These have to be also developed during the study program. Several surveys all over the world are repeatedly done to evaluate the required competences.

Most relevant competences beside technical knowledge of graduates are “Communication skills”, “Teamwork”, “Interpersonal skills” and “Resilience”, as an employer survey from the Australian Association of Graduate Employers (2018, p. 48) shows. The National Association of Colleges and Employers (2019a) carries out regular surveys among employers to find out the most important competences of graduates. Based on these evaluations, the career readiness of graduates is defined by the National Association of Colleges and Employers (2019b): “Career readiness is the attainment and demonstration of requisite competencies that broadly prepare college graduates for a successful transition into the workplace.” These include interpersonal competencies, for example “Critical Thinking/Problem Solving”, “Oral/Written Communications”, “Teamwork/Collaboration”.

Many studies around the world show similar competence areas that are demanded by employers, like communication, teamwork, problem solving, creativity and the ability for

lifelong learning. Engineers have to deal with unstructured, real-world problems and have to work in unfamiliar systems (Azmi, Kamin & Noordin, 2018).

All these from employers demanded skills should be trained within the frame of a study program. An industrial internship during the study program is helpful but not sufficient to gain the required competences. It is necessary to train these competences in diverse lectures and lab courses within the whole study program. Professors should take care of these industrial demands when designing a study program, their lectures and lab courses, and during their daily work with students.

3. Learning Objectives in Electrical Engineering Education

Diverse competencies have to be acquired by students during their study programs. The Tuning project categorized these into instrumental, interpersonal and systemic competences (González & Wagenaar, 2003, pp. 70-73).

The Organization for Economic Co-operation and Development (2005, p. 4) describes a competency as follows: "A competency is more than just knowledge and skills. It involves the ability to meet complex demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a particular context." The European Union (2017, p. 23) describes in their European Qualification Framework (EQF) the responsibility and autonomy that a person has to deal within his or her job. Level 6 says that people should be able to "manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts". From Levels 6 of EQF on, people have to take responsibility for making decisions in unpredictable environments and it is necessary to train this during their study programs.

The difficult term of quality in higher education was reviewed by Schindler, Puls-Elvidge, Welzant and Crawford (2015). There are many different quality definitions available with diverse scopes to stakeholders and views on the institution and many definitions are closely connected to competencies of graduates. The transformative aspect of quality includes the aspects of "Learner-centered approach", "Competency of lectures", "Clarity of outcomes", "Development of critical thinking" and "Student engagement with content" (Schindler et al., 2015, p. 7) that are addressed with this approach of planned chaos. The Purdue University School of Engineering Education defines the competences of their graduated that include "create and synthesize knowledge", "think critically and reflectively" and "demonstrate engineering skills" (Purdue University, 2019). All necessary competences for later work has to be taken into account when designing new curricula (Edwards, Sánchez-Ruiz & Sánchez-Díaz, 2009). Soft skills are not learned to increase theoretical knowledge but to improve later professional performance.

An easy way to increase the education of soft skills is to reduce technical courses and replace these with soft skills lectures. There are two drawbacks for this possibility. The first disadvantage is that the technical content of the study program is reduced. Graduates have lower technical skills and are therefore less prepared for highly qualified work. The other disadvantage is that technical lectures and soft skill lectures are separated and so there is no direct interaction within the curriculum. It is difficult for the students to apply their learned soft skills directly in the technical subjects due to the missing connection in curriculum. The key question is, how to integrate the education of relevant soft skills into a curriculum without sacrificing time for technical education and getting maximum learning success for students.

4. Curricular Concepts

They are currently many initiatives to find very well structured study programs with very good reproducibility for each student cohort. If this is done in a not appropriate way, it leads to a study program with a high reproducibility for students. They get good grades when they adopt to the study program philosophy, reproduce knowledge and work exactly according to the regulations of the program. It is not the goal that students adopt to the study program but it is the goal that they acquire competencies that are important for their later career. It is questionable if graduates who adopted to a fully structured and defined curriculum are successful in their later career with fluctuating boundary conditions in a fast changing environment. The abstract education goals should be defined and stable over time but the way to these goals should be enhanced with random fluctuations.

On the other side there are initiatives of new teaching methods that include the impacts of non-deterministic environments into teaching concepts. One approach is told by Vicent, Gumara and Fitzgerald (2011) where the teacher should switch from the traditional methods of teaching which are passive for the student to activating teaching models. The Socratic method of questioning students without any evaluation what is right and wrong is used. This is suitable for project based learning within teams to improve their motivation and engagement. Agile didactics is another initiative to improve interaction between students and professors for enhanced learning (Arn, 2017). Unforeseen events can happen due to questions and ideas of learners. Professors should react to these events and use them to shape their lectures. In this way, a real interaction is possible that increases learning success. While several teaching concepts count on unforeseen events and interaction between professors and students, the here described concept introduces unforeseen challenges into a course.

An appropriate starting point for introducing chaos into a course could be a project based lab course. This is a simulation of a practical engineering environment where some amount

of chaos with unforeseen events of all kinds occur. There are several examples for project based learning in interdisciplinary self-managed student teams. Aznar et al. (2012) described projects between Electronics and Mechanical Engineering students where first-year students work together to solve real-world projects. Projects of Electrical Engineering and Business students who develop products in a start-up company set-up are described in Fuhrmann and Niemetz (2018). Students search for interesting project topics by themselves and it is therefore not possible to copy projects from former generations. Such projects automatically include some uncertainty about the work schedule, the group dynamics and as a consequence the risk of failure for students. Students are therefore challenged and this increases creativity and engagement for a successful project completion.

5. Introducing Planned Chaos

The introduction of planned chaos in lectures and lab courses has not be confused with chaos from insufficient preparation, missing didactic concept and lecturers' chaotic work! Planned chaos within a course is a well-balanced didactic concept with a lot of work. The first and most important prerequisite of all is that the lecturer has to change his or her self-perception. A lecture with a perfect choreography is not the type of lectures where students learn most for their later professional life. Predictable courses induce only a weak need for attention and alertness, as comprehension can safely be postponed to some later point in time, i.e. never. Problem solving, adaptation to unexpected situations, coping with difficult topics skills are not developed at all as everything is predictable in courses.

As students' later working environment will be unstable and sometimes chaotic, a lecture should also prepare for this surrounding. Therefore, a continuously changing environment for students should introduce steady and unforeseeable challenges. It should not be recognized by students as a chaotic course but as a continuously challenging and interesting course.

It is important to find the right amount of challenges for students. If the challenges for students are too low, there is less learning success than possible. If the challenges are too high, students are over-strained, confused and frustrated. This right amount of chaos for an optimal challenge is different for each student, it depends on the learning type, personal prerequisites and the cultural background. Therefore, it is not possible to find a level which is optimal for all students. If there are doubts about the right amount of uncertainty, it should preferably be lower than too high. When supervising a smaller group of students, the amount of uncertainty can be individually adapted by individual discussions with students and selected help.

As an example, a lab course in the bachelor electrical engineering program where students carry out projects in groups together with management students was used to introduce some

uncertainty (Fuhrmann & Niemetz, 2018). The students get no detailed instructions about all steps during the semester. They get a short briefing of about 30...45 minutes with basic background information. Then they have to form groups, find a topic and start to work. All questions should be discussed within the group and if a solution is not possible among the students, the supervisors should be asked. Active engagement of students is therefore absolutely necessary for a successful completion of the project.

Help for students is done according to the didactic principle of "minimal help" to enable students finding own solutions. This is closely related to Maria Montessori's didactic method "Help me to do it myself" (Montessori Jr., 1976, p. 56). Nützel (2019) writes that emotions are important ingredients for learning success. Not necessarily only positive emotions promote learning, also negative emotions can contribute to learning success. Uncertainty and some amount of chaos can contribute to learning success as long as they are resolved by the learners.

6. Preliminary Results

It is very challenging to evaluate the use of defined chaos in lectures or lab courses like other evaluations in lectures and labs. The intended introduction of chaos should not be directly visible to students and therefore it can't be included within an overall evaluation of a course like all other directly visible topics.

The project lab described in Section 5 was evaluated by using questions which have be to answered using a five point Lickert scale (Fuhrmann & Niemetz 2018). Free text answers are welcome for additional remarks and suggestions. Separate evaluations were done for the groups of electrical engineering and business students. Evaluations for the winter semester 2017/18 (Fuhrmann & Niemetz 2018) and for the winter semester 2018/19 were done. The overall feedback was good to very good, no big differences between the evaluation results for engineering and business students are seen. Students had the impression that the working climate was good, they learned much about their own profession and the profession of the other faculty. Some students complained that they would need more detailed description about their tasks and goals of the project.

During this lab project, the following observations about the uncertainty of the students were made:

- After some initial internal discussions, some groups of students had many questions for the supervisors that led to intense discussions about the project goals.
- Other groups of students made intense research in the internet, and tried to get information from previous groups. Only some questions about project details were asked and no intense discussions evolved.

- A very limited number of students did not take any action but waited until the supervisors asked them and gave them detailed instructions for the work. This waiting time could last for weeks, no active work from the students was recognized.

It is clear to see that the students deal with this uncertain situation in very different ways. They make the experience during this project that their chosen way directly influences the project success. Supervisors intervened in situations where students were obviously over-strained and were not able to find their own way towards a solution. In the end and after some help of the supervisors, all student projects were successful.

There was an intense discussion with one alumnus about this concept. He said that at the beginning of this practical lab course, he was disappointed and frustrated that he got so little information. In other lectures and practical courses, he was used to get all necessary information at the beginning. At the end of this lab course, he saw this course absolutely positive due to the freedom to carry out own ideas and the high learning success. He sees this course very valuable due to similar situations of uncertainty that he experiences in his daily work.

7. Summary, Conclusion and Outlook

The idea for this didactic approach is currently in the starting phase. A preliminary concept was developed and first tests in an electrical measurement lab course were done towards a planned chaos within a project based labs course.

The type and amount of chaos should be adopted according to the type of lecture and study year. It is seen that the right amount of uncertainty is necessary for a high learning success. This optimal amount of uncertainty is different for each student and depends on his or her personality. It is therefore not possible to have the right amount of chaos for all students within a course. It is important to give individual hints according to student's working progress.

Summarized, this model is seen to be an interesting approach with the potential for a didactic method to increase learning outcome for real-world problems. Students learn how to structure the chaos at the beginning of a project. Finding an own way to a solution that no one has found before is always an individual learning success, so no shortcuts are possible.

It is planned to develop this concept of planned chaos further with a critical view on the value to improve learning success.

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Flipped teaching and interactive tools. A multidisciplinary innovation experience in higher education

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Abstract

Nowadays learning methods in higher education are under a constant review process. Applications focused on Blended-Learning allow to speed-up the learning process; this facilitates the design and implementation of interactive resources in the classroom. The present study shows an experience developed with engineering master students. Flipped Teaching approach has achieved significant mention in academic circles in recent years. Undoubtedly, the implementation of this educational methodology improves students' motivation and increases their participation in the classroom.

In this paper different Information and Communication Technologies (ICT) tools and multimedia resources that facilitate the teaching sessions are presented. Its use has been simple and intuitive. These educational tools increase the skills, abilities and competences acquired by students. The objective is to achieve more interactive learning. Students positively value this activities related to the Flipped Learning. In addition, students prefer teaching-learning procedures more dynamic, flexible, creative, participatory and with continuous evaluation. Although the general impression is that they need more effort and more dedication, compared to the Traditional Teaching. Every time there is a greater number of educational tools and electronic devices for higher education. However, its use must be correct so that it can be useful in training students.

Keywords: *Flipped Teaching; Blended Learning; Game-based Learning; Advanced Classroom Technology; Interactive Tools.*

1. Introduction

Do ICTs help us to make our classes more interactive and collaborative? Is it possible to apply new methodological models supported by technological resources available today? In the last few years, mobile devices as *laptops*, *tablets*, *e-books* and *smartphones* became more and more popular. Every time there is a larger number of resources and devices destined for his utilization in education (Artal-Sevil & Romero, 2018). Thus a change has occurred in the nature of higher education. The evolution of devices developed for mobile platforms has allowed the introduction of various free applications in the academic field.

Many authors have cited the relevance of ICT in the *Flipped* pedagogical approach. Thus, Bates and Galloway (2012) or Artal-Sevil (2019) have applied this technique for some years in their educational task. The results were satisfactory. There was an improvement in attitude and student participation. In turn, Roach (2014) described the perceptions during the application of the *Flipped Teaching*. As shown in the results, students respond positively to the introduction of this new teaching strategy, although it entails an increase in academic activities.

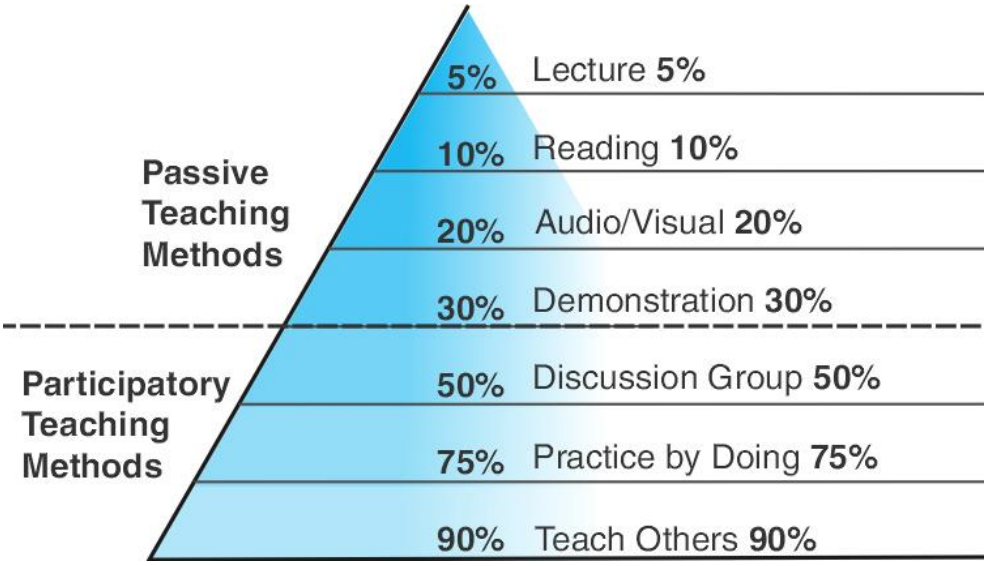

Figure 1. Active and Passive teaching methods. Average retention ratio in students.

On the other hand O'Flaherty and Phillips (2015) developed a deep bibliographical revision and proposed different synchronous and asynchronous activities for their incorporation in the classroom. The results indicate that this strategy increases educational efficiency and provides greater motivation for students. While Cieliebak and Frei (2016) evaluated the influence of the *Flipped* strategy on the skills acquired by students of engineering with

respect to classic methodologies. In the study it is possible to appreciate better results on the non-technical competences acquired by the students. In this way, the *Flipped Learning* strategy is a viable alternative to the traditional procedure. Similarly, García de Oliveira *et al*. (2014) presented a different educational tools that could help teachers during the implementation of the *Flipped Learning* model in the classroom. At the same time, they provide some advice on the evaluation and interpretation of results.

The idea has been to introduce the most current technology for students in the university classroom. This integration has a double perspective. On the one hand, to optimize the teaching-learning process, disclose their knowledge and improve student academic training. On the other hand, the use of new technologies in the classroom can significantly increase student interest. Figure 1 shows the pyramid learning. In the image is possible to observe the different learning coefficients (average retention rate) based on the teaching methods (lecture, reading, audio/visual, etc.). The most active and participatory methods have the largest learning coefficients.

2. Objetives and Educational Context

In this paper is presented an educational innovation experience based on *Flipped Teaching* pedagogical approach with the incorporation of active-collaborative activities developed during the academic year 2018/19 in the Master's degree in Renewable Energy and Energy Efficiency, Master's degree in Industrial Engineering and PostGraduate in Renewable Energy Grid Integration. The experience was approached from the perspective of research-action in teaching team. The main objective has been to improve the use of applications for educational innovation inside and outside the classroom, while student participation is encouraged. At the same time it is possible to contrast the usefulness and effectiveness of the learning strategies. The specific learning objectives set are listed below. All initial objectives were achieved systematically and satisfactorily

- Use new applications, active tools and mechanisms for the continuous supervision of the student. Facilitate the understanding of the concepts and the acquisition of skills and competences associated to the matter.
- Structure the in-class sessions (*seminars*) and academic activities outside the classroom (*webinar*). Motivate students during the development of their academic tasks.
- Develop and incorporate different interactive games and Q&A questionnaires (implementation of the *Game-based Learning* strategy) as a complement to the *Flipped Teaching* model.

3. Flipped Teaching Model

Flipped Teaching or inverted class methodology consists in that the students prepare certain learning contents outside the classroom, usually as homework. Thus it is possible to perform other much more practical academic tasks in the classroom. As a result of the incorporation of *Flipped Teaching* methodology and the introduction of some online tools described in this document, it has been possible to promote a series of educational experiences that enhance the learning process. The use of interactive tools has allowed that the classroom sessions can be more interactive, increasing the motivation of the students. Therefore this method has facilitated interaction and knowledge construction through an active-collaborative learning. Bergmann and Sams (2012) explain that a *Flipped Classroom* is a classroom with mixed direct instructions that focus on constructing students based on the subject, see figure 2. The before-class time is dedicated to the study and preparation of the different academic task in order to obtain a previous knowledge. While in-class time it is dedicated to interactive learning and critical thinking processes. This series of activities include the use of mobile devices, quizzes and games (Artal-Sevil, 2020).

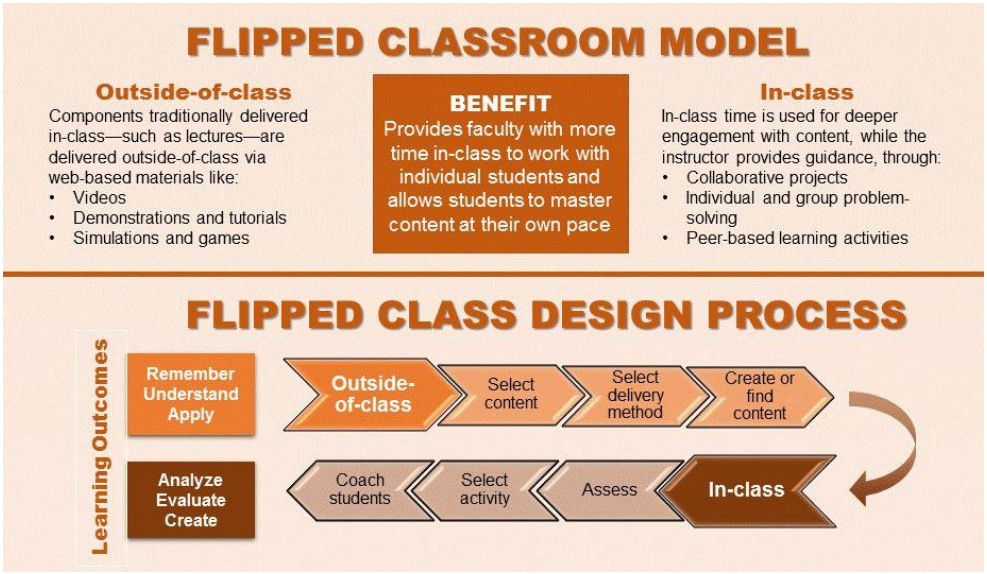

Figure 2. What is the Flipped Classroom? A "flipped class" is a classroom where the typical cycle of content acquisition is reversed.

The objective is to enhance learning and deepen specific content and materials. Therefore, the activities performed in class, are more related to problem solving, collaborative activities or group discussion. These activities are totally opposed to the passive approach in the *Traditional Teaching*; where the protagonist is only the teacher. Thereby the use of ICT tools is essential. The purpose is to improve classroom dynamics and develop

collaborative learning activities. In summary, the method proposes a student-centered teaching. The student has changed from a passive role to an active role (Kerr, 2015).

Applications focused in *Flipped Teaching* and *Blended-Learning*, have allowed to speed-up the learning process. This facilitates the implementation and design of interactive strategies in the classroom. The instructor prepares a session with questions related to the basic knowledge and each student used his own mobile phone to give the answer to the respective question. The results are immediate. In addition, students have instant feedback. The method is based on open-source and easy-to-use tools. There is an increase in motivation, interactivity and personal responsibility. The classroom environment is good and flexible. It is possible to attend different learning rates and respond to the absence of knowledge. Students come to class better prepared. The teacher can also get feedback on the student's knowledge before class. Students can be directed in a more personalized manner. Thereby, the teacher is more useful for the students since in the class time can correct academic tasks and resolve the doubts of students. The ultimate purpose is to consolidate learning.

4. Interactive Tools

ICT tools used in this experience involve the incorporation of free apps and free software as learning support. These applications are used in the implementation of active strategies in the classroom, as *Flipped Learning*. But other strategies have also been used: *Problem-based Learning*, *Game-based Learning*, *Simulation-based Learning*, *Learning-by-doing*, *Puzzle-based Learning*, *Blended-Learning*…, as complement to *Flipped Classroom*. This methodology has a pedagogical effectiveness superior to the traditional system. Students can learn more and better (Artal-Sevil, 2020). Multimedia resources and ICT tools provide the necessary mechanisms to implement a good educational innovation.

Figure 3. Question & Answer format developed with free software Kahoot.

Mobile devices were used to evaluate the effects of learning and the interactivity degree. Concept-tests and questionnaires were used to observe the participation and learning coefficient. During class-time different methodologies with interactive question-answers (Q&A) have been used. Each student has used his own smartphone to respond to the proposed questionnaires. The results are obtained in real time. The use and implementation in the classroom are similar to traditional *i-clickers* (Lucke *et al.*, 2013).

For the in-class activities, different techniques were used such as: resolution questionnaires (test questions); problem resolution and short step by step questions; interactive Q&A (by *Socrative*, *Kahoot*, *Quizizz* and *Plickers* software), educational games and small *theory-pills* (*Nearpod*). *Moodle* has also been used as a repository for documents, files and multimedia resources. Furthermore, this platform manages the different academic tasks of the students. It is a fundamental element in the *m-learning*. *Flipped Learning* is based on abundant multimedia resources (*YouTube* videos) and interactive seminars (*webinars*). All activities are developed sequentially with the theory, seminars and academic tasks. Free software and mobile applications are preferred, especially from the student's view. It is the result of the implementation of the BYOD model (*Bring Your Own Device*) in higher education. All these ICT tools have made it possible to improve the digital competences of the students.

Socrative, *Kahoot*, *Quizizz* and *Plickers* are free software applications that can create online questionnaires in order that the students respond in real time (questions and answers) through the mobile device, see figure 3. The results are obtained immediately and can be shown to students at the end of class. This applications constitute good interactive tools.

Google-Apps (*G-Suite*) offers a powerful set of tools that can be used to develop collaborative environments between students. The platform has a diverse group of applications that can be used for education, such as *Google-Drive*, *Google-Classroom*, *Meet*, *Calendar*, *Docs*, *Forms*, *Slides*, etc.

DirectPoll is a free online tool for educational use. This application allows the teacher to interact very easily with the audience during a presentation in the classroom. It is possible to develop the survey in advance or on the fly, incorporating individual questions as well as multiple choice and other options. The public uses a link, provided by the teacher, to vote.

Nearpod is an interactive classroom tool for teachers to engage students with interactive lessons. This free application allows to show small theory presentations (*theory-pills*) on the smartphone. The platform uses the tablet to manage the content on student's mobile devices. This application combines presentations, collaborative activities, multimedia resources and assessment tools in real time. It is an integrated solution. The application is used to share different contents with students and easily manage the flow of the lesson.

EDpuzzle and *PlayPosit* are other applications destined to the development of audiovisual materials. These programs allow recording video lessons, fractionate a video and insert questions about the fragments seen recently. These tools are more versatile and can incorporate different multimedia resources. Thereby students watch the video of the lesson carefully because they have to answer a series of questions later. Its use is relatively simple and does not require deep technical knowledge.

5. Results and Conclusions

Educational innovation experience here presented is economically sustainable, efficient and transferable to other matters and knowledge disciplines in technical degrees. Several studies indicate that the integration of *Flipped Teaching* together with e-learning can improve results with a most significant learning. The implemented methodology helps to improve student learning. Thus students have achieved the same level of knowledge than in previous years with other more traditional learning strategies. Student participation and motivation has also been increased. Global satisfaction degree of the students in the development of these experiences has been high. Students prefer teaching-learning procedures more dynamic, flexible, creative and continuous evaluation. Although the general impression is that they require more effort and more dedication, compared to the traditional procedure,

see figure 4. This paper also shows a series of free tools intended for *Flipped Teaching* methodology. Its use is simple and intuitive. The degree of student motivation has increased with the introduction of this learning strategy. These educational tools increase the skills, abilities and competences acquired by students.

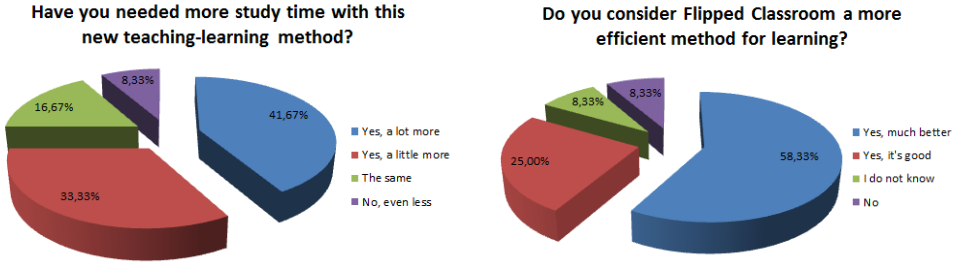

Figure 4. Flipped Teaching model. Survey of student opinion during implementation.

Table 1. Results obtained in the student opinion survey (Likert scale 1-7). Impact analysis of ICT tools on students. Responses obtained in the satisfaction survey in Master of Renewable Energies, Master of Industrial Engineering and PostGraduate in Renewable Energy Grid Integration.

Degree/Master	**Master of Renewable Energies**	**Master of Industrial Engineering**	**PostGraduate in Grid Integration**
Learning is easier using ICT	6,071	6,243	6,127
I like to use ICT in class	6,571	6,563	6,234
The use of applications/ICT generates a lot of stress	1,357	1,247	1,216
It is easy to learn how to use these ICT tools	6,428	6,563	6,449
Working with ICT applications makes me very nervous	1,312	1,247	1,285
With ICT I believe that my learning is more effective	5,933	6,017	6,234
It is a good idea to use serious-games and ICT tools	6,437	6,326	6,453
I feel uncomfortable when I have to use ICT	1,248	1,385	1,285
I believe that ICTs are important for my training	6,571	6,127	6,332
ICT improves my performance	5,874	6,017	6,127

On the other hand, the implementation of the new educational strategy has significantly increased student satisfaction. The willingness of students to use these tools has been very favorable. In order to know the success or failure of the implemented strategy and ICT tools, valuation surveys have been carried out. Table 1 shows the students' opinion about the impact of ICT in the university classroom. This survey is based on the *Likert scale* 1-7. Several conclusions can be drawn from the data presented in Table 1. In general, engineering students consider themselves qualified in the use of these ICT tools and their use in the classroom is considered successful and very positive. At the same time, they also believe that with the use of these applications their learning is simpler and more effective. It is evident that the new teaching model incorporated in the different subjects, provides learning accepted by the students.

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Effectiveness of delivery methods in the transfer of soft skills

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Abstract

Accounting education has in recent years increasingly emphasised the need for developing soft skills. To this end, various delivery methods have been advocated other than the conventional lecture format during the academic programme. This paper reports on a study of the perceptions of graduates on the effectiveness of delivery methods during the academic programme in transferring soft skills. A questionnaire with open and closed-ended questions was administered. Graduates reported that soft skills were most effectively developed when using case studies, followed by collaborative learning. Surprisingly, graduates also indicated lectures as an effective method in soft skills development, by ranking this method after collaborative learning. However, the method of computer-based activities, was reported as the least effective method in developing soft skills. This is a concern, given the prevalence and use of computers and technology in the accounting profession. Educators need to do more in inculcating soft skills, by using additional methods such as mentorship programmes and self-assessment.

Keywords: *Academic programme, accountants, pervasive skills, soft skills, teaching methods, higher education.*

1. Introduction

This paper reports on a study of the perceptions of accounting graduates[1] on the effectiveness of pedagogical methods used in the transfer of soft skills during the academic programme. Soft skills are also referred to as pervasive skills, transferable skills, non-technical skills, social and interpersonal skills, generic skills or employability skills in the accounting literature (Boyce, Kelly, Williams & Yee, 2001; Ballantine & McCourt Larres, 2009; Watty, Jackling & Wilson, 2014; SAICA, 2017). These skills are not subject- or domain-specific (Boyce et al., 2001; Ballantine & McCourt Larres, 2009), unlike technical skills which become obsolete and "often not transferable across different jobs" (Kavanagh & Drennan, 2008, p. 282).

Since the 1980s there have been concerns from accounting educators and professional bodies internationally as to the relevancy of accounting academic programmes. Several reports (American Accounting Association (AAA), 1986; AAA, 1989; Accounting Education Change Commission (AECC), 1990) expressed the need for accounting graduates to master both technical and soft skills. The change in accounting education stemmed from factors such as globalisation, corporate scandals, increased regulations and evolving technologies on business activities (Albrecht & Sack, 2000). In the words of Lines and Gammie (2004) "… the business world in which accountants operate, is becoming ever more dynamic and information rich. The skills and competencies that were appropriate only a generation ago are now far less" (p. 2).

Consequently, professional accounting bodies and educators developed frameworks and reports to address the changes in the profession; and to provide guidance on ways to develop soft skills (Albrecht & Sack, 2000; Lines & Gammie, 2004; Pathways Commission, 2012). In line with other accounting bodies, and the requirements of the International Federation of Accountants (IFAC) the South African Institute of Chartered Accountants (SAICA) developed a Competency Framework (CF), which specifies the technical, and most notably, the soft skills that aspirant chartered accountants (CAs) should acquire during qualification (SAICA, 2017). The CF groups the soft skills into three categories, namely, "ethical behaviour and professionalism" (IA), "personal attributes" (IB) and "professional skills" (IC). These categories are further sub-divided into 26 skills, including eight skills in the IA category, ten skills in the IB category and eight skills in the IC category.

Various educators have responded to the calls by the accounting profession by introducing bespoke methods to address the teaching of soft skills. However, few studies acknowledge the views and reflections of graduates after the academic programme. Lines and Gammie

[1] A graduate in the context of this study is considered an aspirant chartered accountant (CA) who has completed his/her university academic programme and is in the process of completing his/her training programme.

(2004) convey that students play an integral part in the learning process, while Viviers, Fouché and Reitsma (2016) suggest that educators should communicate the methods used to inculcate skills to their students. Therefore, the present study examines the perceptions of graduates on the effectiveness of the methods used during the academic programme in developing soft skills.

The present study contributes to the literature in several ways. First, the paper provides the effectiveness of certain methods in developing soft skills. As emphasised by de Villiers (2010), "despite an already full degree programmes and other internal challenges, faculty will need to find innovative ways to deliver on the demand of stakeholders if they wish to remain relevant and competitive as providers of choice" (p. 10). Given the emphasis of soft skills in the accounting curriculum, the aim of this paper is to understand which methods contribute most to their development. Moreover, accounting schools are under pressure to provide soft skills to graduates entering the profession (de Villiers, 2010). Consequently, educators in South Africa are not alone in their challenge of equipping graduates with the soft skills. Therefore, this study is also useful internationally, on methods that graduates found effective during their academic programme.

2. Literature review

The traditional method of merely lecturing to transfer knowledge is not effective in developing soft skills (Sawyer, Tomlinson & Maples, 2000; IFAC 2015). Bonk and Smith (1998) reiterate this view by conveying that lectures have a narrow focus of knowledge acquisition, where the educator is the source of knowledge. Objective tests have been described as another passive method used in accounting pedagogy that does not result in the transfer of soft skills (AECC, 1995). The increasing technical content required of the accounting curriculum means educators continue to rely on these passive teaching techniques (Boyce et al., 2001). Moreover, an increasing body of work argues for practical, real-world scenarios to be used when teaching soft skills (Mohamed & Lashine, 2003; de Villiers, 2010; Keevy, 2016a). For example, Moilanen (2017, p. 194) argues that "using assignments with real world cases with more ambiguous situations with incomplete information in teaching has offered a way to promote learning skills". This ensures that educators adopt "a creative learning process that does not depend on memorization and extensive use of textbooks" but rather one that is "based on team work, assign[s] students to real companies, case studies, oral presentations, team teaching, involving business professionals in the class rooms, and use of technology and accounting packages" (Mohamed & Lashine, 2003, p. 9).

Consequently, there is general consensus that teaching methods must change (AAA, 1986; 1989; Lines & Gammie, 2004). It has been suggested that a combination of teacher-centred (passive teaching) and student-centred (active teaching) methods should be used (Adler &

Milne, 1995; Mohammed & Abdullah, 2018). Jointly, these methods produce well-rounded accounting graduates with a strong technical foundation as well as additional skills to aid their long-term career success (Mohammed & Abdullah, 2018).

Various educators have responded to the calls by the accounting profession by introducing bespoke "active" methods to address the teaching of soft skills in accounting curricula. For example, Adler and Milne (1995) used a group exercise with the following components: a case study, seminar, presentation, critique session, class discussion and feedback session. A group of students took the lead by presenting a case study and facilitating a seminar discussion. Another group of students then critiqued the case study. Lecturers facilitated the class discussion and feedback session. Cases therefore provide the platform for promoting interaction and discussion of ideas through collaboration (AECC, 1995; Boyce et al. 2001). Cases also provide students with a connection to the real world by engaging in problem-solving, critical thinking and communicating to deal with complex issues (AECC, 1995; Fortin & Legault, 2010; IFAC, 2015). Case studies, in conjunction with collaborative learning can provide an ideal platform to develop soft skills (Boyce et al., 2001; Samkin & Keevy, 2019). Collaborative learning has been described as one of the best learning resources insofar as it permits interaction between students who work in groups with a shared responsibility for the final outcome (Boyce et al., 2001). The evidence suggests that students engaging in collaborative learning achieve higher grades and develop soft skills better than their counterparts who opt for lecture-based learning (Fortin & Legault, 2010).

The use of mentorship programmes has also been described as a student-centred approach, given that students are no longer seen as "an empty vessel to be filled by the instructor" (Spanier, 2001, p. 110). By fulfilling a mentorship role, educators have a far greater educational impact on students by not restricting them to the classroom environment (Spanier, 2001). Jackling and McDowall (2008) convey that mentoring programmes have "the potential to assist in addressing not only academic issues but also more indirectly the social issues that underpin the totality of the university experience" (p. 449).

In a few South African studies, it was found that case studies (Keevy, 2016a), collaborative learning exercises (Keevy, 2015), and mentorship programmes (Keevy, 2016b) could be used to develop all of SAICA's soft skills. However, it was reported that academics did not readily use these methods during the academic programme to inculcate soft skills, as only 64% of academics used case studies, 37% used collaborative learning exercises and only 18% used mentorship programmes.

3. Research method

In order to explore graduates' views as to the effectiveness of methods in developing soft skills during the academic programme, a research instrument in the form of a web-based

questionnaire was developed to elicit the necessary information. The questionnaire consisted of five sections. The first section attempted to elicit information on the university where the participants' completed their academic programme as well as their current training programme. The remaining four sections consisted of closed-ended, ranking questions of a quantitative nature. Participants were asked to rank the effectiveness of the methods used during the academic programme contributing to their soft skills development. The ranking was from 1 (most important) to 8 (least important), and participants could use each number only once. Open-ended questions were also included in the questionnaire to support findings from the questions relying on the ranking response.

The web-link on the questionnaire contained a sidebar guiding participants on the skills included within each of the three categories when answering the questions. For example, when answering the questions for a particular pervasive skill category, a sidebar appeared containing the list of the different skills under each category (see Table 1). The questionnaire was pilot tested by a selected group of students and graduates. A data controller was used to set up an online website where the questionnaire could be answered and the data recorded. The questionnaire, containing a dedicated uniform reference (URL), was sent via email to graduates. The participants were directed to a website and asked to complete the questionnaire by clicking on the URL. The data controller collated the completed questionnaires electronically.

Table 1. List of individual skills included in the IA, IB and IC categories of SAICA's soft skills.

IA	Uses an ethical reasoning process, protects the public interest, acts competently with honesty and integrity, performs work competently and with due care, maintains objectivity and independence, avoids conflict of interest, protects the confidentiality of information, maintains and enhances the profession, and adheres to laws, professional standards and policies.
IB	Self-manages, demonstrates responsible leadership, maintains and demonstrates competence and recognises limits, strives to add value in an innovative manner, manages change, treats others in a professional manner, is a life-long learner, plans and effectively manages teams and projects, works effectively as a team member, manages time effectively, and demonstrates good corporate citizen attributes.
IC	Obtains information, thinks critically, solves problems and makes decisions, communicates effectively and efficiently, manages and supervises, understands and uses appropriate IT systems and tools, considers and applies legal concepts, and understands how the national and international environment impacts a CAs role.

Source, SAICA (2017) .

IA = ethical behaviour and professionalism, IB = personal attributes, IC = professional skills.

3.1. Population and response rate

The population for the empirical work included all graduates who wrote the Assessment of Professional Competence (hereafter APC). In total, 2 050 emails were dispatched with a response rate of 66%. The questionnaire in its entirety was part of a bigger data set. Therefore, only 34% of respondents addressed the portion of the questionnaire relevant to this paper, as none of the questions in the questionnaire was compulsory. As the APC is the final assessment to qualifying as a CA, the graduates had already undergone the full scope of the academic programme and would have had first-hand knowledge of methods used during the academic programme (SAICA, 2017).

4. Empirical findings

4.1. Graduates' views on the effectiveness of the delivery methods in developing soft skills

The objective of these four sections in the questionnaire was to elicit graduates' views on which academic programme methods developed soft skills most effectively from an overall perspective; and in terms of the IA, IB and IC category of soft skills. The results are set out in Table 2 below, and are presented from the most effective to the least effective, based on the mean.

Table 2. Graduates' views on the effectiveness of methods in developing soft skills.

Effectiveness of methods in developing soft skills	**Section 2** **Overall: Soft skills**			**Section 3** **IA: Ethical behaviour & professionalism**			**Section 4** **IB: Personal attributes**			**Section 5** **IC: Professional skills**		
Methods	**M**	**R**	**n**	**M**	**R**	**n**	**M**	**R**	**n**	**M**	**R**	**n**
Case studies	2.61	1	687	2.88	1	579	3.15	1	578	2.71	1	578
Collaborative learning	3.66	2	685	3.70	2	579	3.39	2	579	3.73	2	577
Lectures	3.95	3	685	3.95	3	576	4.45	4	575	4.28	3	576
Objective tests	4.41	4	684	4.49	4	576	4.58	5	574	4.34	5	575
Self-assessment	4.48	5	684	4.54	5	576	4.11	3	576	4.30	4	578
Mentorship programmes	5.41	6	680	5.03	6	574	5.14	6	574	5.44	7	575
Orals and presentations	5.50	7	682	5.51	7	574	5.25	7	574	5.39	6	574
Computer-based activities	5.76	8	680	5.83	8	576	5.82	8	572	5.69	8	574

n = number of respondents who answered the question; M = Mean; R = ranking of 1 – 8 based on the Mean score.

Interestingly for the soft skills as a whole and for all three categories of soft skills, case studies were ranked in the first position, collaborative learning in second position and computer-based activities in the last position by graduates. As far back as 1990, the AECC communicated that using technology creatively in the classroom is essential. Added to this, given the technological advancements in business, it is imperative that accounting teaching focuses on blended learning opportunities to transfer soft skills (de Villiers, 2010). Therefore, it is a concern that graduates ranked computer-based activities in the last position. Participants, however, noted that educators should provide computer-based activities through online lectures (participant 436), interactive e-learning (participant 190), and online quizzes and assignments (participant 764). Lastly, one participant stated that:

> Information technology should have played a bigger role in the syllabus and should have continued into 3rd year level of studies (participant 358).

What is also surprising is that lectures were ranked in either third or fourth position by graduates, and that objective tests was ranked in fourth or five position by graduates. From this result, the assumption that can be made is that these methods are readily used by educators and therefore, considered as effective methods by graduates. However, these methods used individually merely result in knowledge transfer (AECC, 1995; Sawyer, et al., 2000; IFAC 2015). Graduates conveyed in comments that educators should use more interactive lectures (participant 1051), and video lecturing as a means to support the academic programme (participants 1273, 1346).

5. Conclusions, limitations and areas for future research

This paper reports on a study of the perceptions of accounting graduates on the effectiveness of teaching methods in the transfer of soft skills during the academic programme. The results found that case studies followed closely behind collaborative learning as the most effective methods in developing soft skills. Educators are encouraged to rely less on lecturing and objective tests, but introduce bespoke methods, where students can be active participants in the learning process. The results also found that graduates viewed computer-based activities as the least effective method in inculcating soft skills. Therefore, the reason for this low ranking should be researched further, given the prevalence and increasing use of technology in business.

A limitation of this study was that graduates were asked to rank the various methods. It is not clear from the results whether these methods are in fact being utilised by educators. Furthermore, certain methods could be used jointly during the academic programme. For example, computer-based activities in the form of an Excel spreadsheet could be used in a case study exercise. However, this is not apparent from the questionnaire, which could have resulted in confusion among participants when ranking the methods. Further research could

build on this study by using more interpretive approaches such as questionnaires or focus groups to gather information on how these methods are being utilised during the academic programme. A further limitation of this study is that there are various methods that can be used during the academic programme, such as role plays, peer assessment and the like. The given study merely focused on eight methods, six of which are active methods and two passive methods to obtain graduates views. Therefore, further research could build on this study by obtaining insight into all relevant pedagogical methods.

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Social entrepreneurship as a tool for promoting critical, paradoxical learning in the field of business organization and management: An experiment from the University of Zaragoza

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Abstract

There is a growing interest in examining subversive interventions by scholars that may involve the production of new subjectivities, the constitution of new organizational models, and the linking of these models with current social movements. This paper presents the case of the Social Economy Lab (LAB_ES), created in the Faculty of Economics and Business of the University of Zaragoza in 2017. In particular, we discuss the main experiences and interventions made from the LAB_ES around three areas of work: (1) the space of collective work; (2) the space of participation for the university community; and (3) the space of collective research. The study reflects the possibilities of including the study of alternative organizations in the education agenda. These organizations are guided by principles that include democracy, equality, emancipation and environmental sustainability. Likewise, the results and interventions of the LAB_ES are discussed not only to foster critical thinking among the students, but also to provide this group with skills for starting up alternative projects of organization and management outside the university. Finally, some key conclusions are drawn about the role of the LAB_ES as a space for collective research and collective production of critical knowledge about business organization and management, through the involvement of different actors.

Keywords: *Alternative Economies, Critical Thinking, Knowledge Transfer, Paradoxical Thinking, Social Economy Organizations.*

1. Introduction

Especially since the outbreak in 2007/2008 of the last financial, social and humanitarian crisis of the capitalist system, we have witnessed a growing debate in the academic field about the teaching models and pedagogical content that dominate business schools and business schools, as well as the relevance and impact that research on organization and management has on real business practices (Rossi et al., 2017).

Specifically, these discussions have found special acceptance in the academic movement of the so-called Critical Management Education Studies (hereinafter CMES) (Alvesson et al., 2009). This branch of research poses a critique of the 'managerialist' and neoliberal ideology that permeates business schools and business science faculties and of the educational content taught, focusing on economic efficiency, business competitiveness and the dominant logic of 'profit maximization/cost minimization', thus emphasizing the marginalization of critical thinking about organizations that occurs daily in these spaces (Fotaki & Prasad 2015). In this way, the CMES advocates politicizing, problematizing and making more complex the discussion on management in the educational field, addressing the influence that organizations and management practices have on economic and structural inequalities, systems of power relations and modes of domination and control, with the ultimate goal of imagining and generating more democratic, humanistic, emancipatory and socially responsible forms of management (Dehler 2009; Huault & Perret 2011).

At the same time, the field of CMES has embarked on an in-depth debate about the gap between theory and practice, i.e. the relevance of Perret research and theory to influence or transform management and organizational practice (King & Learmonth 2015; Cunliffe & Scaratti 2017). These aspirations at the CMES level are part of a broader debate within the social sciences about how critical research and teaching can generate progressive change within society as a whole (Rossi et al., 2017). This discussion has crystallized into the concept of engaged scholarship, defined by Van de Ven & Johnson (2006: 803) as 'a collaborative form of research in which scholars and practitioners use their different perspectives and skills to co-produce knowledge about a complex problem or phenomenon that exists under uncertain conditions in the world'. Committed scholarship' in the CMES field has taken different forms. These include the dissemination of knowledge beyond self-referential academic circles (addressing not only senior management but also other stakeholders such as trade unions, workers, and minority and marginalised groups in society), the reformulation of academic conferences to promote more creative and dialogical engagement, and to encompass wider audiences (including policy makers), investors, activists or members of alternative organizations), or the involvement of academics as professionals and managers within organizations with the aim of actively influencing management practices and promoting broader social transformation (for a review, see King & Learmonth 2015).

However, as Fleming & Banerjee (2016) point out, a much less explored line of work by the CMES school to advance the understanding of 'committed scholarship' lies in the critical pedagogy of management in educational spaces. This is paradoxical considering that, as illustrated by several works based on critical pedagogy, offering tools to students to think and reflect critically on management is essential to promote emancipatory and constructive social actions, and thus transform the practical reality of management (among others, Dehler 2009; Huault & Perret 2011). Indeed, some authors suggest that it is essential to explore how 'engaged scholarship' can be associated with practices of educational innovation and collective knowledge co-generation that encourage students to learn about alternative forms of entrepreneurship and to become involved in the organizational and management practices that take place in their environment (Cunliffe & Scaratti 2017).

To this end, the experience of the Social Economy Laboratory (LAB_ES) of the Faculty of Economics and Business of the University of Zaragoza is presented, a space created in 2017 to experiment with the social economy on the part of the university community, that is, a place where the students, the PDI and the PAS can practice with economic projects based on the principles of Participation, Mutual Support, Solidarity and Commitment to the environment, within the framework of the University and in contact with the business and association reality of this sector.

2. Context

The LAB_ES was formally created at the beginning of 2017 as a result of the collaboration of professors from the Department of Business Management and Organisation, administration and service personnel and students from the faculty. On the one hand, it was observed that in the Faculty of Economics and Business of the University of Zaragoza there was no space open to all groups of the university community in which to promote and disseminate knowledge about the Social Economy sector. On the other hand, shortcomings were also detected among the faculty's students, related to the lack of skills in two very specific areas: (i) in the capacity for teamwork and cooperation and (ii) in the development of values that provide their professional and academic activity with a sense and capacity for critical analysis of the reality studied and its environment.

In this way, the LAB_ES was designed to try to address both shortcomings. Thus, the space stands as a reference point for the development of socially responsible, ecologically sustainable and economically viable projects, aimed at students, teaching and research staff and administration and services staff of the Faculty of Economics and Business as a whole. Focusing on the students, the final objective is to provide this group with tools, skills and abilities to work as a team, to apply in a practical way the knowledge acquired in the degree, as well as to get to know the social and economic environment from a different

point of view and to be able to meet the needs of social economy entities once their stay at the University is over. The LAB_ES complements the training offered in the degree, encouraging the development of a critical and constructive spirit with reality. Likewise, the LAB_ES is established as a space for the PDI and the PAS to develop innovative collective practices and design new teaching methodologies linked to the transfer of knowledge and work close to the students and social entities of the city. The projects and ideas to be developed in the LAB_ES must respect the following premises:

- It must be promoted from the principles and values of the social economy
- It must focus on the implementation of real projects
- It must promote Knowledge Transfer
- It must generate social innovation
- It must obtain a positive social impact for society

The conviction with which the LAB_ES originates is that the organisations of the Social Economy, i.e. cooperatives, mutual societies, labour companies, insertion companies, special employment centres, associations, foundations and agricultural transformation companies (Bretos & Marcuello, 2017), propose a fairer alternative to the traditional capitalist enterprise, as they are based on principles of a social nature such as the primacy of the person and the social purpose over capital, the defence and application of the principles of solidarity and responsibility, democratic governance, or autonomy of management and independence, among others (Bretos & Errasti 2017).

3. Results

The project has achieved various results, which can be grouped according to the three key spaces that make up the work developed from the LAB_ES. These are the Collective Work Space, the Participation Space of the University Community and the Collective Research Space. It should be noted that these three spaces are enhanced and complemented thanks to the involvement of the LAB_ES team, the collaborating entities and all the users who have passed through them, contributing their time, ideas or work.

3.1. Space of collective work

The Collective Work Space is designed to develop its own projects or to collaborate in other projects of Social Economy entities. The main lines of action developed so far, as well as the main results obtained, are described below.

Development of the project ApS Social Business Consultancy: The objective of this project is to offer new training spaces to the students of the University of Zaragoza, combining social commitment, training, collective reflection and the implementation of their academic knowledge in order to develop social projects at the service of people and groups in a

disadvantageous situation. In this way, the aim is to train socially responsible, ethically prepared business and economics students who are capable of integrating social and environmental aspects into their management and relationship skills, taking as a reference model the Business Social Consultancy developed by the University of Comillas (ICADE). The project was defined specifically through a Teaching Innovation Project based on service learning, which is structured around two main axes: training in economics and business at the service of people, which translates into the implementation of a mobile basic economics school for disadvantaged groups, inclusive businesses, social entrepreneurs, insertion companies, etc., and action on specific social needs, in which students make the knowledge they have acquired during their degree available to participating entities. Along these lines, regulations have been drawn up for the academic structure of the programme and an agreement has been formalised with the ADUNARE Foundation, which manages the Social and Labour Centres of the Zaragoza City Council, and which provides a wide range of users to attend to, being able to select those groups that are most suited to those tasks for which the students are most predisposed.

University Social Innovation Award: In order to recognise and support innovative initiatives linked to the Social Economy and developed by the university community, the first edition of the University Social Innovation Award was announced. In this way, the aim was to promote new ways of satisfying social needs that are not adequately covered by the market or the public sector, constituting new social relations that place people at the centre of their activity and always within the framework of the University of Zaragoza. The Award was attended by 16 people, who developed and disseminated a total of 9 socially innovative projects on social networks.

3.2. Space of participation for the university community

Through this space, the aim is to promote the empowerment of the university community through Social Economy projects, to carry out activities based on the transfer of knowledge to society and to initiate processes to learn about the consumption patterns of a localised group that will allow us to promote responsible habits among them that are respectful of the environment and society. So far, the following initiatives have been developed:

Events at the Faculty of Economics and Business of the University of Zaragoza: Taking advantage of the start of the 2017/2018 academic year and the institutional launch of the LAB_ES, an event was held to present the Social Economy Laboratory, with a twofold objective: to publicise the existence of the Laboratory and all its activities, and to disseminate the work of Aragonese Social Economy entities, bringing them closer to the university community in a dynamic and attractive way. To this end, the event was divided into three spaces: LAB_ES Conference Space, Exhibition Space, Gastro Space. The events were attended by 15 collaborating entities and took place over a whole day in the Faculty of

Economics and Business of the University of Zaragoza, with the aim of reaching 578 potential participants. In addition, thanks to the collaboration of Oxfam Intermón, every Wednesday during the months of November and December 2017 the principles of Fair Trade were disseminated in different locations and on the Campus of the Faculty of Economics and Business, offering a solidarity tasting of coffee, cocoa and cookies and thus taking a first step towards mobilizing and changing practices and attitudes towards consumption.

Seedbed of Ideas: This is an initiative aimed at the students of the Faculty of Economics and Business of the University of Zaragoza in order to provide them with a space in which to think about and develop projects and initiatives linked to the Social Economy based on participation, mutual support, solidarity and commitment to the environment. Since the beginning of 2017, weekly meetings have been held that are open to anyone who wants to get to know the LAB_ES, propose ideas and learn by doing. Throughout the year, these meetings led to participation in the Cinefórum organised by the Delegation of Students from the Faculty of Economics and Business of the University of Zaragoza and to the preparation, dissemination and analysis of a survey on Responsible Consumption with the aim of finding out about the consumption patterns of the university community, in order to carry out a task of communication and dissemination of the alternatives and initiatives of awareness and promotion of responsible consumption existing in the city.

I University-ESS Meeting: In order to learn about and connect the projects for promoting the Social and Solidarity Economy that already exist in other universities, as well as to develop the potential of the University as a key institution for the development of the Social and Solidarity Economy, the I University-ESS Meeting was organised, promoted and held in December 2017. The Meeting, which was organised around the themes of Training, Research and Territory, tackled two fundamental challenges: how to attract or involve the university community in the Social and Solidarity Economy and how to create spaces and methods that favour collaboration between the University and the business and association reality of the sector. The Meeting was held in collaboration with other universities and seven entities linked to the Social Economy, and welcomed 40 participants from Madrid, Catalonia, Andalusia, Valencia, Galicia and Aragon.

3.3. Space of collective research

The objective of this axis or space is to create, promote and make visible useful resources for knowing and recognising the Social Economy. Along these lines, three research projects have been carried out in order to highlight the value of the Social Economy and to establish a methodology for possible future exports.

Directory of Social Economy Entities: In order to unify and complete the existing information on the Social Economy Entities that are federated into representative

organisations, the Directory of Entities drawn up by CEPES Aragón in 2012 has been updated. To this end, data has been collected through the networks or platforms in which the bulk of Social Economy Entities in Aragon are located. Once the information has been unified and the missing data has been filled in by means of manual searches in specialised databases and on the websites of the entities themselves, a database has been created with the data referring to: platforms to which they are adhered, date of constitution, legal form, activity, number of employees, number of members, number of volunteers, invoicing data and contact data.

Cooperative Entrepreneur in Zaragoza: The objective of the second of the research works carried out in 2017 was to analyse the reality of the Cooperative Entrepreneur in Zaragoza, in order to know the number and main characteristics of the Associated Work Cooperatives, a sector that is not federated and about which there is no data. In order to know the evolution of the cooperative sector, the Associated Work Cooperatives created between 2011 and 2017 were analysed, creating a database and a virtual map of them that covers the city of Zaragoza as well as the rural neighbourhoods and municipalities of the province.

4. Conclusions

This paper has presented the case of the Social Economy Lab (LAB_ES). In particular, we have discussed the main experiences and interventions made from the LAB_ES around three areas of work: (1) the space of collective work; (2) the space of participation for the university community; and (3) the space of collective research. The study reflects the possibilities of including the study of alternative organizations to promote paradoxical and critical thinking in the field of business organization and management. These organizations are guided by principles that include democracy, equality, emancipation and environmental sustainability. Likewise, the results and interventions of the LAB_ES have provided students and praticipants with skills for starting up alternative projects of organization and management outside the university. Finally, it is also remarkable the role of the LAB_ES as a space for collective research and collective production of critical knowledge about business organization and management, through the involvement of different actors such as teaching staff, students, practitioners and policy-makers.

The paper is relevant to further understand not only the harmful effects of mainstream neoliberal economic and managerial education (Ghoshal, 2005), but most importantly how the study of social entrepreneurship and alternative organizations can allow us rethinking social responsibility and caring in economics and business organization. In addition, the work contributes in two directions to advance our understanding of the role of 'committed scholarship' in the field of CMES. On the one hand, the work shows the potential offered by the study of alternative organizations not only to promote critical thinking among students,

but also to make them capable of carrying out alternative experiences of organization and management outside the university, based on aspects such as dignity, social justice, welfare and environmental sustainability. On the other hand, the work shows how the participation of diverse social actors (students, faculty, administration and service personnel, policy-makers and practitioners) in teaching and research projects can help reduce the gap between theory and practice, favoring the creation of critical, useful, relevant and practical knowledge for society that serves as a catalyst for developing subversive and emancipatory interventions in real organizational life.

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Shared learning between health sciences university students. Teaching-learning process of hand hygiene

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Abstract

The main aim of the project has been the usage of active teaching methodologies to raise awareness of the importance of hand hygiene in healthcare.

Methodology: The teaching innovation project has put into practise shared learning of knowledge and skills between equals. 11 Nursery Degree students, with a previous cooperative and individual work, participate in a teaching-learning process about hand hygiene with 82 Physiotherapy Degree students, using Tics, workshops on hand disinfection with self-assessment, evaluation of pre and post knowledge and evaluation of the satisfaction with the activity.

Results: The assessment of pre and post questionnaires reveal an increase in the amount of correct answers. 98.8% of students considers they will be able to apply the acquired knowledge in their professional practice. The applied methodology is considered adequate in a 95.1%. Students have shown a great satisfaction with the activity.

Conclusions: The Physiotherapy students have considered the experience to be very satisfying and useful for the professional practice.

The use of teaching-learning methodology has shown to be a valid option for gaining knowledge and skills on hand hygiene.

***Keywords**: Educational innovation; learning between equals or shared learning; hand hygiene; satisfaction.*

1. Introduction

One of the aims of the World Health Organization (WHO) Security Program is *"To promote and develop the knowledge and patient's safety culture between professionals and patients at any level of healthcare"* (WHO, 2019). *This aim in Spain, the* Ministry of Health, Social Services and Equality *implements and implies the development of actions to improve the information and training about professionals', patients' and citizens' safety"* (Ministerio de Sanidad, Servicios Sociales e Igualdad, 2016).

Safety Strategy for 2015-2020 includes among its specific aims "To maintain and encourage the expansion of the Spanish National Health System's Hand Hygiene Program to all healthcare centres" and recommends "To preserve and consolidate the developed actions for a better adherence to hand hygiene among professionals, patients and carers, in hospitals, primary care, residences and health assistance centres".

According to actual data of health services, 1 out of 10 patients contract an infection while receiving healthcare (WHO, 2019), which leads to longer hospital stays, long term disability, increase in microorganisms resistance to antimicrobials, massive additional cost to the health system, high cost for the patients and their families and unnecessary deaths. In this context, it is appropriate to incorporate the promotion of patient's safety culture in Health Sciences students before starting the practical period in sanitary institutions.

The infection prevention and control, including hand hygiene, is essential to achieve Universal Coverage in Health for three reasons:

- It is practice based on evidence.
- It has demonstrated an impact in the quality of care and Patient's Safety.
- It reaches all levels of healthcare (Ministerio de Sanidad, Consumo y Bienestar Social, 2019).

The hands are the main mode of transmission of germs in healthcare. Hand hygiene is recognized by the WHO as the cheapest, simplest and most effective mean to prevent the infection associated to sanitary assistance and crossed transmission of multiresistant organisms.

In light of this scenario, the WHO has proposed, in the World's Alliance for Patient's Safety, the campaign *"Save lives: wash your hands"*. Thus, the Ministry of Health, Consumer Affairs and Social Welfare has started the Hand hygiene campaign: *Saving lives is in your hands*, given that the conclusions of the Prevalence Study of Nosocomial Infections in Spain (*EPINE*) 2017, evidenced that nosocomial infections affect 7,74% of patients in Spain.

In the teaching field, specifically in Health Sciences degrees, it is important to incorporate training, awareness and hand hygiene promotion campaigns.

1.1. Justification and adequacy of the convocation

The European Higher Education Area (EHEA) proposes significant changes in the teaching-learning processes. On one hand in the learning approaches that university students use during their academic training, and on the other hand, in the methodological used and teaching strategies that have been implemented (Argos et al., 2013).

This innovation Project is adequate to the *Resolució de 10 de juny de 2019, del vicerectorat d'ocupació i programes formatius, per la qual es convoquen les ajudes per al desenvolupament de projectes d'innovació educativa per al curs 2019-2020* because it is centrered in the improvement of university teaching quality, specifically, in the line of "Active methodologies in learning".

The project implements shared learning between equals, collaborative and cooperative work, techniques such as "focus group" and the use of TICs in the classroom, specific about the learning-teaching process, object of the project "hand hygiene".

1.2. Background of the activity

During the 2018-2019 academic year, a educational innovation project was developed in *La Fe* Nursery School, which, using active teaching methodologies, promoted leaning from the conception, design, planning, development and evaluation of the project "Active learning on hand hygiene". This project has achieved a high academic performance on the matter, due to the distribution of roles and individual, as well as collective, responsibilities, to critic thinking and to the rigorous transmission of knowledge and skills.

The results of the project were, among others:

- The student body acquired an active role in the learning process through a stimulating interaction, individual and group responsibility, as well as positive interdependence.
- The teacher's role was of orientation and coordination in the teaching-learning process and of providing the teaching means.
- The knowledge questionnaire showed an 84% of correct answers, against a 16% of incorrect answers.
- The result of the competence test was: 100% of students passed, 71% with top qualification.

As a conclusion, we can affirm that the project achieved a great participation, a very satisfactory acceptance of the teaching-learning process on hand hygiene for the correct

usage of new technologies in the classroom by Nursery Degree students, and that the academic performance achieved was high.

Therefore, the shared learning project was proposed to the students of the Nursery Degree that had participated in the previous project and students from the Physiotherapy Degree.

2. Aims

The aims of this educational innovation project have been:

- To achieve the acquisition of knowledge and skills on hand hygiene, through shared learning between Nursery and Physiotherapy students.
- To raise awareness of the importance of hand hygiene in healthcare.
- To achieve the satisfaction of the student body for the usage of active teaching methodologies.
- To incorporate new technologies in the classroom.

3. Methodology

A teaching-learning process has been put into practice with 11 3rd year university students from the Nursery Degree of the *La Fe* Nursery School, that had, in the previous year, developed an active and participating teaching-learning process on hand hygiene. They shared knowledge and skills on hand hygiene with 82 2nd year students from the Physiotherapy Degree of the Universidad de Valencia.

4 sessions were done with four different groups of students. Each session consisted of a theoretical part, a practical workshop, evaluation of pre and post knowledge, individual self-assessment of the procedure of hand disinfection and evaluation of the satisfaction with the activity.

In the theoretical part, *power point* presentation tools were used with the projection of audio-visual content, one of which, elaborated by a group that acted as teachers. The practical workshops were done with the individual participation of the students and the usage of an hydroalcoholic solution with fluorescein, a metal box and ultraviolet light torches.

For the evaluation of knowledge and satisfaction, the *on-line* "*Kahoot*" resource was used.

The acquired knowledge was assessed with a pre-test and a post-test questionnaire with 20 true-false questions.

The satisfaction of the student body was assessed with a 14-question questionnaire divided in 3 blocks: four, of general evaluation of the activity, six, of methodology and organisation

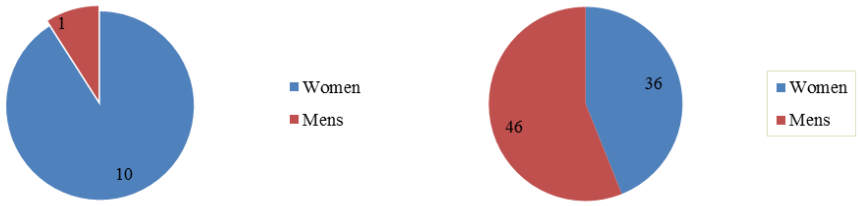
of the used resources and four, of the evaluation of the teaching team (the Nursery Degree students).

A practical individual self-assessment of the hand disinfection procedure was also done, using the ultraviolet light lamp.

The activity was done at the end of November of 2019.

4. Results

Four sessions were done. 11 3rd year student from the Nursery Degree and 82 2nd year students from the Physiotherapy Degree formed the teaching team. The distribution by sex is shown in figure 1.



A B

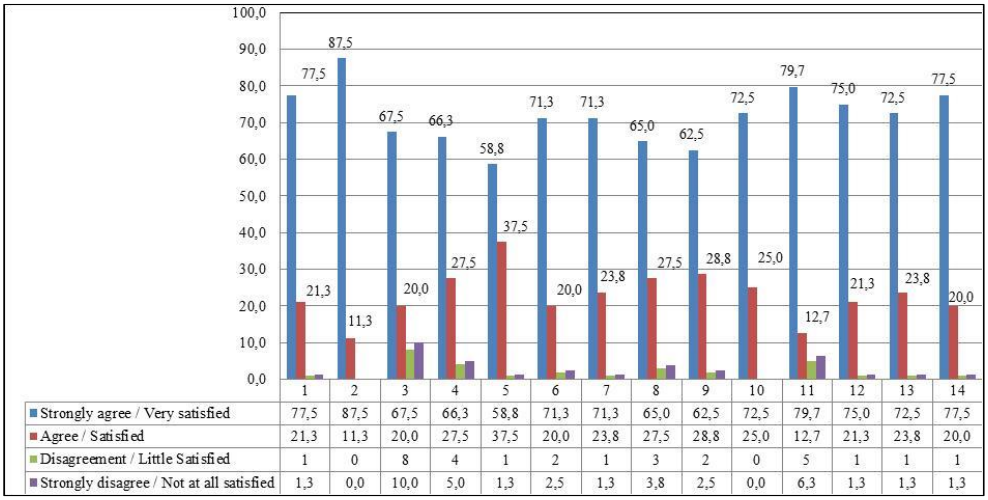
Figure 1. Distribution by sex. A. Teaching team. B. Physiotherapy participating students.

The evaluation of the pre and post questionnaires of the sessions shows an increase in the percentage of the amount of correct answers. In table 1, the results of each of the sessions are shown.

Table 1. Percentage of correct and incorrect answers per each of the sessions.

Answers	First session Pretest	First session Posttest	Second session Pretest	Second session Posttest	Third session Pretest	Third session Posttest	Fourth Session Pretest	Fourth Session Posttest
Correct	69,26%	69,26%	75,71%	86,79%	71,09%	90,00%	75,88%	89,71%
Incorrect	30,74%	30,74%	24,29%	13,21%	28,91%	10,00%	24,12%	10,29%

Figure 2 shows the satisfaction of the Physiotherapy students with the activity. All the items have been valued, by over 60% of the students, with the category of strongly agree or very satisfied, between 11-37.5%, with the category of agree or satisfied, and only some items were answered with the category of strongly disagree or not satisfied by 0-10% of the students.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Strongly agree / Very satisfied	77,5	87,5	67,5	66,3	58,8	71,3	71,3	65,0	62,5	72,5	79,7	75,0	72,5	77,5
Agree / Satisfied	21,3	11,3	20,0	27,5	37,5	20,0	23,8	27,5	28,8	25,0	12,7	21,3	23,8	20,0
Disagreement / Little Satisfied	1	0	8	4	1	2	1	3	2	0	5	1	1	1
Strongly disagree / Not at all satisfied	1,3	0,0	10,0	5,0	1,3	2,5	1,3	3,8	2,5	0,0	6,3	1,3	1,3	1,3

Figure 2. Global satisfaction levels of Physiotherapy students.

The general evaluation shows a satisfaction percentage in the category of strongly agree, between 66.3- 87.5% and agree, between 11.3-27.5%. The item with higher punctuation was Will I be able to apply the acquired knowledge in the professional practice? 87.5% strongly agreed, whilst 11.3% agreed (figure 3).

With the question *¿In general, has the logistic organization contributed to the development of the activity?* 72.5% strongly agreed, whilst 25% agreed. Regarding the question *Have the contents developed during the training session found to be useful?* 58.8% answered strongly agree and, 37% agree. In relation to the methodology, *The used teaching methods have been adequate for the optimal development of the activity?* 71.3% answered strongly agree and, 23.8%, agree (figure 4). The satisfaction with the teaching team has been very high (figure 5).

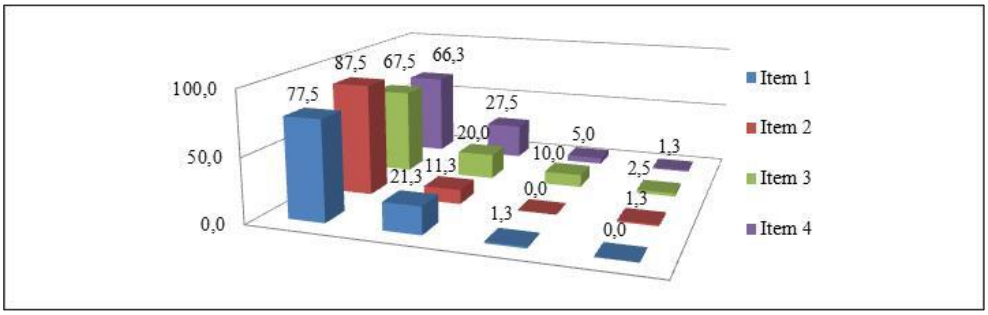


Figure 3. Percentage of satisfaction level of the general evaluation of the activity block.

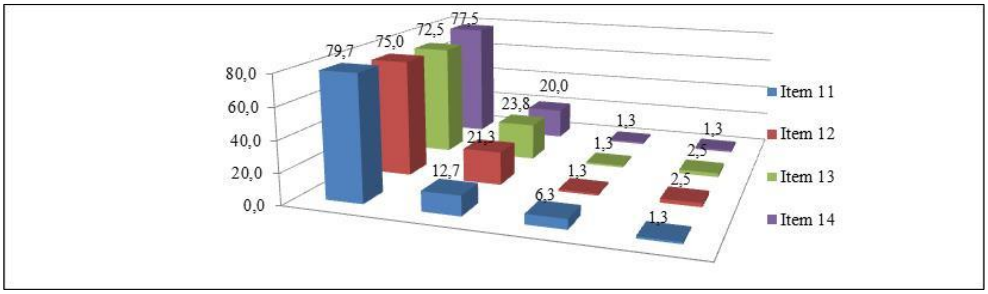


Figure 4. Percentage of satisfaction level of the methodology/organization and resources block.

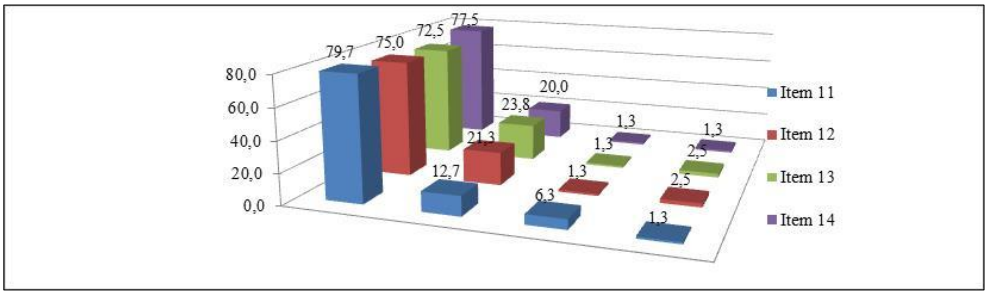


Figure 5. Percentage of satisfaction level with the teaching team.

5. Conclusions

The incorporation of active methodologies, like shared learning between equals has shown to be a positive option in the teaching-learning process to acquire knowledge and skills on hand hygiene.

The Physiotherapy students have considered the experience to be very satisfactory and useful for their professional practice.

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Disruptive Pedagogy: *Guerrilla* Tactics in Large Classes

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Abstract

Guerrilla instructional strategy is when one instructor (the guerrilla) enters into their colleague's class that is in session unannounced, sits for a while to gain insight on what topic is being taught, takes over and facilitates students' learning for about ten minutes and then leaves the classroom. The strategy is disruptive as an unconventional approach to enhance student engagement and learning. The temporary takeover of roles is designed to be a surprise to students. In addition, the host is not privy to what the guerrilla's plan is. In this paper, we share themes that emerged from the thematic analysis of our teaching reflections and our students' experiences with guerrilla pedagogy. It was evident that students appreciated having two experts who have different instructional strategies collaborate in ways that captured their interests. The experience was positive and fostered a strong sense of respect and trust between colleagues. The "guerrillas" felt vulnerable as they implemented the strategy

Keywords: *guerrilla; teaching; learning, experiences.*

1. Introduction

In this study, we used *guerrilla* instructional strategy to facilitate students' learning of key concepts within two courses namely pathophysiology and human anatomy and physiology. *Guerrilla* instructional strategy is when one instructor enters a class in session, sits for about 5 minutes and then temporarily takes over the instruction for about ten minutes and then leaves the room unannounced. According to Anderson and Fierstein (2018), *guerrilla*-teaching approach is an unconventional approach that is designed to achieve conventional powerful learning dynamics. The approach is unconventional in the sense that one instructor temporarily takes over the instruction in a way that disrupts the instructional strategy of their peer. Weems (2013) pointed out that *guerrilla* pedagogy is "a form of engagement that makes use of a wide range of strategies, tactics, and missives toward the aim of reterritorializing both the academy and what counts as knowledge production" (p. 51). The teaching and learning norms are challenged by the unconventional approach that has its roots in flash mob phenomenon. The strategy has an element of surprise and suspense for the students. As pointed out by Weems (2013), memorable experiences includes situations where learning "surprise the very subjectivity of the subject" (p. 55). Having students surprised by the entry and takeover of instruction by the guerrilla instructor created a different learning and teaching dynamic that could be memorable to the students. Wills (2007) pointed out that creating memorable and fun learning environments helps students with information processing and long-term memory. The argument on how learning is enhanced by enjoyable learning environment is also supported by neuroscience. Thanos et al (1999) indicated that the brain chemical transmitters related to students' level of comfort and enjoyment could influence information processing and storage in the brain. The disruptive learning experience has a potential of creating memorable experiences that could result in an increase in long-term retention of the material presented. Our desire is to create learning environments that support students' information processing and storage in the brain.The main aim of this study was to implement a disruptive instructional strategy that would engage students and facilitate their learning of some key concepts in the courses taught by the "*guerrillas*". This paper explores instructors and students' experiences with *guerrilla* pedagogy.

2. Method

2.1. Study context

The study was implements at a community college in Canada. Students enrolled in the two courses taught by the *guerrillas* participated in the study. A total of four sections each with about a hundred students (a total of about 400 students) experienced the *guerrilla* pedagogy. The courses taught by the two instructors are pathophysiology for health

professionals and human anatomy and physiology. The participants were students enrolled in a practical nursing program. The two *guerrilla* instructors have been teaching the two courses for six years and they are very familiar with the content. One of the instructors has a master degree in nursing- considers himself as a content expert who also utilizes educational technology. The other instructor has a doctorate in curriculum, instruction and teacher education, a masters degree and undergraduate degrees in biological sciences- considers herself as having technological, pedagogical content knowledge.

2.2. Rules for Guerrilla Pedagogy

Anderson and Fierstein (2018) argued that *guerrilla* teaching approach as an unconventional method that is designed to create a powerful learning environment. These authors described certain ground rules for guerrilla teaching, see figure 1 below

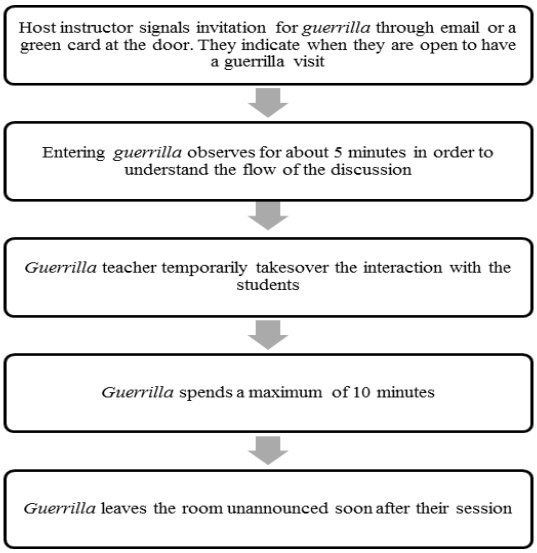

Figure 1. Rules for Guerrilla Instruction

Each class experienced four guerrilla visits. The guerrillas used the DEAL reflection model (Ash & Clayton, 2009) to reflect on their experiences before and after the visits. In their reflections, the guerrillas Described their experiences, Examined what went on and Articulated their Learning (DEAL). At the end of the semester, the *guerrillas* shared their reflections with each other. They only shared parts of the reflection they were comfortable in sharing. Students who consented to providing feedback completed an end of course evaluation sharing their experiences with *guerrilla* pedagogy. This paper presents data that emerged from the thematic analysis of the students' responses to open - ended course evaluation questions and the *guerillas*' reflections.

3. Results and Discussion

During the process of *guerrilla* teaching the initial intent was to enhance student learning. The added or secondary benefit of instructor learning also emerged during the process. Figure 2 below shows the main emerging themes on students and instructors' experiences with guerrilla pedagogy and some examples of direct quotes. It is important to note that, there were some shared experiences between students and their instructors.

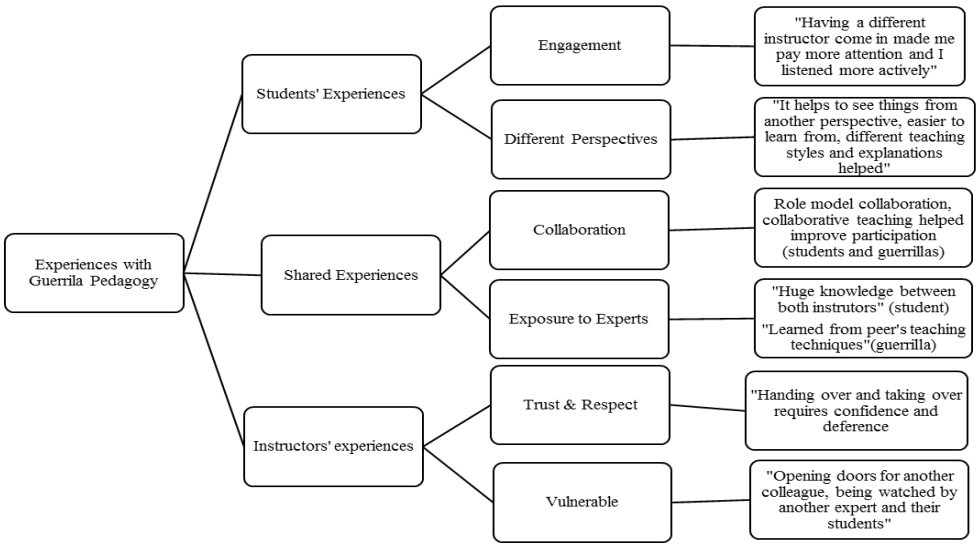

Figure 2. Themes on Instructor and Students' Experiences

3.1. Students' Experiences

Students indicated that having a surprise visit by the *guerrilla* instructor helped them to focus and improved their engagement. They pointed out that they benefited from interacting with the guerrilla. Though we did not formally measure student learning, their feedback demonstrates that the *guerrilla* surprise and instruction were memorable and enjoyable. According to Wills (2007), students learn better when they enjoy the experience and that when they are bored- "information flow to the higher cognitive networks is limited and learning process grinds to a halt" (p. 2). As a result, it can be inferred that by creating memorable events/activities and fun learning environment, educators enhance students learning and storage in long-term memory. A student stated that they felt more confident with what they learnt from the *guerrilla* instructor. Another student stated "… it was very inclusive and sometimes different teachers have a way of explaining things that make what

we are studying easier. Some have a playful attitude that make it more engaging and fun and it's interesting when different teachers work together as we get to hear the perspective of others". The survey showed that 92.86% of participants who completed the end of course survey enjoyed having the *guerrilla* surprise in their classroom. It is also important to note that, on day one of implementing the *guerrilla* strategy, students clapped and had a standing ovation as the *guerrilla* instructor was exiting the room. Students' written, verbal and non-verbal feedback was evidence of how the approach helps to create a dynamic learning environment in large classes. It is interesting that most students indicated that the time the *guerrilla* spent in their class was enough though they wanted more visits. Students pointed out that their attention span aligns with the time spent by the *guerrilla* in their classroom. A student who did not like the approach commented that they were used to instructional strategies of their instructor and having another come in put them off for a while.

3.2. Instructor's Experiences

Though the main aim was to enhance student learning, the opportunity also provided instructor learning moments. Waghid (2014) argued that it is important for the educator to disrupt pedagogical encounters and reflect on what counts as good teaching. Through critical reflections, we noticed that we both learned from each other during the process. Observing a colleague facilitate learning to your students in a different way and seeing student reactions also enhanced our instructional skills. Crow and Smith (2005) pointed out that the strongest collaborative teaching relationships are built on a foundation of empathy and trust. We believe that we came out of the experience as a stronger collaborative team who trust each other more. As argued by Pope-Ruark and Moner (2019), we also became "intellectually and emotionally available for each other" (p.14). We allowed each other to be vulnerable and supported each other. In addition, we modeled collaboration in ways that were noticed and appreciated by our students in their feedback. Though we did not plan together, we both learned from this unique form of collaboration where we opened doors for each other, observed a peers interaction with students and we also learned from each other alternative ways of presenting the same material. Through critical reflection before and after a class visit, we increased personal awareness of our instructional strategies from different angles. As a result, we gained insights on areas we could improve on.

4. Conclusions

Based on students' feedback, they valued having a *guerrilla* instructor surprise them and commented that they had an opportunity to learn from different perspectives and instructional strategies. Students indicated that having two content experts who have different instructional strategies helped them to engage with learning materials and paid more attention to what was being presented. Two students indicated that they did not like

the strategy- one said it was a show off and the other said it disrupted her notes taking because she got confused on what was going on. What we learned from students' feedback is that majority of them enjoyed the experience and they indicated that it enhanced their learning. It was encouraging to see students' reactions and to read their comments about how much they valued the experience and that the combined knowledge and expertise was good to have in a classroom. However, we are cognisant of the fact that different students have different learning preferences.

From the reflections, we also learned that the *guerrilla* instructional strategy is a great collaborative teaching method. Unlike other collaborative activities where instructors plan together, *guerrilla* strategy saves time because instructors do not have to plan together. The strategy provided lots of learning opportunities as the host watched the *guerrilla* interacting with students in a different way. Teachers usually close their doors when teaching- with *guerrilla* approach, the door is open at any time that is suitable for the *guerrilla* to visit. Our trust and respect of each other as peers got stronger with each visit. At the same time, each successive *guerrilla* session decreased the instructor's feelings of apprehension and vulnerability.

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Student participation and peer-to-peer learning processes in primary education

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Abstract

This study considers the influence that classmates have over a student's learning process in an individual sport. "Others" are defined as classmates who become educational agents and establish mechanisms of educational influence during learning processes through peer-to-peer relationships. From the perspective of the teacher researcher, the goal of changing and improving the author's own teaching practice is presented as the starting point for the design, validation and implementation of a support-recall-projection (SRP) proposal for intervention. The data analysis showed that the proposal contributed to the development of independence, decision-making, teamwork and respect for each person's pace of learning among primary education students in physical education.

Keywords: *student participation, peer-to-peer learning, basic competencies, and teamwork.*

1. Introduction

This paper, as a reflective journey towards improving the author's own teaching practice, presents the process of designing and validating an innovative proposal for intervention in physical education area according to the government guidelines on the educational context based on basic competencies. Based on teamwork strategies, the new proposal provides an innovative focus on the mechanisms and processes involved in learning an individual sport and it is presented as an alternative to traditional teaching models in the processes of learning individual sports (Layne, Todd; Hastie, 2013) (Famose, 1982) (Ramírez, 2008).

The psychological and pedagogical principles of the SRP[1] methodology outline a scenario based on a constructivist context (Bruner, 1981) (Coll, 1993a). In this scenario, teachers introduce processes of cooperation and reflection that enable students to get problem-solving and decision-making skills. Students become an educational agents of learning process where communication system enables them to compare and modify their schema of knowledge and their representations of what is being taught and learnt (Light & Wallian, 2008). Its use helps students to restructure and reorganize their experiences and knowledge highlighting above all the strengths of each of them.

This new way of education in physical education (by the implement of the SRP proposal) represents the main answer to the question of the study: How can I turn a traditional learning context of physical education into a basic competencies learning processes?

The conclusions of this research shows us that using SRP methodological proposal contributes to the development of basic competencies among the students who become active agents and protagonists of teaching and learning processes, which are aided by classmates according to the new role of the teacher as facilitator and mentor (Zabala & Arnau, 2007).

2. Psychological and pedagogical principles of the stages in the srp proposal for intervention

SRP[2] (Support, Recall, Projection) are the initials of the three stages in the proposal for intervention that is based on research; juxtaposes cooperative (Johnson, Johnson & Holubec, 1999) and individual learning structures and promotes a group approach to learning, without overlooking individual challenges.

In the first of the three stages, the **Support** (S) stage, small work teams are formed (that are proposed by the teacher depending on the group's needs and the content covered in the

[1] Suport, Recall and Projection are the fases of the proposal which are described in the following section of the work.

[2] Ramírez (2012)

session) to start to practice the contents of the session, which are written on the board in the form of indicators[3]. The indicators inform students about what they should learn in terms of swimming strokes or specific motor skills. This stage involves interaction classroom processes at social level, stresses the importance of the group as a factor that triggers learning (Johnson, D.W.; Johnson, R.T.; Johnson Holubec, 1984) (Kagan, 1994), and is based on the concept of teaching as an aid (Vygotsky, 2000). Peer collaboration (Damon, W. & Phelps, 1989) is the cornerstone of collaborative work between students and promotes the establishment of mechanisms of educational influence between them, in the form of support and on the basis of the concept of peer-to-peer positive interdependence working together to achieve common goals (Geer, J., McCalla, G., Collins, J., Kumar, V., Meagher, P., Vassileva, J, 1998). This situation enables each student to progress and to achieve higher levels of learning and reflection than they would have been able to achieve without the assistance, as well as a notable increase in awareness of what they are learning (Bruner, 1981), in a significant way (Coll, 1993b).

On the second stage, that of **Recall** (R), teacher is managing a positive climate of team reflection on what occurred in the previous stage, at both individual level (reflections on what you have to improve by comparing your execution with that of your classmates) and group level (reflections on what your classmates should improve in their motor execution), taking as a point of reference the contrast between actual performance and the indicators on the blackboard. As the first stage, language is of central importance. In this case, it links cognition (theory and reflection) to the learning of some technical movements (the practice) (Fosnot, 1996) (Light, 2008).

Finally, the **Projection** (P) stage is organized at individual level. In this stage, each student projects into their own practice the aspects of motor execution that their teammates highlighted in the Recall stage and should be improved. The memory of those aspects that you compared with your classmate's performance in the Support stage will help to improve their own performance in the Projection stage.

3. Research method and design

The creating process of the SRP proposal was defined through the use of the intervention in a ten pilot swimming school programme sessions aimed at the same time, to introducing basic skills to the practice and also to improving it's teacher practice. It was cemented after the fourth session, when no further changes were made to the structure of the stages. Subsequently, the research method and design were devised. The participation of ten teach

[3] There should be no more than three indicators. They must be written clearly to make it easy for the students to understand them, and they must be attainable: they should not be difficult to execute by those who aim to push beyond their possibilities.

to swimming professionals in the study, made it possible to validate the research by using the SRP proposal in their school swimming sessions with a population of 182 students. Those professionals were formed in a seminar at University and trained to use SRP proposal in two school sessions. After the first session we met again at University to discuss together about the process, how to solve problems and encourage them for the second session. After implementing the two sessions we keep discussing at University in the seminar about the proposal in order to write final conclusions. Both sessions and meetings were recorded on video to be analysed in detail by two external research who at least analysed 640 session minutes setting the indicators for each objective of SRP proposal that we could display in different charts and quantify their frequency.

Taking into account the characteristics of research, and in line with Anguera (2004), the study uses a qualitative and quantitative approach. Quantitative methodology was used at the outset of this study to quantify types and frequency of student behaviour, which had previously been divided into different categories. Data were analysed by using IBM® SPSS® Statistics 21.0 software. To assess the effect of the SRP proposal implementation on different basic competencies, a table for repeated measures was performed. Opinion from professionals about the SRP proposal during discussion sessions (qualitative) were used to identify strategies in order to reinforce and complement the data analysis by a quantitative perspective (Castañer, M., Camerino, O., & Anguera, M. T.; 2013). In parallel, Cohen's Kappa coefficient certified the concordance between objectives and cathegories in each session by both external observers.

4. Contribution to the development of basic skills

In this section I would like to focus on Perrenoud's ideas on the concept of skill, which were one of the precursors to educational change. Zabala and Arnau (2007) set out criteria that enable us to determine characteristics of teaching basic skills. These criteria can be summed up as: significance, complexity, and the procedural nature of learning based on basic skills. In terms of the significance of learning, and in reference to "schemes of thinking" (Perrenoud, 2002), there is a need to review students' schemes of action with respect to other situations and experiences (Hastie, P. 1998).

On the basis of this proposal, the following table shows the achievement of basic competencies and their indicators as a result of the implementation of the SRP proposal. It's the result of students' contribution and participation to the development of basic skills:

Table 1. Contribution of participation in the SRP proposal to the development of skills.

Skill in independence and personal initiative	Skill in learning to learn	Social skill	Communication and linguistic skill
• **Take decisions (on the use of material, in accordance with the indicators written on the board at the start of the activity)** • **Seek solutions (how to use the material)** • **Self-esteem (pace of learning, open activities, contribution of solutions)**	• **Be aware of our capacities** (chose which material and decide how to use it to solve a minor problem according to my level) **and of the learning process** • **Accept and learn from success and mistakes** • **Learn from classmates executions and feedback**	• **Accept others' opinions and feedback** (to accept classmates' corrections. Correct classmates) • **Help classmates** (to learn and to improve) and **accept** their help.	• **Organize knowledge** (the contents of the board) • **Explain and express** what classmates solve successfully and what they need to improve, in relation to the indicators on the board • **Listen** to classmates.

5. Conclusions

The detailed quantitative analysis of the different sessions carried out by different physical education teachers allow us to confirm that:

In terms of the potential of the SRP proposal for intervention in an educational context, it appears to be a teaching strategy that could have an active impact on students' involvement as the real protagonists of the learning process.

As a strategy, it could and must co-exist with all other learning processes as another tool that is open and flexible.

In terms of learning process, the proposal for intervention encourages students' independence (both personal and with respect to the group) and decision-making in a learning environment

that is based on cooperative learning strategies, in contrast to the traditional approach in Physical Education lessons.

The SRP proposal offers to the teachers the opportunity to establish work dynamics in the classroom, although the lesson take place in the swimming pool or gymnasium that differ from current school classroom.

Coaches who participated in the process of validating the SRP proposal have incorporated some of the elements and stages into their practice related with teamwork, which shows that ideas from the proposal have been disseminated.

For students, the SRP proposal provides an opportunity to technically improve the learning of a sports technique, and to become better people who respect the learning pace and process of each member of a group, and treat all members equally.

The proposal therefore contributes to the development of basic skills in students who participate in its practical application.

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Student Understanding of Number Line Graphs

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Abstract

This paper addresses how students understand number line graphs. Utilizing a Think Aloud interview followed by a reflection-eliciting interview, we investigate how two successful College Algebra students understand what it means to graph a statement with one free variable on a number line. These particular students show a mathematically non-normative understanding of this concept; to wit, they do not view the number line graph as representing a solution set. This study illustrates the importance of future research into how students understand the concept of solution representation via number line graphs.

Keywords: *college algebra; number line; graph; solution set.*

1. Introduction and Literature Review

When studying intermediate algebra, students often graph inequalities on number lines. A student asked to graph "2x-3>5" on a number line often begins by employing a computatation, expressed as a series of equivalent statements: "2x>8", followed by "x>4". Aided by "x>4", the student would then label "4" on the number line, mark an open dot on it, and shade everything to the right of that open dot. Their resulting number line plot is correct because it displays all of the numbers that, when substituted for "x" in "2x-3>5", make that inequality true. This is consistent with the United States Common Core Standards, which explain that a student as early as grade six (ages 10-12) should "recognize that inequalities of the form x > c or x < c have infinitely many solutions and represent solutions of such inequalities on number line diagrams" (National Governors Association, 2010).

The idea of number line graphs as representing solution sets is not limited to inequalities; any statement about real numbers in one free variable, say P(x), can be thought of as representing the solution set {x: x is a real number and P(x) is true}. For example, the number line graph of the statement "|x-2|=6" includes closed circles at precisely 8 and -4. The idea of number line graphing is closely related to the idea of "solving for x". When we "solve for x" in, say, "|x-2|=6", we write something like "x=-4,8"; that is, we describe the solution set of the inequality similarly to how we would graph the solution set on a number line. Because describing solution sets covers a large portion of algebra curriculum (see, for example, Miller and Gerken, 2016), it is important to understand how students approach this task and remedy misunderstandings. Some work has indicated that students do not understand "solving for x" as involving solution sets (Frost, 2015). This paper expands that work by addressing the visual analogue, which is how students understand number line graphs, which we (the mathematical community) understand as representing solution sets. That is, this study considers the following questions: 1) What do students think it means to graph a statement (with one free variable) on a number line?, and 2) How do students see the graph of a number line as relating to the idea of solution set?

There appears to be a dearth of literature on how students understand number line graphs of statements in one free variable. However, there is some literature on how students understand solution procedures of statements in one free variable that *may* be graphed on number lines. Almog and Ilany (2012) found that high school students erred in solving absolute value inequalities, frequently misusing logical connectives such as "and" and "or". Sfard and Linchevski (1994) report on a similar phenomenon, in which high school students answered that "$x_{1,2}$>3,-2" is a solution to "x^2-x-6>0" but could not (i.e. did not, despite probing from an interviewer) explain further what that answer means. Additional research supports the idea that students, including pre-service teachers, struggle to interpret the results of manipulating equation and inequalities (Bicer et al., 2014; Blanco & Garrote, 2007; El-khateeb, 2016) Specifically, Bicer et al. (2014) find that pre-service teachers often incorrectly represent their

solution on the number line. It seems reasonable to think that such students might have a mathematically non-normative understanding of what it *means* to graph something on a number line. These students may not understand a number line graph as representing a solution set.

It bears mentioning that I am not using the word "set" in "solution set" in a formal, set-theoretic sense. There are multiple mathematically normative ways that a student could conceive of a number line graph of a statement P(x). One is in the more formal, static way; the number line graph simply represents the set of real numbers that make P(x) true. Another is a more dynamic way in which a student might view a number line graph of a statement P(x) as the result of an infinite process of plugging in each real number x. That is, a student might view a number line graph as representing a *record* of plugging in individual values of x, checking for truth of P(x), and then marking x on the number line if P(x) is true. In this study, I investigate if students view a number line graph of a statement P(x) as correct when the graph displays precisely the values of x that make P(x) true.

2. Methodology and Theoretical Perspective

Data were collected via individual interviews. I adapted a two-interview structure from Koro-Ljungberg et al. (2013) in which the first interview (for each student) begins with a simple, non-mathematical warm-up activity to get the student comfortable verbalizing their thoughts. It continues with a Think Aloud (TA), during which the student narrates their thoughts while solving problems. I later conducted a separate in-depth and loosely-structured interview (cf. Ginsburg (1981)) which enabled me to probe students on their thinking and elicit reflections.

I am guided by a pragmatist perspective similar to that of Pierce and adopted by constructivists in math education (Clement, 2000; Crotty, 1998). This perspective views the thoughts and mathematical meanings of a student as inaccessible to direct observation. To overcome this inaccessibility, student thought is constructed through models that are consistent with their behavior. As described in Clement (2000), individual student interviews are consistent with constructivism in that they provide data (student responses) for building explanatory models of student thought (student meanings that account for such responses). Since there has yet to be research on how students understand number line graphs, this study is intended to be expoloratory and aimed at discovering student mental structure (Ginsburg, 1981).

3. Subjects and Methods

The participants, Sara and Hannah, were enrolled in College Algebra at Anonymous State University (ASU). They were recruited via a mass email by their instructor and chosen because they were the first to contact the recruiter. They were compensated with a $30 Amazon gift card. Both students were earning an A in the course. Sara was in her late 20's, held an undergraduate degree, and had returned to college to earn a second undergraduate degree in Computer Science. Hannah was 19 years old and studying to be an elementary math teacher. She had taken introductory calculus twice.

Their College Algebra course was administered entirely online. The course utilized ALEKS (Assessing and LEarning in Knowledge Spaces), a McGraw-Hill adaptive learning and assessment system (Aleks.com, 2019). The mathematical meanings that students have and construct in this course have yet to be studied.

I conducted the interviews privately, in my office. The interviews were performed a week apart starting at the end of Spring 2019. During the interviews, the students answered questions, worked on a computer within the ALEKS learning environment, and worked on an iPad. The computer and iPad screens were recorded with audio. The first part of the TA included standard, routine problems within the ALEKS environment (see Fig. 1). These included linear inequality solving and graphing, as well as problems solving absolute value equations. Due to the close relationship between solving for x and graphing on a number line, "solve for x" type problems were included.

A Solve for w in $3 < 13 - 5w$	B Solve for x in $\|4x - 8\| = -4$
C Graph $3 < 13 - 5w$ on a number line	D Solve for v in $\|6v + 18\| = 12$.

Figure 1. Standard problems, which were included in the Think Aloud (TA). A, B, and D were administered online in the ALEKS environment, whereas C was not..

The TA was intended to reveal how the students approached such problems on their own. The TA ended with nonstandard problems (see Fig. 2), outside the ALEKS environment. These problems were sequenced at the end of the TA, as their nonstandardness had the potential to trigger reflection with which the student might not typically engage.

E Graph $\|6v + 18\| = 12$ on a number line.	F Pretend that your classmate, John, graphed $x^3 - x < 1$ on the number line below. Is his answer correct or incorrect? 

Figure 2. Nonstandard problems included at end of the Think Aloud and revisited during the Follow-Up interview.

The purpose of the more routine problems was to see if students consciously thought of solution sets when engaging with the typical course problems; these problems could be solved by applying routine algorithms and hence did not *necessitate* thinking in terms of solution sets. The purpose of the nonroutine problems was to see if students thought of the number line as representing solution sets. While solving absolute value equations is included in the curriculum, *graphing* them on number lines is not (hence the inclusion of Problem E as a nonstandard problem).

If a student understands a number line graph as representing a truth set, then Problem F[1] should not be diffulct. The student need only observe that, for example, -2 makes the inequality true but is not shaded in the number line. Probing questions were included in the interview protocol for students who struggled with these problems. In particular, for Problem F, if students did not think to plug in a value of x, I prompted them to plug in a value of x that was inconsistent with the provided number line graph.

4. Results

Both students approached the problems procedurally, and neither of them appeared to view the number line as representing a solution set. Sara's meaning for "graph P(x) on a number line" appeared to be as follows: *get x by itself by performing symbol manipulation, and graph what she calls "the result". For her, the "result" is as follows: something of the form "x>a" meant to shade everything greater than a, and something of the form "x=a,b" meant to shade (put closed circles on) both a and b.* Hannah's meaning appeared to be as follows: *perform symbol manipulation to get x by itself. The result involves some sort of critical numbers* (in Hannah's words, "*what x is*"); *if the result is something of the form "x>a", then a is a critical number, and if the result is something of the form "x=a,b"then a and b are critical numbers. Mark the critical numbers on the number line, resulting in a segmented number line. For each segment of the number line, choose a number c in that segment and assess the truth-value of P(c). If P(c) is true, shade the portion of the number line where c is.* I refer to these as their meanings ("Sarah's meaning", and "Hannah's meaning") for graphing a statement on a number line and illustrate how these meanings manifested themselves in the interviews.

Hannah and Sara performed similarly on the standard problems (see Fig. 1). They followed the procedures that they had learned in ALEKS to arrive at answers. Both students made a mistake in solving Problem B (solving for x in |4x-8|=-4); they wrote both "4x-8=-4" and "4x-8=4", then entered the results of solving those individual equations as their answer. This procedural focus suggests that neither student was approaching these routine problems with solution sets in mind. However, Sara and Hannah's differing responses when learning that

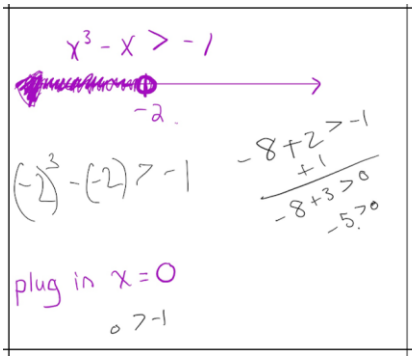
[1] Due to interviewer error, Sara received a slightly modified version of Problem F: see Fig. 3.

their answers to Problem B (solving for x in |4x-8|=-4) were wrong illustrate differing understandings. Sara clicked on ALEKS' explanation, which asserted that all problems of the form |f(x)|=c where c is negative have no solutions, and accepted that her answer was wrong because this problem fit that form. Hannah, on the other hand, plugged in a value of x that she found and then assessed the truth value of the equation with that value of x. While calculating each side of the equation, Hannah realized that anything she plugged in would make the equation false and concluded that it therefore had no solutions. This reaction suggests that Hannah, unlike Sarah, viewed the "solve" task to be about finding values that make the statement true.

Despite Hannah's eventual success on Problem B, her attempts to graph Problem E indicates that she did not view a number line graph as representing a truth set. In Problem D, she correctly solved for *v* in the equation $|6v + 18| = 12$. This fact, together with her eventual performance on B, suggests that she viewed her resulting values of v to be members of a truth set. Therefore, *if* she thought of a number line graph as representing a truth set, providing the graph would have been a trivial task; just plot -5 and -1. Instead, Hannah got stuck when her meaning for "graph P(v) on a number line" (described above) did not yield a result for her. After plotting -5 and -1 on the number line, she proceeded to plug numbers into the original equation and check for truth or falsity.

Hannah's performance on these problems suggests that she did not understand a number line graph as representing a truth set; in Problem B, she seemed to understand a solution to an absolute value equation as representing a truth set, but her response to Problem E suggests that she did not always understand this concept. Sarah's response to Problem E was not particularly revealing, yet it was consistent with her meaning for "graph P(v) on a number line"; having written the correct solutions for Problem D (see Fig. 1), Sara correctly put solid dots on the number line at -5 and -1. Sara did not mention the idea of solution sets or truth and plotted her solutions.

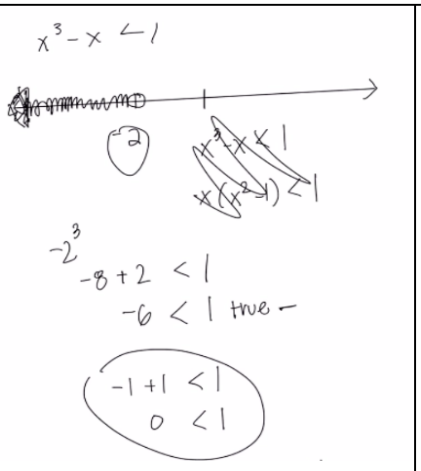
Student responses to Task F (see Fig. 2) were especially revealing. Both students immediately tried to solve the inequality on their own and only stopped when I told them that they would be unable to. Sarah did not think to plug in a number on her own, so I prompted her to plug in x=0. The fact that 0 made the inequality true but was not shaded on the number line was irrelevant to Sarah. Instead, she was preoccupied with figuring out where the hypothetical student got the -2 from in order to be able to evaluate his accuracy (see Fig. 3).



Interviewer: Do you feel like it [the "-5>0"] tells you anything about it?
Sara: No, not at all.
Interviewer: OK, why not?
Sara: Cause it doesn't tell me *why* he put negative two on the number line.
Interviewer: OK, so now what I want you to do is, I want you to plug in…plug in um, x equals zero into the inequality [writes "plug in x=0" in purple]
Sara: So that's all that would be [writes "0>-1"]
Interviewer: OK. Do you have any thoughts on that?
Sarah: I'm very confused. I don't know what's happening with this problem.
Interviewer: Okay so well you plugged in x equals zero and you got zero greater than minus one. Does that show whether his answer was true or false?
Sara: No.
Interviewer: Why not?
Sara: Because I have no idea what the negative 5 would be in relation to that 2.

Figure 3. Sara's Responses to Problem F, Follow-Up Interview

Hannah's response to Problem F was more involved. She began plugging in values of x on her own. She first plugged in -2 and assessed the resulting statement as true. However, she did not know what to do with that information. The fact that -2 was not shaded on the number line yet made the inequality true did not indicate to her that the number line graph was incorrect. Yet, plugging in x =-1 and getting a false statement, together with the fact that the -1 was not shaded, did tell her that the graph was incorrect (see Fig. 4). At face value, this is evidence that Hannah might be viewing this number line graph as representing a solution set. However, a closer look indicates that Hannah was considering a segmentation procedure for critical values of x. Instead of discussing the idea of solution set, she continued to focus on the segmentation of the number line by fixating on whether "it [a critical value] is -2". She considered the possibility that the hypothetical student should have graphed the portion of the number line right of -2. The fact that -2 would be unshaded in such a graph, yet made the inequality true, was irrelevant to her; the critical values are not where she checked for truth, only the in-between points on each segment of the number line. Again, her meaning was to find the critical values, segment the number line, and test values within each segment.



Hannah: So I already know it's wrong because of that.
Interviewer: OK so, you know it's wrong because of what?
Hannah: Because this statement is true [circles "0<1"]. But it could also mean the, the line should be on this side. So, I'm gonna try negative 3 now. So that's 27. Smaller than one, and that's negative 24. That's true too. So I'm lost.
Interviewer: So what I was wondering is, when you did this you told me that this told you something. What did this tell you?
Hannah: That when I plug in negative one that the statement is still true, meaning that it still should be under the line.

Figure 4. Hannah's responses to (modified) Problem F, Think-Aloud

5. Discussion

This data suggest that, like the command "solve for x", students might not view "graph on the number line" as a task about representing solution sets. This is despite both students performing well in the standard course problems. The good news is that both students, at the very end of the interview, appeared to improve their understanding of number line graphs as solution sets. This suggests that the mere act of reflection and exposure to nonstandard problems might have prompted the students to develop stronger meanings. Of course, future study is needed to further explore this hypothesis.

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Enhancing the practice of feedback through arts: an integrated open strategy

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Abstract

This paper presents the experience conducted in the framework of the Erasmus+ FeedBack project, which aims at developing the practice of feedback through arts. The article introduces the practice of feedback as essential tool to enhance teaching and learning activities in the different level of education, with a specific focus on higher education. The FeedBack project has developed an Art-Based Feedback Model, which has been firstly defined in terms of actors, who give and receive feedback through different channels. Furthermore, the model has been integrated with the concept of Art-Based Initiatives, directly related to processes of Sustainability, Inspiration and Transformation implemented in teaching and learning contexts. Through an open and integrated virtual and face-to face strategy, that includes a digital toolkit, webinars, Massive Open Online Courses, events and workshops, the Arts-based FeedBack Model has been disseminated in several countries, stimulating the discussion and innovating the teaching and learning practices. This strategy lead to positive outcomes in terms of raising awareness of the topic, supporting the design and personalisation of the feedback process itself and, thus, enhancing the teaching and learning experience, especially in higher education contexts.

Keywords: *Feedback, Art Based Initiatives, Digital Toolkit, Teaching and learning innovation.*

1. Introduction

When designing teaching and learning processes that fosters the acquisition of theoretical concepts, methods, processes, skills, the first idea that comes to instructors' mind is the organisation of teaching and learning activities to be delivered. Within these activities, assessment plays a key role to understand the starting point from which the students learning will take place, to monitor progress and set the following steps or adjustment to be implemented, to evaluate if the results have been achieved and how the learning have been consolidated. Feedback is the element of the assessment process that strongly support its main aims, and the process of learning in general. Grant Wiggins, citing several authors (Bransford, Brown, & Cocking, 2000; Hattie, 2008; Marzano, Pickering, & Pollock, 2001) states that by teaching less and providing more feedback, teachers can produce greater learning. Hill (2007) identifies feedback as the element that support learners in moving round the learning cycle. It supports the process of reflection and the consideration of new or more in-depth theory, and helps the learner plan productively for the next learning experience (Multiprofessional Faculty Development, 2018). Feedback informs a student and a teacher about the performance in relation of the learning goals previously set. According to Hattie and Timperley (2007), it responds to the questions "Where I'm going", "how I'm Going" and "Where to next", supporting the redirection or refocus of the actions, both of teachers and of students. Wiggins (2012), and with him several authors, describes the characteristics of a helpful feedback which has to be goal-referenced, tangible and transparent, actionable, user-friendly (specific and personalized), timely, ongoing, and consistent. He also highlights the main problem related to the lack of time teachers and instructors lament during learning and teaching activities, but he suggests that no time devoted to feedback actually means "no time to cause learning". There are numerous strategies to provide the feedback students need. These strategies include the use of different channels, i.e. technology to provide feedback to large classrooms; the inclusion of different actors in the roles of the feedback givers, for example peers, mentors and tutors, other teachers; the implementation of different and innovative approaches, to support learning and the development both of hard and of soft skills. While the first two points are largely covered, there is limited evidence of innovative approaches used to stimulate and deliver feedback. In this context, the FeedBack project explores how Arts-based learning can be applied to the feedback practice: according to the report "The Value of Arts-Based Initiatives" by the University of Basilicata, an Arts-Based Initiative (ABI) can be defined as any organisational and management intervention using one or more art forms to enable people to undergo an art experience within an organisational context, as well as to embed the arts as a business asset (Schiuma, 2011). ABIs primary goal is to design "creative learning through an alliance with arts-based pedagogical processes" that can be applied in any subject area. This approach aims at facilitating ABIs that are "thought-provoking and capable of engaging people into reflection, self-assessment and

development of a new and different knowledge" and can therefore be linked to the practice of feedback.

2. The Feedback project: output and first results

FeedBack (http://www.thefeedbackproject.eu/) is a 3 year project (September 2017 – August 2020) built upon the premises stated in the previous paragraph. The main aim of the project is the improvement of the feedback practice to enhance learning through arts. It's supported by the ERASMUS+ programme (Key Action 2, Strategic Partnerships) and involves 5 partners from 4 European Countries (United Kingdom, Italy, Portugal, Slovenia). All partners work in the field of education, from primary school to higher education.

The project is composed of two main phases: the first one is focused on research and analysis of the state of the art; the second is centred on design, production, test and dissemination of the Digital Toolkit. Aim of the Digital toolkit is to gather different ABIs to support the practice of feedback in different contexts (both in education and work environments) through different channels,both digital and face-to-face or physical. During the first project meeting (December 2017) the partnership has set a common background defining Feedback as "a gift, an energy to go on. It leads to a process of transformation that arts-based learning can enable through the facilitation of moments of reflection and, consequently, self-assessment which can support individuals to improve, change and develop". The first phase of the project, the "State of art phase", helped the partnership to tackle the definition of Art-based feedback thanks to an extensive literature review and national focus groups in the 4 Countries. The literature review covered different topics: the feedback practice and its application in workplace and education, feedback best practices, understanding and applying the feedback message, art-based approaches in education and art-based initiatives to support reflection. FeedBack Project partners planned several focus groups, involving teachers (from kindergarten to higher education), managers, coaches, higher education learners, researchers, tutors and vocational trainers. Participants were invited to share their experiences about feedback practice and to reflect on how they used it in their teaching activity. Experiences collected were highly heterogeneous, but focus groups final outputs were actually similar. All the focus group participants agreed on the effectiveness of feedback but they also expressed their uncertainty onhow to properly integrate feedback into their hands-on teaching practice. Hence, the need arose for spreading knowledge about feedback and for defining a simple model of feedback to support educators in their daily activities.

From these premises the partnership designed the "Art-based FeedBack model" (Fig. 1). Starting from a general communication process, as suggested by Ilgen, Fisher and Taylor (1979), the feedback model has been defined in terms of actors (sources and recipients) which

give and receive feedback (the feedback message) through different channels (paper, technology, etc.). According to the model, feedback is a 3 steps process:

1. delivery: the feedback message has to be properly designed in terms of contents and time (related to specific goals) and in terms of style (tailored on the recipient characteristics) in order to support the sustainability of the process;
2. reflection: the feedback message has to spur a careful thought and inspire an attentive reflection;
3. refocus: the feedback message stimulates a change in actions, resulting in a transformation that implies learning.

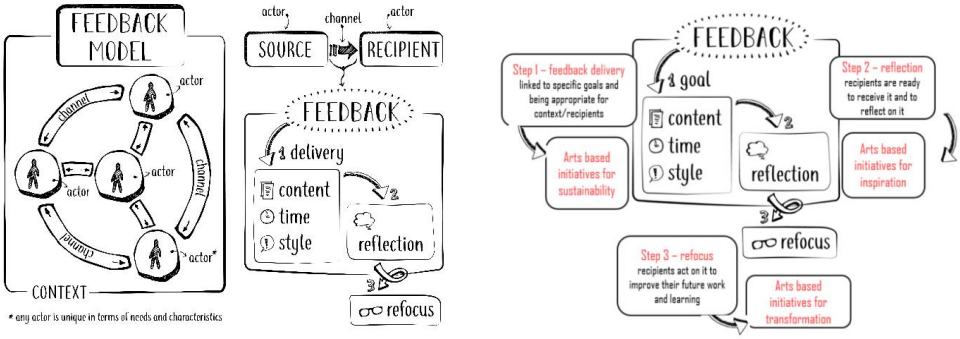

Figure 1. The Art-Based Feedback Model.

The FeedBack model has thus been integrated with the concept of ABI, defining:

- ABIs for sustainability: carefully planning the feedback delivery allows learners to positively accept teachers or peers advices and to take real advantage from them;
- ABIs for inspiration: reflecting on their work brings learners to a more inspired mind set to understand what they have to relearn, improve and refocus on;
- ABIs for transformation: refocusing on the initial objectives of their work helps learners to positively transform their point of view.

The State of Art report, collecting results of the first project phase, can be downloaded from the Project website (http://www.thefeedbackproject.eu/). In the second phase of the project, the partnership focused on designing and sharing the FeedBack program, aimed at supporting the application of feedback practice in different contexts. All partners collaborated in designing ABIs, that were then gathered in the online Digital Toolkit (http://www.toolkit-thefeedback.eu/, Fig. 2). ABIs are categorised according to their aim (sustainability, inspiration, transformation), the time they required (5-10 minutes, 10-30 minutes, more than 30 minutes), the way in which participants are involved (single, couple, groups).

Each ABI has a dedicated page on the Digital Toolkit in which the user finds instructions on how to implement the activity, tools needed, some additional tip and, where possible, an example of the activity performed (http://www.toolkit-thefeedback.eu/activity/uncharted-territories/).

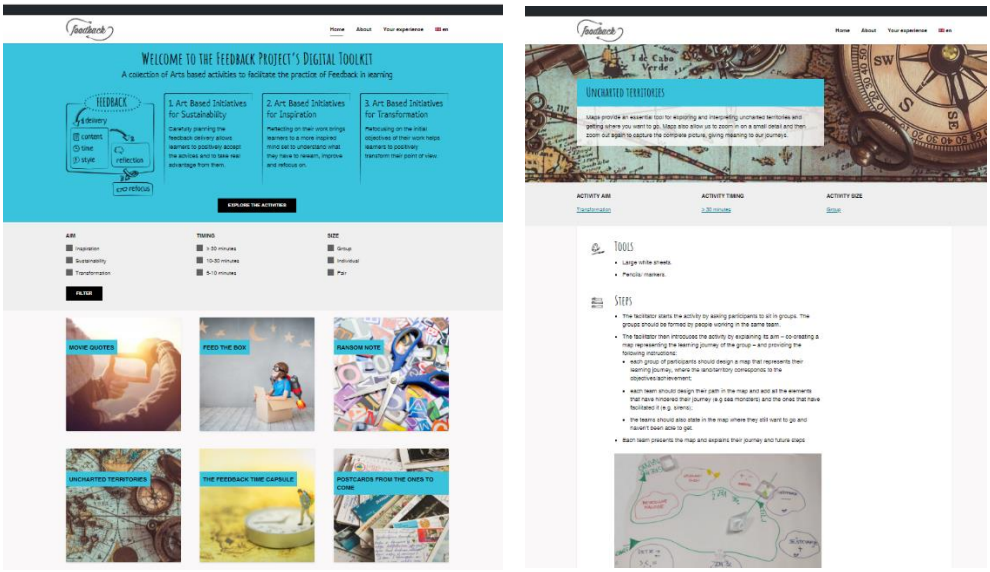

Figure 2. The Feedback Toolkit.

From December 2019 till March 2020, a Digital Toolkit pilot test was launched: it involved 100 educators from the four project Countries. The aim of the pilot test was to collect feedback about the usability of the Digital Toolkit and about the effectiveness of ABIs proposed and tools offered (Art-Based feedback design tools, Activities deck). Suggestions collected from the pilot test were crucial to successfully improve the Digital Toolkit and, consequently, to better support the practice of Art-based feedback. In particular, each ABI page has been implemented with a picture that shows the output of the ABI itself: this improvement supports the comprehension of the activity with real examples. Furthermore, starting from Art-based feedback design tools, some of the involved educators designed their personal ABI: some of them were included in the Digital Toolkit. After the testing phase, additional feedback was gathered through an online survey, directly reachable from the Digital Toolkit, and thanks to interviews with final users. Furthermore, testers from all the Countries have been invited to an online focus group to collect the last suggestions. Finally, during an online meeting, the partnership analised the collected feedbacks in order to reach a final evaluation. Data gathered though the online survey (89 responses, from the four Countries) shows positive results: 73% of users declares that the toolkit is easy to navigate. The activities in the toolkit are considered clear (77%) and useful (79%). Higher education

teachers involved in the testing activities were interviewed: they declared that the art-based feedback perfectly supports the collection of information and data on skills development and teacher awareness of the real feelings of the participants. Teachers confirmed that art-based feedback activities shared in the Digital Toolkit are easily adaptable to different needs and contexts. The Art-based FeedBack practice supports the enhancement of individual skills, and creates an environment where positive attitudes are strongly stimulated. Furthermore, it facilitates interaction also when verbal or written communication is difficult, for example with international students. Finally, data collected through Google analytics from September 2019 to March 2020 (7 months) shows a massive use of the Digital Toolkit, mainly by users coming from the four project Countries. Around 800 users visited the Digital Toolkit in the analised period, with peaks of about 30 users per day. The page view number is around 7,500 with around 1,640 sessions. The average session duration is around 5 minutes, showing that users browse among the platform contents and activities.

3. Approaches and strategies

As stated earlier, the aim of the FeedBack project is to develop the practice of feedback through arts by designing and spreading a clear model of feedback. Goal of the project is also to set the foundations for future online and face-to-face programs about feedback practice enhancement. Core of process are design and innovation: to ensure a wider dissemination of the outputs developed and to foster the use and application of new technologies in education and training, the consortium chose to deliver the outputs through an open approach and an integrated strategy which leverage on several channels, real and digital, to reach the results.

3.1. Open approach

ABIs activities shared in the Digital Toolkit, all designed by the partnership and by the teachers involved in the project, have been released and licensed under a Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/). Hence, all the project outcomes are, actually, Open Educational Resources: this open approach has been chosen in order to maximise the potential of future exploitation and transferability of project results. By reaching a wide audience of end-users, the partnership wants to spread and support the practice of Feedback as an integral part of the teaching and learning processes. Furthermore, the open approach strenghten the idea that Feedback project results are a source of inspiration for educators. They can adapt the ABIs proposed by the Digital Toolkit to their context and their specific needs; they can even design new ABIs. This open approach allows to integrate the Digital Toolkit into different initiatives, supporting the FeedBack project objectives. For example, the toolkit have been integrated within two Massive Open Online Courses (MOOCs), accessible from the Polimi Open Knowledge Platform (www.pok.polimi.it): “New Assessment Strategies - The magic of feedback” and

"Progettare l'innovazione didattica". The first one is licensed under a Creative Commons Attribution – NonCommercial - ShareAlike 4.0 International License (http://creativecommons.org/licenses/by-nc-sa/4.0/) and introduces new ways to perform assessment in teaching and learning activities. The second one is a course about the integration of the design culture into teaching and learning innovation.

The FeedBack project has been presented during the Open Education Week (taking place online on 2020, March 2nd-6th https://www.openeducationweek.org/) and listed in the resource database of the event (https://bit.ly/33WiGY1).

3.2. Integrated strategy

An integrated digital and physical strategy have been put in place in several dimension. The "state of art" and "activities design" phases have been conducted partly during face-to-face meetings, partly during online activities and through e-collaboration processes among partners. These activities have led to the creation of two outputs, presented during the "Training for trainer" week (2019, June 17th-21th), taking place in Liverpool with ten participants: during this event, participants designed new activities and started a discussion which has then continued online. The Multipliers events, designed and implemented to share the project results with a larger audience in the four partner countries, have been conducted both during face-to-face and online meetings. In Italy, more than 40 participants (teachers from the STEM field) subscribed to the event organized by METID - Politecnico di Milano and 26 attended on 2019, November 6th. A webinar have been organised and delivered online on 2019, November 21th, to meet the needs of those that couldn't attend: 69 participants subscribed to the event and 24 finally participated, while the others could watch the recorded meeting via zoom (http://bit.ly/381dbbt). Similar data and activities have been carried out by other partners. In Slovenia more than 35 participants, mainly teachers from primary and secondary schools, attended the multiplier event. During the event they were trained on the Art-Based FeedBack topic, planned the FeedBack process to be implemented during their teaching and learning activities, and designed new ABIs for feedback. The multiplier event was supported by an E-learning space in which all the participants could find materials and resources to support their tasks (http://bit.ly/381e8k3). The integrated digital and physical strategy has been put in place also regarding the digital toolkit: all the activities have been shared online but also collected in the "FeedBack Deck", which have been used during the multiplier events and have been shared on the online toolkit as a printable version of the activities. The deck includes two blank cards to support the idea that each person responsible of the feedback process, should use the toolkit and the activities designed as a source of inspiration, adapting them to the context and the specific needs or even defining new activities. To support the design behavior, two tools have been shared in the platform: an online form to share with the partners the new activities designed and two printable

frameworks, which support the design both of the feedback process and of the Arts-based FeedBack activities.

4.Conclusion

There is limited evidence of Art based learning being applied to feedback in either the educational context or in the workplace. Within the teaching profession examples are more likely to be found in art-based subjects. The FeedBack project have designed and tested innovative feedback practices and an open and integrated strategy, to create awareness on the topic and to support design and personalisation of the process. The results show that the art-based feedback practice can enhance the teachers and learners experience. Feedback can be innovative: it has to be carefully designed by the feedback giver in order to consider differentiation and to build strong relationships between tutors and their learners. Learner are more likely to act on the feedback received to improve their learning if the feedback is structured according to their needs. A key challenge is "Change". Often educators tend to work with what they are familiar with and may be reluctant to try new ways of working, including new ways of giving feedback. However, the benefits can be rewarding for both the tutor and learner and new innovative methods applied in the classroom and in the workplace can lead to increased productivity, improved work life balance, job satisfaction, mutual respect and a feeling of "value". Innovative and creative ways of giving feedback demand further consideration: creative and innovative feedback approaches can contribute to make any learning environment, becoming more interesting, dynamic and engaging.

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Adoption of evidenced-based teaching strategies in STEM and non-STEM courses after a common faculty development experience

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Abstract

North Carolina State University undertook a faculty development initiative, TH!NK, beginning summer 2014. TH!NK is a campus-wide initiative designed to develop faculty members' abilities in cultivating students' higher-order skills in critical and creative thinking and self-reflection. Faculty and courses in a wide variety of disciplines were involved in the initiative, with the ultimate goal being an institutional transformation in the way that teaching is approached across campus. This paper shares early outcomes of five years of the program, which engaged approximately 130 faculty members. We assess the adoption of teaching strategies and how adoption varied between STEM and non-STEM courses based on a 2019 survey of TH!NK-trained faculty (n=72). We observed that an intensive, multi-day, interdisciplinary faculty development institute, paired with long-term peer mentoring and accountability, led to a high rate of adoption of the strategies. While non-STEM faculty utilized a wider array of teaching strategies prior to training, both groups made gains post-training, with the greatest gains among STEM faculty. There were notable outcomes observed in faculty use of the strategies in other courses and sharing activities and assignments with colleagues inside and outside of their home departments.

Keywords: *Faculty development; evidence-based pedagogy; critical thinking; creative thinking; metacognition; student learning outcomes.*

1. Introduction

1.1. Problem and Significance

In order to build the citizenry and workforce of tomorrow, learning environments must foster and support critical and creative thinking skill development. Higher education must shift the paradigm that often does not explicitly emphasize creative and critical thinking in lower level courses but then holds the expectation that students will be prepared for the higher-order thinking required in the capstone, project-based courses where students often struggle with the process (Atman et al., 2005).

Our campus has adopted a model for defining the critical and creative thinking process. The model incorporates raising questions and formulating problems; gathering and assessing relevant information; synthesizing and generating diverse ideas; considering alternatives; reaching reasoned conclusions; and effectively communicating. This process is iterative, with self-reflection on one's own thinking at the center. The process spans academic disciplines, though methodologies may vary. Explicitly articulating these skills helps develops student awareness, and also provides language to faculty for delivering specific feedback to students.

While many publications have explored factors contributing to successful faculty development models (Czajka & McConnell, 2019; Lavis et al., 2016), we were unable to identify papers that quantified the frequency of adoption of evidence-based teaching strategies in classrooms after faculty training. Often, these data are not collected due to the lack of systematic evaluation of faculty development outcomes (Hines, 2009). It is routine practice for program assessment to be reduced to measures (e.g., participation, satisfaction) that neglect to tell the full story of how the program impacted a change in practice.

1.2. Program Goals

The TH!NK Program at NC State University seeks to bridge the gap between evidence-based research on teaching and teaching practices in the classroom through an intensive faculty development program. Through this work, we aimed to transform the culture of teaching on our campus away from teacher-centered instruction and toward student-centered instruction that promotes higher-order thinking. Allen et al (2019), previously described implementation of various aspects of the TH!NK initiative.

1.3. Faculty Development Plan

The key individuals in the initiative are the *TH!NK Director* - responsible for creation and implementation of faculty development, recruitment of fellows and faculty, vision; the *TH!NK Fellows* – a team of five award-winning faculty members who created and implemented the program with the Director and provide mentoring to participants; *TH!NK*

Faculty - the cohort of faculty who participated in the training, made enhancements to their courses, and assessed outcomes of their students; *assessment professionals* in both the Office of Assessment for student learning outcomes and the Office of Faculty Development for faculty learning outcomes; and of course, *students*. Faculty participation was voluntary, but a stipend was provided.

Approximately thirty faculty members participated in training each year (15 in the first year). Each year, a new faculty cohort participated in an intensive TH!NK Institute in May at the start of summer break. Faculty worked on course revisions over the summer with the support of an interdisciplinary peer cluster consisting of other faculty participants and a TH!NK Fellow, having small "cluster meetings" approximately three times over summer break. Each cohort reconvened in August prior to the start of the semester to share pedagogical innovations and receive structured peer feedback

The primary goal of the Institute was to define the critical and creative thinking process across disciplines and provide faculty with the tools to create opportunities for students to practice the skills in the process, as well as tools to provide feedback on students' thinking *process* rather than just on the work product. Some of the themes integrated throughout are removing barriers to intellectual risk taking, prompting targeted self-reflection, and questioning assumptions. Evidence-based teaching strategies and concepts that faculty engage with during the institute included: defining and assessing the critical and creative thinking process (Ennis, 1985; Rhodes, 2010; Sternberg & Lubart, 1999); peer evaluation (Volz & Saterbak, 2009); divergent and convergent thinking (Schommer, 1990); critical thinking scenarios (Carson, 2015); data visualization and concept mapping (Novak, 1990); SEE-I (state, elaborate, exemplify, illustrate) (Nosich, 2011); metacognition and self-reflection (Bruning et al., 1995; Hofer & Pintrich, 1997).

TH!NK Faculty were held accountable by their Fellow and peer cluster to produce materials by August including: a revised course syllabus; a description of an activity where students evaluate the works of others; a description of at least one activity or assignment designed to encourage/integrate student self-reflection; and a capstone Critical and Creative Process activity – an assignment that integrates the opportunity for students to practice and receive feedback on the critical and creative thinking process.

1.4. Research Questions

This paper addresses the following questions:

1. What are the trends in adoption of 13 evidence-based instructional strategies by faculty who teach STEM or non-STEM courses after a common faculty development experience?

2. How commonly did faculty implement changes in additional courses, and share activities, assignments, or concepts gained during the training with colleagues?

2. Methods

2.1. Faculty Impact Survey

A survey was developed to gather matched pairs data from five cohorts of faculty who completed TH!NK training between 2014 and 2018. The survey asked faculty about their use of specific evidence-based teaching strategies in their TH!NK course before and after the training, as well as intended future use. In addition to the pre/post matched pairs data, course-level data was collected in order to examine strategy adoption in STEM and non-STEM courses. The survey had questions about whether faculty had implemented changes in their other courses, and whether they shared TH!NK activities and assignments, or mentored others inside and outside of their department. The survey was administered to 126 TH!NK faculty members and 72 responded (Response Rate=57%).

2.2. Data Analysis

First, descriptive statistics for the demographic data were summarized. Then, we used SPSS to analyze the matched pairs data, and calculated Cohen's *d* to measure the change in strategy adoption as an outcome of the faculty development training. Cohen's *d* measures 'effect size', or the magnitude of difference between the two means (pre/post), which is an indicator of the importance of the difference between them (Cohen, 1988).

2.3. Participant Demographics

Faculty of all ranks, and from every undergraduate-serving college on our campus, participated in the Institute. Of the 126 participants, approximately 60% were professional-track and 40% were tenured or tenure-track. Over 25% of participants in the training were tenured. In the training, 47% of faculty were transforming a STEM course and 53% a non-STEM course. The proportion of survey respondents was representative of the demographics of those who participated in the training.

3. Results

3.1. Adoption of evidence-based teaching strategies in STEM and non-STEM courses

The survey asked participants to indicate, for each strategy, whether it was used in their course both prior to and after participating in training. For this analysis, responses were separated by STEM (e.g., science, technology, engineering, mathematics), or non-STEM (e.g., humanities, social sciences, education, business, design, arts) course types.

In Figure 1, for each strategy on the left, a stacked bar is shown for STEM (upper bar) and non-STEM courses (lower bar). The lighter shade represents the percent of survey respondents who used the strategy prior to training, and the darker shade indicates the increase in use, or total percent of respondents who used the strategy post-training.

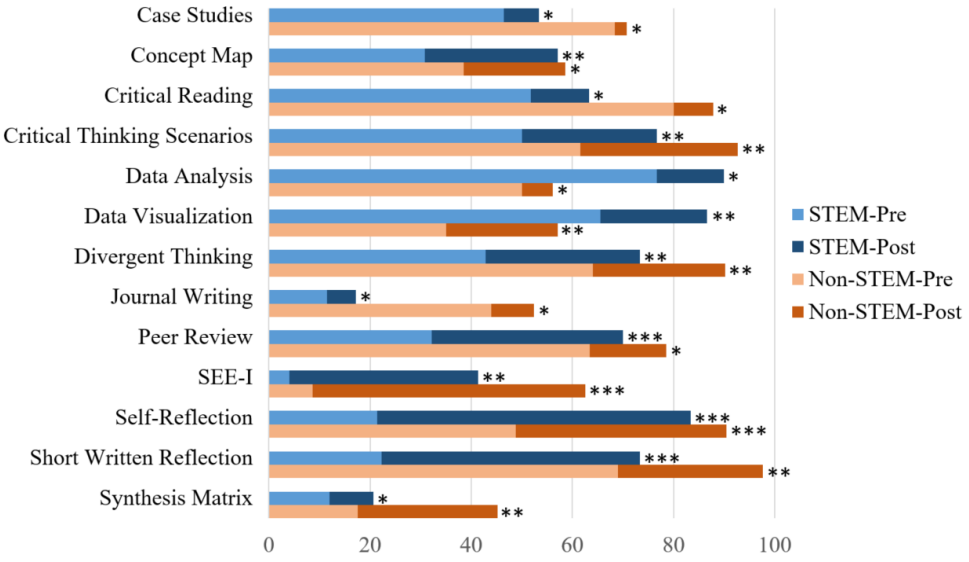

*Figure 1. Strategy adoption by faculty who teach STEM and non-STEM courses with effect size. The effect size for the pre/post strategy usage is indicated by asterisks at the right end of each stacked bar (*small=.2, **medium=.5, ***large=.8).*

In the faculty population overall, not separated by STEM status, over half of the strategies evaluated showed over 0.5 effect size pre/post-training. The three strategies with the largest effect size for both STEM and non-STEM courses were SEE-I, self-reflection, and short written reflections with effect sizes of 1.0, 0.98, and 0.73, respectively.

It is important to note that among the low adoption strategies - journal writing, case studies, and critical reading - journal writing usage was low before and stayed similarly low, while case studies and critical reading were already highly utilized by approximately ⅔ of faculty prior to training. Thus, in some cases where there was a lack of new adoption it was due to high usage prior to training. It is therefore important to consider both gains in use and overall use in discussing which strategies were valued by faculty.

In almost all cases, with the exceptions of data visualization and data analysis, faculty teaching non-STEM courses were more likely to utilize the evidence-based teaching strategies post-training, compared to faculty teaching STEM courses. While both course types showed gains in adoption, the gains among STEM faculty were greater, thereby reducing the gap in usage. Notably, faculty teaching STEM courses reported the increased

use of short written reflections and other forms of self-reflection, as well as peer review, for which the analysis showed very large (over 1.0) effect sizes. In most cases, when we look at post-training usage, popular teaching strategies were embraced in both course types and unpopular strategies were mostly shunned by both types. Outliers are, again, data visualization and data analysis, which had greater use in STEM courses. Use of the synthesis matrix and journal writing was not extremely popular among either group, but both were utilized at a greater level in non-STEM courses. This may support the idea that while a small number of these strategies are discipline-specific, most are applicable to similar degrees across disciplines.

Across the board, faculty reported that prompting students to reflect on their own thinking was one of the most impactful enhancements to their courses. One faculty member wrote "*I really feel like giving [specific self-reflective prompts] to all of my classes would benefit me in the future, as it has successfully given students a better platform to give more significant feedback to their learning gains rather than what they didn't like about the course or what they enjoyed about the course."*

We also asked faculty about their intention to use each strategy in the future. In all cases, faculty not only reported intending to continue usage, but many faculty indicated that they intended to try additional strategies in the future.

3.2. Informal spreading of ideas, assignments, or teaching strategies among faculty

Of respondents who teach more than one section of their TH!NK course, 92% reported implementing changes across sections. Of those who teach multiple courses, 100% report implementing changes to additional courses based on their learning in the program. Respondents also reported sharing TH!NK ideas, assignments, or activities. Approximately 85% of survey respondents reported sharing inside their own departments and 40% shared outside of their own departments.

4. Conclusions

We observed that the combination of an intensive, multi-day faculty development institute, paired with peer mentoring and accountability over a prolonged period of time, led to a high rate of adoption of a number of evidence-based teaching strategies among our faculty cohort. This aligns with research suggesting that faculty development programs include at least two of the following: a sustained effort, lasting a minimum of four weeks, feedback on instructional practice, and a deliberate focus on changing faculty conceptions about teaching and learning (Desimone & Garet, 2015; NRC, 2012).

Faculty teaching non-STEM courses utilized evidence-based teaching strategies focused on critical and creative thinking more than STEM faculty prior to TH!NK training for most of

the strategies we introduced and evaluated. However, following training, while both groups made large gains, gains among STEM faculty were even greater, helping to close the gap between usage between STEM and non-STEM faculty. While there were some strategies that were utilized at greater levels by STEM faculty prior to training, the overall trend may indicate that STEM faculty were less likely to have been exposed to a wide variety of teaching strategy options prior to training. In most cases, strategies that were very popular were popular among both groups, while less popular strategies were not favored by either group post-training. This argues against a need to have separate training for faculty based on discipline when it comes to critical and creative thinking. And indeed, faculty overwhelmingly expressed that gaining perspective of peers from different disciplines helped them gain awareness in gaps in the way teaching is frequently done in their own discipline. One faculty member said "*I highly value the relationship of [my faculty cohort] in the enhancement of my THINK course. Forming these relationships in the THINK training has enabled me to meet other members of the faculty from different colleges and disciplines, and I have learned from their different perspectives and approaches to critical and creative instruction.*"

Across the board, faculty indicated making changes not only to their TH!NK course but to all of their courses. Many report sharing ideas, assignments, and teaching strategies with colleagues both inside and outside of their academic departments. This not only indicates a snowball effect of these ideas throughout campus, but also indicates that participation has encouraged interdisciplinary interactions in the realm of teaching and learning.

To date, approximately 11,000 students (student enrollments) have been impacted directly in TH!NK courses. We are currently analyzing and writing up the student learning outcomes from the first phase of our program focused on first-semester freshmen, and also beginning to gather longitudinal data on students in majors where multiple faculty intentionally incorporated critical and creative thinking skill development throughout all years of the curriculum. An initial bird's-eye view of the data points to gains in a greater number of unique critical thinking skill areas post-intervention compared to pre-intervention and faculty training. We also learned that our first-year students score very high in convergent thinking tasks, but have more room to grow in skills that require divergent thinking and where there is not necessarily an answer that is "best" from all perspectives. These student learning outcomes will guide us in planning the next phase of TH!NK faculty development.

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The Interactive Classroom Methods for science classes

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Abstract

Interactive methods are good resources to make students reason and think because they improve open analysis and hypotheses and develop divergent thinking in Science, Technology, Engineering, Mathematics, Computer Science subjects. The aim: for students to build knowledge from intersubjective relationships by studying and working autonomously; develop the ability for self-learning and publicize trends of perspective development with new methodologies so teachers and students can enrich themselves with these experiences.

The appropriate use of interactive methodologies contributes to a higher level of work from the teacher, through them it discovers attitudes and capacities of his students, their willingness to work and curiosity for research. And at the same time, students can work in a more practical way the contents and acquire training and information for later use in the mentioned subjects. This improves the approval rate by 10%.

Keywords: *Teaching-learning experiences; methodologies; interaction; learning.*

1. Why use Interactive Methods?

The incorporation of computer science and computers into classes as in homes forces Education teachers to reconsider how to teach today and which methodologies use in classrooms to teach not only computer science but to generate disciplines known as STEMC (science, technology, engineering, mathematics and computer science) to promote the development of constructive thinking. Information and computer technologies facilitate a new possibility for teachers to offer students a more personalized, balanced, varied and flexible attention to work and teach by favoring the teaching-learning process.

Interactive methods are a good resource for making students reason and think because they favor open analysis and hypotheses and develop divergent thinking in subjects mentioned for both educational computing and computer science teaching.

What we aim to do is to make known both methodological tools and their use to process information and carry out research projects, solve problems, work cooperatively... to promote the development of students' skills. Integrated classes (computer media tenure and their use in union of interactive teaching methodologies) achieve a greater number of educational and teaching objectives.

The interactivity of these methods is based on actions and functions that are exercised on a reciprocal basis in the teaching-learning process between teachers and students, and in these proposed methods the student will be in charge of searching for the contents that will make up the topic or unit raised by the teacher, using and analyzing techniques and new technologies. Students become the center element of the activity and must organize and work collaboratively and make decisions. Teachers oversee errors, help and facilitate in the learning process and in the construction of knowledge. It is the unity of instruction and education, the union of the school with the life and systematization of teaching. The teacher designs the teaching situation (case, problem, simulation, etc.) Its functions focus on the following aspects:

1. Present the task and give clear instructions on how to perform it; facilitates conditions, provokes and organizes situations, space and materials. The teaching process is an intercom process.

2. Negotiate the work process, the objective and the composition of the group, provide information and resources to achieve them, respond to queries, correct errors.

3. Deploys actions and stimulates the exchange of explanations and justifications in the realization of a task, so that the student understands the logic of the contents in the work sequence and in the evaluation of results.

4. Seeks to ensure the success of the weakest components and basic learning objectives and to develop knowledge and learn to think and act in their own style.

2. What are Interactive Methods for?

To deal with real problems or practical situations involving control of skills like those to be handled by a science professional, computer science... Critical thinking skills are worked: generating ideas, solving problems, developing hypotheses, verifying them, making decisions, etc. And interpersonal and teamwork skills are developed, alongside with the communication to search for information, select it, argue, use specialized languages, etc. The general objectives to be achieved with these methodologies are:

- Make students learn among themselves by studying and working autonomously.
- Develop self-learning capacity
- To publicize trends of perspective development with new methodologies which help teachers and students enrich themselves with these experiences.

3. How students learn when using Interactive Methods

+ Students analyze demand, think, organize, search for information, work as a team and make decisions, and teachers help and facilitate their learning building process.
+ With these methods the interaction occurs between peers when they cooperate to do a common task by helping and receiving help, i.e. with reciprocity.
+ When working in a work group, different points of view are expressed, ideas are contrasted, and possible solutions or alternatives are developed together creating enriching situations to advance and learn.
+ When a group helps a partner not miss time, it is learning because it improves one's understanding and mastery of the subject and communication skills

4. Guidance for using Interactive Methods

- Few students in the group: interdependence and collaboration to learn and help how to learn. Randomly formed, by list order, depending on the proposed task, etc.
- Group heterogeneity: to achieve learning by interaction. They should be aware of the cooperation that this task requires and the advantages of carrying out group work.
- Good organization of work: help groups adopt a management style to build the learnings and decide how to work by seeking the exchanges of ideas, etc.

- Responsible for functions as spokesperson, secretary, responsible for the material, etc. on a rotating basis.

At the same time, techniques such as:

- Use new technologies: propose interaction activities and ask for clarification when students intervene.
- Deepening for reasons. And answer the questions with other questions.
- Interpret data, give examples, make clarifications, summarize, ...
- Make brief exhibitions to present concepts or techniques.
- Use concept simulation techniques in science.

The various interactive methods have many elements in common and it is not always easy to narrow the difference. Its implementation usually requires students to:

- Use strategies to process information from oral exposures, written texts, graphic material, iconic or statistical material.
- Develop participatory, descriptive, explanatory and argumentative materials.
- Interact in class from assumptions, exercises and verification and acting activities.

The following is a series of Interactive Methods to be used in Science, Technology, Engineering, Mathematics, Computer Science.

5. The Case Method

Proposes conjectures and seeks solutions, example of environmental issues.

5.1. What is it?

It is the description of a specific situation that brings a specific reality closer to a group of people in training. An initial analysis of the case is performed in a group, with a teacher-oriented work script to interpret and clarify. And then define the problems, reach conclusions about the actions to take, search and analyze information, contrast ideas, defend them with arguments and make decisions.

5.2. Features

- The situation presented must be real or appear to be, because it is logical and admissible.
- It must be relevant to students, so that they can be involved in their resolution.
- It must be unresolved, as students must generate hypotheses, contrast, make guesses, complete knowledge and seek solutions and alternatives.
- It should not have a single solution as the discrepancy must have a space.

- The decision to be made must be argued.

5.3. What is favored?

- The ability to analyze and train in real case resolution with functional learning.
- Intrinsic motivation for learning and developing communicative skills.
- The possibility to experience an authentic assessment linked to real events.

Figure 1. Example of this method in a virtual course at the University of Veracruzana

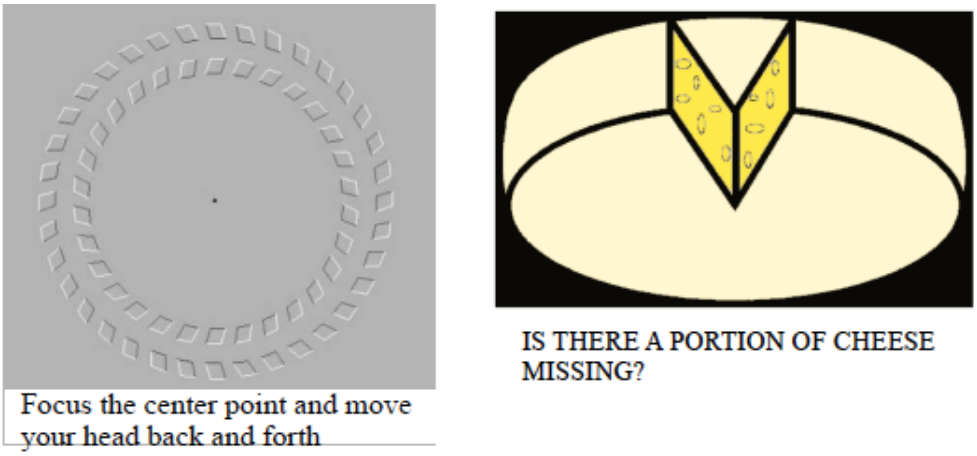

Figure 2. Interaction activity to advising vision concepts to the case method.

6. The chain of questions

Emphasizes analysis of a hypothesis promoting memory capacity. For example, in the use of computer applications, human biology...

6.1. What is it?

It is a structure suitable for reviewing any subject worked and preparing the exam. For about three minutes each team thinks of a question about the topic that will be raised to the team next to them, following an order.

6.2. Features

Questions are asked about fundamental issues (which might be on an exam) worked in the class to help the other teams. Four-component teams are organized. It starts by giving to all teams 3 minutes to search for a question.

After three minutes, one team's speaker asks the next team, who answers it, and then the team's speaker asks the next one, and so on until the last team asks the question to the first team that has started. There are two speakers per team: to ask the question they have thought between everyone and to give the answer. You can make the rounds you want.

7. The Puzzle

It favors the proposal of hypotheses and the interrelationship of different solutions individually to find and verify the right thesis and solution.

7.1. What is it?

This technique is especially useful for areas of knowledge where content is likely to be "fragmented" in different parts (e.g. experimental, technological, sciences). All students need each other and are "forced" to cooperate, because each of them has only one piece of work to be done and their teammates have the others, essential to successfully complete the proposed task: the global mastery of a subject under consideration.

7.2. Features?

The material under study is split into as many parts as members the team has, so each of its members receives a piece of the information on the subject that all the teams are studying, and does not receive the information of the others teammates. The student should prepare his own dossier with the information given to him by the teacher or that he has been able to search for.

Then, with the members of the other teams that have studied the same sub-item, they form a "group of experts", where they exchange information, delve into key concepts, build schemas and conceptual maps, clarify the doubts raised, etc.; we could say that they become experts in their section. Each of them then returns to their home team and is responsible for explaining to the group the part he has prepared.

8. The Projects

They promote global and multidisciplinary studies by applying them to detailed research plans to develop apps or green apps.

8.1. What are they?

His idea is that learning involves direct contact with the object of study through a planned task, carrying out activities, resources and skills that culminate in results performing work, with proposals or an exhibition, of an object, etc.

8.2. Features

It works on real problems and engages in various disciplines. It requires understanding the task, planning, searching for various sources of information, teamwork and the realization of the project.

They allow to globalize contents. Students carry the incitement, work autonomously with the help of the teacher who provides them with resources and collaborates with them. The activities to be carried out, the documentation to be delivered, deadlines and evaluation criteria must be defined.

8.3. What do they favor?

- Learn to make your own decisions and act independently.
- Improves the motivation to learn because it relies on experience and allows you to apply what you have previously learned to specific situations.
- Strengthens students' self-confidence and encourages research learning.

Example of collaborative research project on primates, involved: team formation, dossier concreteness, use of tics; involved the organization and planning of tasks of two groups at the international level for the production of the project and its exhibition.

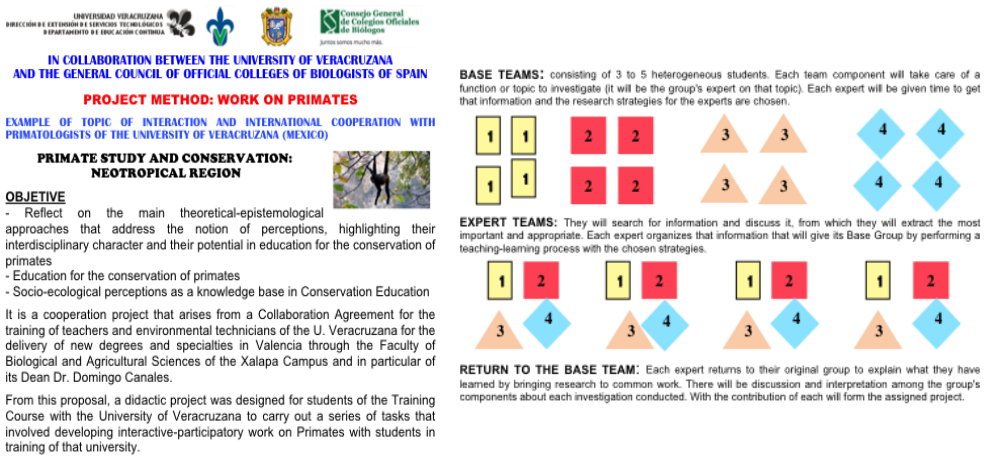

Figure 3. Example of work using project methodology. And example of the puzzle method that pleases hypotheses and solutions

9. Simulations

Emulate realities using computing and information technologies for environmental problems by viewing their evolutions and making decisions to correct them.

9.1. What are they?

They are wide range activities that allow to reproduce or represent in a simplified way a real or hypothetical situation. They are the most effective means of testing different hypotheses about environmental and computer processes using models. It proposes different hypotheses and solutions that make it easier to understand the consequences.

9.2. Features

Its objective is to make decisions or come to understand the interactions of people with the environment around them such as: localization of industries, roads, railways, urban issues, etc. are very useful in Science, Technology, Engineering, Mathematics, Computer Science.

Used: presentation, realization and visualization of the organization of living things in Biology, Artificial Intelligence in Computer Science... helps students understand the intentions and motivations of social agents.

9.3. Simulator apps

Carbon Footprint Simulation Programs: ceroc02.org/calculadoras/. Models of interactions between pairs of species. The GLOBE program. The global reports of the Intergovernmental Panel on Climate Change...

10. Results

These methodologies are being used in the university and middle schools for two courses, we would need some more course to see the most reliable evolution. In the last two courses with 70 students (35 in each course) 50 students approved in first instance, an average of 25, in previous courses the average was 21 students. We believe that students learn the contents more quickly, that is, they use less time to understand the concepts and there are a greater number of approved in first calls of the subjects.

11. Conclusions

The conclusions of these methodologies concern both teachers and students.

1. These methodologies serve as another means for teachers to improve their level of work with their students, participating in the tasks presented with the educational materials developed. At the same time it serves to discover the attitudes of the students, their willingness to work and curiosity for research.

2. Students carry out a set of activities that encourage learning based on theoretical training, developing hypotheses, working content and solutions to the topics raised by acquiring training and information for later use in the Science, Technology, Engineering, Mathematics and Computer Science.

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Breaking down the classroom walls: How to train future media professionals in an interdisciplinary and applied way while fostering social change

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Abstract

This paper describes an effective methodological strategy that the Consolidated teaching innovation group in Communication and Audiovisual Media (In-COMAV), composed of a multidisciplinary teaching team, has been developing since 2016 within the Audiovisual Communication degree program offered by the University of Barcelona. This strategy consists of promoting service-learning projects within the context of various courses. Here we present the viability criteria established for the acceptance of projects oriented toward collaboration with organizations outside the university, the critical success factors and the results that this initiative has had on students, teachers, the university and society. Such results are perceived positively, yet there are still challenges and limitations to be overcome to ensure the continuity, sustainability and effectiveness of service-learning projects in higher education.

Keywords: *teaching innovation; service-learning; unfair competition; interdisciplinary learning; applied learning.*

1. Introduction

As is widely known, universities play a social role. They are regarded as key institutions not only for personal and professional development, but also for promoting social change, so they serve a dual role. First of all, universities provide the professional training for high-level jobs. Secondly, and just as significantly, they train in skills and abilities that allow students to develop values and virtues that can enhance not just individual but also social well-being. Therefore, universities must promote educational innovation initiatives with a social impact, aimed at facilitating competency-based learning.

2. Improving Audiovisual Communication students' career readiness

With this in mind, for three years now a team of professors, now recognized as a consolidated teaching innovation group (In-COMAV), have been implementing some ideas to improve the professional preparation of students. This experience is taking place in the Audiovisual Communication degree program offered by the University of Barcelona's Faculty of Information and Audiovisual Media, whose objective is to train media professionals and content creators with a 4-year curriculum covering various professional profiles: scriptwriter, producer, director, visual and sound post-production designer, researcher and corporate communication specialist.

The set of initiatives this team is implementing to improve the career readiness of students includes training them in various forms of persuasive communication, promoting their participation in fiction and documentary film festivals and, more particularly, promoting the development of service-learning projects that combine learning and community service.

3. Application of service-learning methodology in Audiovisual Communication

The main innovation of service-learning lies in developing a well-articulated, coherent and original educational activity in which the pedagogical purpose is combined with solidarity (Puig *et al.*, 2007; Martínez, 2009). As a methodological approach, service-learning makes the point that teaching cannot be limited to training students while locked in a classroom (Rodríguez & Tiana, 2015).

In the context of the Audiovisual Communication degree, service-learning projects involve the production and direction of a short film with a clear social benefit. These projects therefore have a professionalizing role, as participating students are trained while working to meet real needs in their environment. They also promote knowledge transfer and interdisciplinary work, since students cooperate with professionals from different disciplines (historians, physicians, librarians, etc.).

In the last three years, nine projects have been completed, and three new ones have been launched, involving a total of 50 students and 12 professors. This has meant collaborating with three other faculties and five other institutions (including hospitals, professional societies and neighborhood associations):

- Barcelona School of Nautical Studies, Polytechnic University of Catalonia
- Faculty of Medicine and Health Sciences, University of Barcelona
- School of Nursing, University of Barcelona
- Maritime Museum of Barcelona
- Language Services, University of Barcelona
- Official Association of Librarians-Documentalists of Catalonia
- Popular Historical Archive of Camp de la Bota and La Mina
- Podiatry Hospital, University of Barcelona

Altogether, these projects meet a variety of social needs: some of them seek to raise awareness about compliance with medical therapies, or against self-medication, others relate to coping strategies within a disadvantaged neighborhood, and others aim at disseminating local language and culture, just to mention a few.

Regardless of the topic covered, these projects share a common trait: all of them have been triggered by external proponents, although they have been submitted to a selection committee since not every proposal for collaboration could be accepted. Some of them lacked the social commitment and formative spirit necessary to fit into the educational model of service-learning.

4. Service-learning project requirements

Proponents' requests often sound like a job offers without a salary. From what we have observed, such predatory behavior, seeking out free labor, is widespread. We therefore needed to ascertain some objective facts to decide on what was feasible (and what was not) before involving students and teachers in a new project. To this end, a set of guidelines was developed, first, to identify which proposals have real educational potential, and second, to avoid unfair competition with media professionals: in no case can any project ever replace the provision of a professional service.

This set of guidelines has proven useful for identifying what can (and what shouldn't) become a service-learning project and who can be a recipient of the service. In this sense, it might also be considered a compendium of best practices.

4.1. What a service-learning project must have

- *Value from an academic perspective*. The initiative must have a pedagogical value and must facilitate the development of the specific and cross-cutting skills that the degree aims to confer.
- *Social, political, cultural or economic impact*. The resulting product must achieve something of public value; it must have some social, political, cultural or economic impact and must have the endorsement of a public institution, a social entity or an organization.
- *Status as a teaching innovation project or a knowledge transfer project*, which also means that students need to be provided with a training program.
- *Natural development within the framework of a course*, from both an academic and a chronological point of view (one academic semester or, only in exceptional cases, one academic year), with a professor who will act as mentor, guiding the students on their learning path.
- *A proponent who is prepared to provide some funding*, if necessary. On one hand, media schools are not production companies and shouldn't act as if they were. On the other, students should not be required to cover any expenses whatsoever. If there is the need to rent specific equipment, the proponent should cover the expenses. After all, the proponent is the project beneficiary.

4.2. What a service-learning project is not

- *Work without salary*. It should be clear that a service-learning project is not a job assignment. Students should not have to "respond to the proponent's orders." Even if they are working with a "client", it is still an academic project, not a business relationship. Students must conceptualize the product and do some research on the work to be carried out; they must play a leading role in the design of the product.
- *A platform for commercial benefit*. The product cannot be intended for any kind of promotion or economic benefit. It cannot be an advertisement or a promotional video. Even if there is no profit involved, the product cannot be intended for the sole benefit of the proponent. If the project is internal to the university, there is an appropriate formula: scholarships. In every project, students should get some benefit in terms of curriculum or experience. Even the media school itself could benefit in terms of brand enhancement.
- *Unfair competition*. The students' activity should not result in unfair competition with media professionals. The proponent should be aware that students are, after all, pursuing a learning activity within the framework of their education, so they may make mistakes and the final product might not be entirely satisfactory. Of course, the university will always ensure the quality of service but in no case should it be committed to providing a professional service. In any case, having this point stated

in the guidelines is a protection for teachers and students. It should be borne in mind that most projects involve an investment of money, which would justify a complaint if the result is not fully satisfactory.

5. Methodological advantages

This initiative has an innovative approach as it emphasizes interdisciplinarity:

- The scope is encyclopedic, as the topics covered are widely varied. Normally, teaching innovation is focused on the discipline itself: nursing studies deals with nursing issues; architecture studies with architectural issues, etc. As teachers of Audiovisual Communication, we need to be open to all fields of knowledge.
- Participating teachers belong to varied areas of knowledge, so if we want to work on persuasive communication, we are not limited to oral communication, but also consider written and online communication, which involves personal branding and other issues.
- Participating students may come from different degree programs and work together on a joint project. In such cases, they are assessed using both joint and separate evaluation rubrics. The joint criteria are those related to the project development (cross-cutting skills), while the separate criteria are those associated with the specific skills of their corresponding degree programs.
- This methodology breaks out of the limits typically associated with specific courses: it breaks down the classroom walls and forces students (and also teachers) to engage in different disciplines and to engage in dialogue with external agents, which is inherent to working in the media industry.

6. Results

The results observed suggest a marked increase in students' enthusiasm and motivation. Students who participate in these initiatives are aware that the projects they carry out have a social utility and are used in communication campaigns. They perceive learning in an applied, practical way, which is more fun and motivating than ordinary exercises. Since they have to negotiate with a "client" (the proponent) to assess and determine what is really needed, they learn to analyze context, to formulate objectives, to break down complex situations and to design action plans.

In this way, students develop both social and professional skills. Also, as these projects are developed in the field of Audiovisual Communication, students have to build work teams covering all the usual profiles present on a professional film crew. This provides a valuable opportunity to learn role-oriented skills in a real working environment and to develop an

aptitude for teamwork. As a side benefit, students participating in this type of initiative tend to earn higher grades (see Table 1). Furthermore, sometimes they are even willing to continue working on the same project after graduating, as has already been observed by other authors (Einfeld & Collins, 2008).

Table 1. Grades earned in service-learning (SL) and non-SL projects

Course – academic year		SL projects	SL projects avg. grade	Non-SL projects avg. grade
Project II	2016–17	2	9.1	7.56
Project II	2017–18	1	8.04	6.83
Final Project	2017–18	2	8.4	7.48
Project II	2018–19	1	7.31	7.35
Final Project	2018–19	2	7.37	7.65
Idea to Screen	2019–20	1	9	7.19
		9	**8.2**	**7.34**

Source: prepared by authors

7. Keys to success

So far, this experience has allowed us to identify some keys to the success of service-learning initiatives:

- *Planning and control*. If a media school wants to engage in service-learning projects, it should do it gradually to make innovation sustainable and to guarantee its continuity. Developing service-learning projects needs an effective infrastructure. It is wiser to begin with a single project, even a large one, and complete it, than to start many small projects at once and end up not completing any. Also, the burden of management is multiplied with each new project, which is reason enough to focus on a few good projects, or only one, rather than spreading the resources out too thin.
- *Receptivity*. From inside the university it is sometimes hard to know all the needs of the outside world. In order to identify them, an exercise in humility is needed. The university must listen to the outside world and understand its particular needs, not to impose solutions, but to find a way to help solve problems. The university should

not be working *for* external agents, but *with* them, as equals (those agents being, for instance, another faculty, a neighborhood or a medical department).

- *Collaborative benefit.* In this context of collaboration, all parties should win, and the benefit to be provided to each party has to be clearly defined from the start. First of all, the external agent wins because they are benefiting from this initiative. Students should get some benefit (learning, experience, personal growth) and should not be used as free labor. Moreover, their creations can be disseminated in different media and as such should be a valuable contribution to their CVs. Teachers get out of the classroom, negotiate with a "client" and guide the students in a professional context. Finally, by promoting SL, the university is developing new forms of training that are valuable in multiple ways.
- *Rigor*. Students do their part to face challenges and overcome problems, and they therefore should be trusted. However, this trust must be accompanied by rigor: their learning must be connected to the courses of their degree program and must also have clearly defined objectives and appropriate assessment procedures.

8. Conclusion

This experience with service-learning projects has allowed us to establish a set of useful guidelines for identifying collaboration proposals with educational value for Audiovisual Communication students. It is our belief that these guidelines can be equally applied to other disciplines as well, as they characterize what service-learning projects are really all about. On the other hand, the methodological advantages offered by these initiatives as teaching and learning experiences cannot be overemphasized: service-learning projects are conceived and developed in complex, real-life situations that demand interdisciplinarity and teamwork.

In this context of collaboration, one positive aspect deserves to be underlined: service-learning is beneficial for all parties involved. Students learn to apply their knowledge: they solve real problems and also develop entrepreneurial and other skills. Teachers, for their part, can reinforce interdisciplinary work and academic coordination. University departments achieve greater institutional outreach by incorporating social engagement into their brand image and highlighting the relationship between knowledge and social welfare. Finally, society is another major beneficiary, since the university gives back to society just what is expected from it: the training of individuals who will contribute to collective well-being.

The results achieved show that students involved in service-learning projects are highly motivated and enthusiastic, as they are aware of the real social impact of their efforts. Students also benefit from applying social and professional skills in a way that is not possible in the closed context of the classroom.

Universities are very much aware of the value of social engagement, and they are already looking for ways to incorporate this dimension into higher education (Arroyo, 2019). Such social engagement can be stated in the European diploma supplement, but to guarantee its sustainability as an educational practice, teachers who mentor service-learning projects also deserve recognition, since extra effort is needed to provide the personalized attention these projects require. This remains a challenge to be overcome in the future.

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A Case Study of Internationalisation in Chinese Non-government Institutions

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Abstract

China's non-government Higher Education sector has experienced 40 years of growth but has faced a range of problems in recent years. There is an urgent need to think carefully about future directions and approaches that non-government universities might take. Internationalisation is changing the world of education and has become important strategically for Higher Education institutions across the world. This research explores what internationalisation might mean and provides an understanding of internationalisation in the context of Chinese non-government universities. Under the internationalisation framework in Western academic literature, this study investigates the practice from a case study university in China. Data were collected through semi-structured interviews along with document analysis. Participants indicated that internationalisation is learning, integrating initiatives for mutual benefit and can be an accelerator for overall development of universities. Furthermore, the government and society need to work together to create a more equitable government policy that positively encourages China's non-government Higher Education institutions to bolster internationalisation.

Keywords: *China, non-government institutions, internationalisation.*

1. Introduction

China undertook economic reform and issued the first opening-up policy in 1978. At the same time, China started to open the Higher Education (HE) system to the world. Since then, the Chinese HE system has grown to be the largest in the world in terms of student enrolments (Hammond, 2016; van der Wende & Zhu, 2016). As well, China has become a popular destination for study abroad (Hammond, 2016; Kirby & van der Wende, 2018).

As a product of the Chinese Opening-up policy and HE structural reform, Chinese Non-government HE Institutions (NgHEIs) re-emerged in the early 1980s and have become one of the important components of Chinese HE. By the end of 2018, there were 2663 Regular HEIs in China, with 749 NgHEIs, accounting for 28.13% of the total universities in China (MOE, 2019).

Private HE has relieved the pressure of increasing demand for HE and hastened the development of mass HE. However, China's non-government HE sector has faced a range of problems in recent years marked by *Revised Non-government Education Promotion Law* (hereafter: *New Law*) (MOJ, 2016) in 2016. The *New Law* introduced a classification management model to divide non-government institutions into two types: Non-profit and For-profit. However, since the *New Law* has been drafted for four years, there has been neither supporting strategies nor implementation approaches in most provinces in China. In addition, non-government universities face self-development and identity problems as graduate students are not as highly regarded as students from government universities and may have reduced opportunities. These challenges create great uncertainty and there is an urgent need to think carefully about the future directions and approaches that non-government universities might take to respond.

Under the impact of economic globalisation and the integration of science and technology, internationalisation is changing the world of education and has become important strategically for HEIs across the world (Altbach, 2002; Gould, 2017; Wihlborg & Robson, 2018). How could an internationalisation strategy for non-government universities provide an approach to facilitate and link all university activities for ongoing development? Knight (2008) argues "Internationalisation means different things to different people" (p. 1). The purpose of this research is to explore what internationalisation might mean and provide an understanding of internationalisation in the context of Chinese NgHEIs to potentially inform future policy development. This study can also inform Western scholars who wish to understand the internationalisation practice in the Chinese social context and to Western HE institutions who encounter similar challenges.

2. Research question

What is the meaning of internationalisation in Chinese non-government universities?

3. Research design

This research employed a qualitative case study methodology. Data was collected from a Chinese non-government university through semi-structured interviews and artifact analysis. Interpretive analysis was used. In guiding this research, the conceptual framework of a Western scholar, Knight (2008), was used to examine China's IHE. Knight (1994) portrays internationalisation as a complex process including: (a) definition, (b) rationale, (3) approach and (4) strategy which can all work together to examine the meaning and process of China's internationalisation of NgHEIs. Neave's model, Davies' model and Rudzki's model are all famous models for internationalisation strategies. However, Knight (1994) and Knight and de Wit (1995) believe internationalisation is a process with many complexities. Knight's model is used here because it provides a holistic frame for examining China's IHE.

Knight's working definition of internationalisation was employed in this study.

> Internationalisation at the national, sector and institutional levels as the process of integrating an international, intercultural, or global dimension into the purpose, functions or delivery of postsecondary education (Knight, 2015, p. 2).

Seven top and mid-level leaders, including two university leaders, two department directors and three school deans, came from three campuses of the case university, were interviewed face to face individually in China, in Mandarin. They are all in decision-making positions where they determine the university direction, create university-level policies and the internationalisation strategy, and they lead and motivate faculty and students in their practice.

4. Findings

4.1. The Brief Profile of the Case Study University

Founded in 1984 in Beijing, NGU is the first new-type of Non-profit university in the public-owned and non-governmental system. The total number of students enrolled was approximately 20,000 with 80% of them from Beijing. Currently, NGU has more than 40 sister colleges and universities from 20 countries. The international collaboration program in relation to students and faculty is diverse and abundant including high-level projects in China's NgHEIs that have enhanced NGU's social reputation and total development. NGU has successively ranked in the top of non-governmental universities in China since 2011.

4.2. The definition of internationalisation at NGU

Participants of NGU view internationalisation from different perspectives. The participants who contributed these ideas are indicated in brackets. In general, these perspectives were categorised into three groups: *developing trends, standards, and cultural exchanges.* Most importantly, in the context of HEIs in China, it is *an approach or goal to learn from others and two-way exchange to create mutual benefits through cross-broader, cross-ethnic and cross-culture activities* (NG2, NG4, and NG7). Internationalisation is not *Westernisation* (NG1[1]) - *the process of being internationalised is not learning and accepting others totally, but selectively combines our own problems and characteristics to create knowledge with our own distinctive features*. The concept conveyed was one of exporting and spreading knowledge and influencing others for mutual benefits in the future.

4.3. The rationales of internationalisation at NGU

According to Knight (2008), the traditional rationales for internationalisation include "social and cultural; political; economic; and academic" to examine "Why internationalisation" is important. At NGU, commonly participants considered that both internal and external factors contributed rationales, with internal reasons being stronger.

Internal motivations were for survival and the development of their institution, keeping up with public institutions, as well as meeting the needs of students and faculty.

For example, NG7 introduced the idea that internationalisation was used as a standard to evaluate the quality and reputation of HEIs. This standard forces institutions to foreground internationalisation to ensure their survival.

In addition, participants thought internationalisation was perhaps the quickest way to remedy the gap between their institution with public ones and may assist in catching up with public universities through cooperation with high-quality foreign universities (NG5 and NG7).

External motivation

Participants recognized that Chinese students wanted to study overseas, but there were also students who wanted to come to China to study (NG5 and NG6). Moreover, China needs international talent to help promote national reform. Thus, graduates with an international vision and background were highly regarded, especially because Chinese people want to share Chinese culture and show the real China to the world (NG3).

[1] NGU 1-NGU 7 are references to my seven interview partners for anonymity.

4.4. Approaches and strategies of internationalisation at NGU

Knight (2008) proposes six groups of approaches: “activity; outcomes; rationales; process; ethos and abroad/cross-border” to frame and examine "How to internationalise". Strategies, programs and policies work together to examine the strategies of internationalisation at the institutional level (Knight, 2008). Strategies are divided into Academic strategies and Organisation strategies. At NGU, approaches were described for each of these strategies.

Organisation strategies, programs and policies at NGU

The main features of internationalisation practice at NGU were:

1. Positioning internationalisation as an aspirational long-term goal by writing it into the outline and annual plan (NG1, NG2, NG3 and NG5). It helped drive the long-term goal to form a highly-ranked University that is metropolitan, application-oriented, and international. In addition, all strategies were implemented with the support of human resources, material, energy and financial resources (NG1, NG2, NG4 and NG6).

2. The Internationalisation strategy links closely to the distinctive strength of disciplines and specialties of NGU to provide talent cultivation, teaching, researching and social service. Participants recognised that international cooperation can be enhanced through professional development and talent training (NG3 and NG7). At the university level, they developed international courses through both compulsory and elective courses (NG3 and NG7). At the secondary colleges level, some courses have integrated the issue of internationalisation into the curriculum, such as Community Care, Community Rehabilitation and Aged Care (NG6). NGU has also established the Sino-Danish Senior Citizen Centre in Demark to help deal with global health problems.

3. Balancing the relationship between internationalisation and localisation (NG1, NG4 and NG7) is important. Participants believed NgHEIs were local universities so internationalisation should serve to improve the level of local specialties, local characteristics of culture and industry. In addition, collaboration was not only emphasised in Western countries but to cooperate to access advanced resources throughout the world (NG1, NG2 and NG6). For example, NGU’s collaboration with Cuba has created a breakthrough of China in Latin America which has facilitated NGU’s social reputation nationally and internationally.

Academic strategies and programs of NGU

Guided by high-level university strategy and supervised by a motivation management and decentralised system, NGU has created “a platform for international communication and cooperation with distinct levels, diverse types and two-way interaction” (NG4).

1. In terms of students, NGU has Sino-foreign cooperative education programs at the master's degree level with XX University, a top five university in UK, a Confucius Institute in Italy, a master's program for international students from *BRI* region, and a double-degree international program and international courses with credits for domestic students. NGU also offers exchange programs with a very clear hierarchy according to the level and discipline of students in different grades (NG4 and NG5). In addition, they care about students who do not have any opportunities or financial resources to go abroad, and undertake "internationalisation at home" as well as extra-curricular activities to benefit these students (NG4). The above collaborations which covered high-level (masters), national strategies (*BRI*) and programs integrated into local teaching have greatly improved NGU's reputation and total development.
2. In terms of faculty, scientific research and social service, short-term exchange and semester visiting scholar programs for teaching and learning were common (NG2 - NG7). NGU has also set up several international scientific cooperation platforms, for research projects and joint publishing opportunities. In addition, many social service projects have cooperated with foreign teachers and sister institutions (NG4).

5. Discussion

In 2010, China overtook Japan as the world's second-largest economy. In the same year, the *Outline of the National Medium - and Long-Term Programme for Education Reform and Development (2010-2020)* (hereafter: *2010 Outline*) was issued by the MOE in May 2010. The *2010 Outline* stressed the requirement to develop human capital and innovative personnel for national economic growth (MOE, 2010). In addition, the *Vision and Actions on Jointly Building the Silk Road Economic Belt and the 21st Century Maritime Silk Road* (hereafter: *BRI*) (NDRC, 2015) was released in 2015, which guided the direction of internationalisation of HEIs in China to promote extensive cultural and academic exchanges through two-way interaction among students particularly in the *BRI* region.

Under these national and policy contexts, Chinese HEIs have contributed to international talent cultivation and the national *BRI* strategy. NGU is not an exception. Due to its short history and limited resources compared with public universities, as well as some marginalised within the Chinese HE system, self-development and keeping up with public universities have become the principal rationale as well as political rationale such as serving the state and sharing the culture/social aspects that are driven by patriotism and social community. This is quite different from the current trend of internationalisation in most Western countries, where revenue generation has become the primary driving rationale behind internationalisation of HE (Altbach & Knight, 2007; Redden, 2016; Wadhwa & Jha, 2014).

Facing self-development issues, the stress from the public sector and the uncertain national *New Law* for the non-government sector, leaders at NgHEIs, as shown in this case study, have a strong commitment and great expectations for internationalisation. As such, internationalisation is highly regarded as an important strategy to facilitate the distinctive strengths and enhance the quality of institutions. The non-profit orientation, the flexible system and the supported funding from the institution itself, has created a positive policy and cultural atmosphere for leaders, faculty and students to engage in internationalisation, as well enabling NGU to consider other ways to attract government support and social recognition.

NGU had a range of high-level communication and cooperation programs for students and facility that were both domestic and international. Most of the programs were reflected through teaching, researching, social service and cultural heritage. NGU's practice was consistent with Knight's definition of internationalisation as "the process of integrating an international, intercultural, or global dimension into the purpose, functions or delivery of postsecondary education". According to (Wu, 2019), Western experience is relatively limited in practicality. Committed to building a multilateral international cooperation platform (Xiong, 2019) and grounded in local contexts, NGU integrates its development goals and current situation with Western experience, yet is committed to create its own characteristics through transformation and innovation. Thus, it views its' internationalisation strategies as contributing to national and global development through learning and sharing.

However, there are barriers to access internationalisation. The language ability of students and the lack of cutting-edge knowledge and stressful work pace for faculty were the core internal barriers to advancement. Furthermore, inequitable government policies between public and non-government sectors and lower social reputation, for NgHEIs, have a negative impact that attributes lower status and fewer resources of students, faculties and institutions to non-government universities. The external barriers have led to the internal problems which have limited the development of internationalisation in NgHEIs.

6. Conclusion

This case study has provided insights about a Chinese non-government university and demonstrates that Knights' view of internationalisation is useful in considering non-governement universities in China. In the context of China's NgHEIs, internationalisation is positioned as an accelerator for self-development, an important option for public and non-government universities to develop in parallel, a process of two-way interaction, integration, mutual benefits and cultural transmission. An implication of the findings from this case study could be that NgHEIs, the government and the society work together to create an equitable government policy to reduce the internal issues of HEIs, such as subsidising China's NgHEIs to become more internationalised.

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Interaction in spoken academic discourse in an EMI context: the use of questions

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Abstract

Studies on metadiscourse (Hyland 2005) have focussed on engagement as interaction. An example of engagement is asking questions (Hyland 2009: 112) and indeed the importance of questioning for content learning has been researched extensively in pedagogical studies as fundamental in co-constructing meaning (Dafouz Milne & Sanchez Garcia 2013: 130). Research in an English Mediated Instruction (EMI) context found that teachers' usage of questions in the classroom was affected by low levels of language competence and in these cases, strategies such as questioning could easily be underused or even misused, thus affecting the teaching and learning of content (Drljaca Margic & Vodopija-Krstanovic 2018: 32).

Our study examines lecturer questioning at an Italian University by triangulating face-to-face surveys of lecturers, student questionnaires, and transcribed lecture recordings. Findings have practical applications for providing targeted coaching for non-native EMI lecturers with regard to appropriate linguistic strategies to encourage interaction, and also have implications for research into linguistic strategies used within EMI.

Keywords: *Questioning, Spoken Academic Discourse, EMI.*

1. Introduction

Establishing interaction plays a fundamental role in social communication (Hyland 2005; Molino 2018). Studies on metadiscourse in English for Academic Purposes (EAP) in both spoken and written texts have focused on interaction through engagement. One example of engagement in the classroom is asking and answering questions (Hyland 2009), and such patterns of interaction are a powerful resource in scaffolding students' learning (Coffin 2010; Morell 2004). The importance of questioning for content learning has been researched extensively in pedagogical studies as one of the main ways meaning is co-constructed (Dafouz Milne & Sanchez Garcia 2013: 130).

EAP research into questioning has also focussed on lecture discourse (Crawford Camiciottoli 2008; Chang 2011; Dafouz Milne & Sanchez García 2013; Morell 2004). A number of studies have adopted a discourse-analytical perspective to focus on audience-oriented discourse markers versus content-oriented discourse markers. Crawford Camiciottoli (2008) refines these divisions into sub-functions, describing content-oriented discourse markers as either focusing information and/or stimulating thoughts, while audience-oriented markers are used for eliciting response, soliciting agreement or requesting clarification. Audience-oriented markers thus all aim to stimulate some sort of interaction.

Our study focuses on the spoken English of Italian lecturers teaching in English as the Medium of Instruction (EMI) across two macro-disciplines: Physical Sciences (PS) and Social Sciences (SS). In Italy lecturers are not required to have any teaching qualification, nor are obliged to undertake any training in order to perform their teaching activities, even in their first language. Costa and Coleman (2013) found that teaching styles in most Italian universities were based on traditional, monologic lectures: a format generally incompatible with stimulating questioning (Northcott 2001). In addition, many Italian lecturers have weak English language competence (Campagna & Pulcini 2014). It has been suggested that weak English in an EMI context affects teachers' use of questions (Dafouz Milne & Sanchez Garcia 2013), possibly leading to underuse or misuse of certain classroom discourse strategies (Molino 2015), and thus negatively affecting both the teaching and learning of content (e.g. Drljaca Margic & Vodopija-Krstanovic 2018: 32).

In order to collect data to identify issues and attitudes towards EMI so that teaching support could be provided, we interviewed lecturers teaching on Bologna University's international degree courses. The students attending these courses were also asked to complete an online questionnaire. Our aim was to find out 1) whether questions are used in EMI lectures, and if so, 2) what sort of questions, as well as what 3) lecturers and students say about the use of questions in their lectures. We also wanted to know whether findings varied according to the macro-disciplinary area.

Below we compare the frequency and function of questioning across SS and PS lectures and compare this with both lecturers' and students' perceptions. In this way our aim is also to triangulate findings between what lecturers and students say takes place in the lecture, and the lecture itself. Our hypothesis was that, given the lecturers' general lack of training and weak English language competence, there would be little room for questioning. We also expected to find issues impeding the correct use of questions, such as non-standard pronunciation, intonation and syntax. Considering the predominant monologic lecture style in Italy, we would also expect questions to be content-oriented rather than audience-oriented.

2. Methodology

2.1. Lecturer survey

18 PS and 22 SS lecturers from Masters' degree courses were interviewed. Participants were asked, in Italian, what interactive teaching techniques they used. Typical questions were:

- *How satisfied are you with the level of interaction in your EMI lecture?*
- *Do you do anything to promote interaction in the classroom? If so, what?*

Lecturers were also asked about their teaching experience and training, their teaching style and classroom practice, and the number of non-Italian students attending their classes.

2.2. Student questionnaire

Students were asked to complete an anonymous online questionnaire. 23 students participated. Questions included:

- *How satisfied are you with the level of interaction in EMI lectures?*
- *Does the lecturer usually ask questions?*
- *Is it easier for you to learn if the teacher asks questions?*

2.3. Lecture recordings

Data concerning the lecture recordings is shown in Table 1. After transcription, questions were identified and divided into audience- or content-oriented.

Table 1. Details of lecture recordings.

	Lectures	Lecturers	Time	Words
Physical Sciences	8	7	9 hours	52784
Social Sciences	3	3	7 hours	22567

3. Findings

3.1. Lecturer surveys

The average class size for both SS and PS lecturers was 25-50 students. Such numbers would be ideal for the use of interactive strategies (Crawford Camiciottoli, 2007; Lee & Subtirelu, 2015).

Over 50% of the students in most PS classes were non-Italians, while over half of the SS classes surveyed had up to 50% or fewer internationals.

The majority (75%) of lecturers had followed no course in teaching in English, but had had more than five years' experience teaching in English.

Nearly all lecturers claim to make use of the monologic lecture style, though just over 50% also use the workshop/seminar style. In the case of the monologic lecture, we thus assume that little face-to-face interaction would take place in class, although 70% of lecturers also claim to set up group and/or pairwork activities at some time during the lecture. Peer teaching in the form of short class presentations was also mentioned. SS lecturers also mention the discussion of case studies as collaborative exercises.

3.2. Student questionnaires

Both students and lecturers share the same perceptions about classroom interaction, as regards teaching style, with most students confirming that the traditional teacher-fronted style predominated. However, while lecturers referred to questioning as their main technique to encourage interaction, asking questions to elicit response from their students, the students mentioned other classroom activities such as collaborative group discussion. A few also noted comprehension check questions (*Ok? Does everybody understand?)* as an interactive technique.

Students confirmed that lecturers asked questions in class. Some PS students showed they were aware of the rationale behind this, mentioning that lecturers' questioning encourages students' conceptual understanding. Most students said they answered lecturers' questions, and even asked questions themselves.

3.3. The transcripts

Over 80% of PS lecturers' 'questions' were found to be progression markers such as *ok, right?* and *no?*, while in SS lectures, progression markers made up just 25% of all 'questions'. Crawford Camiciottoli (2008) disregards progression markers considering them not real questions, since "lecturers do not really engage with students or wait for their reaction" (2008: 1221). We also discounted progression markers as questions since they do not stimulate interaction. SS lecturers asked more questions (5.8 per 1000 words) than PS lecturers (3.5 per 1000 words). However, there was also much variation among the individual lecturers. One PS lecturer used 8 questions per 1000 words, for example, while at the other end of the scale, two PS lecturers asked <1 question per 1000 words. Instead, the SS lecturer who most frequently asked questions used 15 per 1000 words, while the other two SS lecturers asked <3 questions per 1000 words.

If we consider individual lecturers' contributions, the highest question frequency was in SS, while the lowest frequencies were in PS. However, four PS lecturers used questions with greater frequency than the remaining two SS lecturers. These findings suggest that any interpretation of the results pertaining to question frequency and discipline should be done carefully. Table 2 shows the breakdown of the total questions considered, and the division into audience- or content-oriented.

Table 2. Questions in lecture transcripts.

	SS	**PS**
Questions (minus prog. markers)	109	128
Questions /1000 words	5.8	3.5
Audience-oriented	101 (93%)	84 (66%)
Content-oriented	8 (7%)	44 (33%)

Audience-oriented markers – actual questions that the students might answer – were found to make up 93% of SS lecturer questions compared to 66% in PS lectures. Content-oriented questions to make the audience focus, mainly followed immediately by the lecturer's answer, were much more typical of PS lectures (33% of questions).

A higher proportion of content-oriented questions would better help students to focus individually on the dense material which is the subject of the lecture, but this would be to the detriment of the level of interaction in the classroom.

4. Discussion

4.1. Questioning in the two disciplines

While Chang (2011) noted that questions for classroom management, such as audience-oriented questions, tend to be more frequent in SS classes, due to their more "persuasive and dialogic nature", in our study lecturers from both disciplines actually asked this type of question. However, there is much variation among lecturers of both disciplines, thus suggesting that individual attitudes and experience may contrast the 'nature' or culture of disciplinary knowledge.

4.2. Perception of degree of interaction

Both lecturers and students are aware of the current degree of interaction in their classroom and some of the strategies used to encourage it. However, for some lecturers, the lecture setting is mainly conceived as a transfer of knowledge, less dialogic and more controlling, and therefore interaction becomes unnecessary.

Although only 30% of PS and SS lecturers reported interaction in their classroom to be 'high' or 'very high', most were satisfied with the current level of interaction. They perceived three main constraints to promoting a higher level of interaction: 1) time constraints: more time dedicated to interaction would prevent them completing the course syllabus; 2) class size: the higher the number of students, the more difficult it is to engage them actively; and 3) cultural differences between international and Italian students.

Unlike their PS colleagues, SS lecturers also mentioned strategies other than questioning as their main interactive strategies, such as collaborative case studies and group discussions. Additionally, SS lecturers mentioned the active role played by international students, which led lecturers to adapt their teaching style appropriately.

4.3. Influence of English language competence

Lecturers also reported a lack of confidence in their own pronunciation and speaking ability in general. Indeed, as Molino (2015) also found, progression markers such as *ok? mm eh?* occurred 4 times more frequently in Italian EMI lecturers' speech than in native speakers' lectures. This could be due to lack of confidence in their own language competence during the elaboration of complicated content material, together with a greater perceived need to make sure the students understand. This might suggest the massive use of audience-oriented

questions is not so much to promote interaction *per se* but just as a request for clarification. The use of more content–oriented questions among PS lecturers could be due to the type of material being taught, information-heavy and with little room for discussion. However, such lecturers also need to be able to actively stimulate student interaction, particularly in order to cater for international students and foster learning.

4.4. Framing the questions

Questions need to be asked effectively. Typical strategies of Italian speakers include using intonation and gestures to indicate questions, as well as adopting Italian syntax. These strategies could lead to misunderstanding. However, the transcripts also contained examples of good practice, such as the use of metalanguage to signal intentions: '*I'm going to ask you a question*'.

4.5. Students' experience with questions

While all students claimed they answered lecturers' questions and even asked questions themselves, most students, particularly from PS, admitted they preferred asking questions at the end of the class. This represents a missed opportunity for other students to benefit from hearing the answers. As the transcripts showed, there were fewer audience-oriented questions in PS lectures, and thus PS students were given fewer opportunities to intervene by the lecturer. Only the more confident students therefore would venture to interrupt the lecturer.

5. Conclusion

Our original hypothesis was that, given the general lack of teacher training, weak English language competence, and prevalence of monologic lecture style in Italy in general, there would be little room for questioning. Instead, all lecturers mentioned their use of questioning to promote interaction in their classes. The transcripts however showed a discrepancy between their perceptions and what actually happened.

SS lecturers tended to adapt their teaching practices in favour of a more interactive classroom environment, also depending on the presence of international students. Instead PS lecturers mentioned cultural issues which prevented them from achieving a higher level of engagement in their classes.

We found some adaptation of the teaching style in general, with an increase in audience-oriented questions, though there was a much higher proportion of content-oriented questions in PS lectures than in SS lectures.

The presence of non-standard question formulation and the reliance on 'questioning intonation' was evident, though signalling metadiscourse was occasionally found in the transcripts.

Our lecturer sample however was small and further research is required to seek out less experienced lecturers and add to the corpus of lecture transcripts.

Adequate training is essential in order to raise awareness in lecturers about how their language choices ultimately encourage or discourage interaction and thus learning (Costa 2016). A fine example illustrating this is the common lecture-final "Any questions? No questions", which on no occasion produced any response.

Pedagogical training has been described as more necessary than language training (Klaassen 2001). In addition, the acquisition of interpersonal competence in communicative multicultural settings in English is fundamental.

Practical applications for providing targeted coaching for non-native speaker EMI lecturers with regard to appropriate linguistic strategies could include peer reviewing and commentary on other lectures, with particular focus on questioning; raising awareness as to which questions are answered by students, with subsequent discussion as to why this might be; inviting lecturers to review their own recordings and commenting on and improving their own use of questions, to promote interaction; as well as exercises involving rephrasing questions.

EAP teachers need to better understand the discourse preferences of university instructors and the interactive features used in content courses (Lee & Subtirelu 2015: 61) and likewise "university faculty may also benefit from understanding the ways in which experienced EAP instructors seek to make academic discourse accessible" (ibid.). While their conclusions refer to metadiscourse in general, this certainly applies to strategic and appropriate use of questioning in the classroom.

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Developing Effective Instructional Skills: The Master Educator Program at SUNY Buffalo State

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Abstract

With higher education facing budget cuts and declining enrollment, instructor effectiveness continues to be crucial, particularly in a state of increasing workloads with restricted resources. However, the dilemma of how to develop effective instructional skills while still maintaining a research agenda stems from a larger contradiction within professional disciplines; teaching is essential to the profession but holds a devalued position compared to research. It is not enough for an educator to recognize that teaching and research are mutually reinforcing, universities must also recognize and support this reality. Understanding that we must learn to be good instructors, even as teaching is devalued, led our School of Professions (SOP) to reflect on how we can develop strategies for becoming effective educators while still fulfilling our research (and service) agenda. With the Master Educator (MEP) program, our school is developing internal talent via instructional coaching between our School of Education (SOE) and our School of Professions. Research indicates that traditional forms of professional development are not effective. In turn, research on instructional coaching in K-12 setting has indicated a much higher implementation rate than traditional approaches to professional development; however, to our knowledge, there have been no attempts at implementing instructional coaching at the university level. The MEP is the first program to implement this practice at the university level.

Keywords:*; Business; Education; Instructional Coaching; Mentoring.*

1. Introduction

Current conditions in the United States indicate continued higher education budget cuts in many states, and thus, teacher effectiveness continues to be crucial in a realm of potentially increased workloads with constrained resources (Roach, 2014). Much of the research involving quality of teaching in post-secondary business is based on student perceptions, with scarce literature covering teachers' formal training to teach, much less their perception of their own skills and abilities in the classroom.

Skinner (1956) stated that college teaching is the only profession for which there is no professional training. University Ph.D. programs in the United States emphasize content and research-related skills, while teaching skills are what are immediately put into practice. Recent literature has seen an increase in the area of teaching the teacher how to teach. Walstad and Becker (2003) stated that "Teaching a course or leading a recitation section is an important instructional duty that, if not handled well, can hurt a department by increasing student complaints, decreasing majors, and negatively affecting employment." Marx et al. (2016) suggested that the the world's largest business accreditation agency, the Association to Advance Collegiate Schools of Business (AACSB) International, cultivate teaching accountability standards of business doctoral programs. There are other academics that believe a more restrained approach to accreditation standards is warranted (Lewicki & Bailey, 2016). Regardless, SUNY Buffalo State has seen the need to improve teacher performance in the classroom as an effectiveness and student retention effort. Since accreditation changes are not imminent, the change must be at a personal, and eventually college-wide, level.

Academia creates a tension which sociologist Jodi O'Brien (2006) called "schizophrenic state of academe." Colleges and universities stress the importance of one third teaching, one third scholarship, and one third service, when, in reality, faculty members know that research is the primary area of responsibility, especially when striving for tenure and promotion. Irby (2013) stated that becoming effective teachers does not distract from scholarship. Instead, it enhances scholarship by enabling researchers to use appropriate terms and examples needed communicate clearly and effectively. While teaching and scholarship should be mutually reinforcing, junior faculty especially internalize that publications and grants are the accomplishments that are highlighted in reaching tenure and promotion.

2. Master Educator Program (MEP) at SUNY Buffalo State

2.1. Purpose of Study

Examples of teacher training are emerging. The faculty of the School of Agriculture of the Pennsylvania State College enacted a project called "Teaching College Professors to Teach" in which ten lessons were given during a one-week program by Dr. William Kilpatrick of Teachers College, Columbia University. In addition, LEGO Education has a U.S. Education Masters Educators program, in which early learning and high school educators use LEGO solutions to enable success of students via hands-on learning experiences (Powers, 2019). At SUNY Buffalo State, the Master Educator Program (MEP) was developed and commenced in September 2018, with the first cohort at the end of its two-year term. The mission of the program is as stated, "By enlisting Master Educators as agents of change, our ultimate goal is to organically grow an extraordinary culture within the School of Professions for both faculty and students" and the vision is "To provide every School of Professions major with a transformative educational experience that inculcates and inoculates them with 21st century skills." In short, the program aims to future-proof every student. The School of Professions hopes to eventually achieve national acclaim for educational practices that successfully close the gap between 21st century workplace demands and a 21st century education.

The program was developed as an action step out the most recent strategic plan. A cohort of six professors was chosen amongst the elite teachers within the School of Professions. Each of these professors was paired with an instructional coach from the School of Education. In year one, the cohort and the coaches attended monthly training modules including: foundation setting, emotional intelligence, high-leverage practices, high-impact practices, classroom management, 21st century skills, understanding today's students, creative thinking, and utilizing technology. Coaching sessions between each coach and mentee were established based on an individual basis and need. Summary of the modules included: 1) techniques for understanding our current generation of students, and how they learn and apply knowledge, 2) the skills that employers are seeking in students and ways to bridge that gap, ensuring students are exiting university with a skill set that makes them employable and successful in the current work force, and 3) incorporating the content from the previous areas into our courses in an effective manner that engages students and facilitates learning. In year one, each cohort member was responsible for implementing, at a minimum, one educational approach into one class. The level and degree of implementation varied across cohort members. An example of a course implementation plan for year one can be seen in Appendix A.

Year two of the program continued to add training, while focusing on readying the cohort to transition from mentee to mentor in year three. Year two modules included: teaching

practices, mentoring, classroom management, distance learning and related technology (amid the Covid19 pandemic), leadership practices, and, finally, a closeout celebration. Experts in each of the content areas acted as instructors and facilitators. The cohort used the class sessions to practice skills, which were then applied outside of the classroom. An array of techniques was applied within their courses. Learnings from the applications were shared amongst the cohort and with the university and leadership board. Cohort two recruitment is now in process and will cross all schools within the university.

Coaching may have different degrees of formality and structure. Facilitative coaches see coachees as equals who make most, if not all, decisions during coaching. Directive coaches are the opposite, and strive to transfer knowledge to the coachee. The dialogical coach uses a balance of advocacy and inquiry. They ask insightful questions while imparting their knowledge. This coaching style has been found to be an effective model between our colleagues. By creating a model in which designated space and times were established for coaches and coaches to come together to solve problems and to share teaching experiences, we are creating a culture that recognizes the importance of teaching and support networks. The formal peer mentorships provide the School of Professions faculty with accessible resources for teaching-related questions, modeling, and techniques. To our knowledge, no other post-secondary institutions have adopted a model of teacher training that includes a peer-to-peer coaching model.

2.2. Methodology

As an initial study, final grades, both in whole and by grading category, were captured before and after implementation of educational strategies ($k = 2$). The sample size (n) per group ranged from 38 to 77. Use of ANOVA is appropriate if $n - k > 0$. In addition, the number of A's through F's given per semester were also captured. Grades were analyzed using Analysis of Variance (ANOVA) techniques, comparing each of the graded means of sections before and after implementation. However, the ANOVA does not tell you where the difference lies, thus a t-test was conducted to test each pair of means.

2.3. Results

Based on the ANOVA results in table 1, the null hypothesis can be rejected at the 5% level, and we can conclude that the means are not all equal, indicating that there was a difference between the means of the three semesters of data captured.

Table 1. ANOVA Results

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	30495.47	7	4356.49	204.29	1.95E-14	2.66
Within Groups	341.19	16	21.32			
Total	30836.66	23				

Source: Mathien (2020)

The t-tests were used to test the null hypothesis that the means of two populations are equal. T-tests were conducted across all pairs of means, and found to be insignificant at the 5% level for all pairs; therefore, we fail to reject the null hypotheses that the means are equal for all pairings. When testing the last two semesters, when the most changes were implemented, at the 10% level, the results were found to be partially significant, thus we are unable to conclusively reject or fail to reject the null hypothesis at this level. The results from this test can be seen in table 2.

Essentially, an ANOVA provides a statistical test to determine if the means of several groups are all equal and, as a result, generalizes t-test to more than two groups. The t-test is used when determining whether two averages or means are the same or different. An ANOVA can be more useful than a two-sample t-test as it has a lesser chance of committing a type I error. The ANOVA is preferred when comparing three or more averages or means. A t-test has more odds of committing an error the more means are used, which is why ANOVA is used when comparing two or more means.

While the results are inconclusive and do not support statistical changes in the overall averages between semesters, when looking at the ANOVA results or when looking at the raw data, means in all areas are improved after implementation of MEP techniques. The final semester is also the first semester is which no students failed the course. Student qualitative feedback was also consistent with improvement satisfaction of the course.

3. Conclusion and Recommendations

Learning to be an effective educator is an ongoing process. The academic model that doctoral students encounter in their Ph.D. programs is limited, and the students that they ultimately teach are typically quite different than the students in their program. Many new faculty assume they will be teaching dedicated, academically-oriented students, and are often surprised to find students who have trouble with writing papers and reading, and many who have little enthusiasm for learning. It is important for educators to develop strategies for engaging 21st century students.

Table 2. T-Test Results

Compare Means (Spring 2019 to Fall 2019)						
Descriptive Statistics						
VAR	N	Mean	Std Dev	Var	Min	Max
Final Grades Spring 2019	77	81.98	16.99	288.85	0	98
Final Grades Fall 2019	38	87.47	16.44	270.29	0	98.15
t-test assuming unequal variances (heteroscedastic)						
Hypothesized Mean Difference	0					
Mean Difference	-5.48					
Variance (Welch-Satterthwaite)	282.77					
Test Statistic	1.66					
Degrees of Freedom	76					
H1: Mu1 - Mu2 ≠ 0 / Not equal (two-tailed)						
t Critical Value (10%)	1.66	p-value	0.10	H1 (10%)	Rejected	
H1: Mu1 - Mu2 < 0 / Less than (lower-tailed)						
t Critical Value (10%)	-1.29	p-value	0.94	H1 (10%)	Rejected	
H1: Mu1 - Mu2 > 0 / Greater than (upper-tailed)						
t Critical Value (10%)	1.29	p-value	0.05	H1 (10%)	Accepted	

Source: Mathien (2020)

Developing institutional support for preparing faculty to teach is an important step for both teaching effectiveness and student retention. The MEP is a move to improving student education, creating students that are better prepared to enter the workforce, and faculty members that are supported in their balance of the three pillars of teaching, service, and scholarship.

This study is an initial look at the implementation of educational techniques learned within the MEP across three semesters. Data will continue to be tracked, and future research will also include control variables for overall student GPAs to account for lower admission standards due to decreased enrollment numbers.

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Appendix A: Sample Course Implementation Plan (Operations Management)

Module	Topics	Blackboard	Pre Assess	Post Assess	Class Act	Semester	Evidence-Based Practices
	OM	OER Text	Prep Guide	Ticket out		Team project	**3 Jars - beginning of every class**
	Value Chain	OER Links	(CT, C, CTM, CM)	Quiz		(CT, C, CTM, L)	#1 - What - On time 5/5, 4/5, and 3/5;IP comp 5/5, 4/5
	Perf	Lecture		HW			#2 - Each student - index card: Name & Photo side A,
OM Overview		Prep Guide					Side 2 - Q's: 1) when do you feel listened to?
	Comp Adv	OER Text	Prep Guide	Ticket out	Porter's 5 Forces		2) When do you feel cared for? 3) When do you
	Comp Priorities	OER Links	(CT, C, CTM, CM)	Quiz	PEST, CA		laugh at school? 4) When do you get to be a leader?
	Strat Planning	Lecture			Value Chain		5) When do you feel most safe? Unsafe?
OM Strategy		Prep Guide			(CT, C, CTM, GM)		#3 - Brainstorm and dot vote first class
	Mfg	OER Text	Prep Guide	Ticket out			
	Service	OER Links	(CT, C, CTM, CM)	Quiz			**Interteaching - beginning of each module**
Product/ Service Design		Lecture Prep Guide					Interteach prep guide complete based on readings and lecture prior to class.
	Prod/Proc Matrix	OER Text	Prep Guide	Ticket out			Discussion with student in different colored ink
	Svc/Position Matrix	OER Links	(CT, C, CTM, CM)	Quiz			Randomly collect as part of class participation grade
Process Selection	Process Design Process Analysis	Lecture Prep Guide					**Ticket - end of every class**
	Facility Layout	OER Text	Prep Guide	Ticket out	Worked expl		Part of class participation "Muddy Point" or "One-Minute Evals"
	Product Layout	OER Links	(CT, C, CTM, CM)	Quiz	Goldratt Game		
Facilty Design	Workplace Design	Lecture Prep Guide		HW	(CT, C, CTM, AA, L)		Forms provided and collected
	Quality	OER Text	Prep Guide	Ticket out	Red bead exp.		
	Six Sigma	OER Links	(CT, C, CTM, CM)	Quiz	(CT,C,CTM,AA,L)		**Potential other options:**
	Other Strategies	Lecture		HW			Think or Write/Pair/Share
	SPC/Control Charts	Prep Guide					Kahoot
Quality Mgmt	Process Capability						Partnering techniques - i.e clock partners
	SCM	OER Text	Prep Guide	Ticket out	Designing a SC		
	Effic/Respon SC	OER Links	(CT, C, CTM, CM)	Quiz	(CT, C, AA)		**21st Century Skills (SOP Majors):**
	Push/Pull	Lecture					CT - Creative thinking, critical thinking, problem solve
SCM	SC Perf	Prep Guide					C - Communication
	Lean	OER Text	Prep Guide	Ticket out	Paper airplanes		CTM - Collab & teamwork
	Lean Six Sigma	OER Links	(CT, C, CTM, CM)	Quiz	(CT, C, CTM, AA)		GM - Adopting global mindset (model, embrace, reflect)
	JIT	Lecture					AA - Agility & adaptability
JIT & Lean		Prep Guide					L - Leadership
	Capacity	OER Text	Prep Guide	Ticket out	Worked expl		
	Long-term	OER Links	(CT, C, CTM, CM)	Quiz	(CT, AA)		
	Short-term	Lecture		HW			
Capacity	Theory of Constraints	Prep Guide					
	Intro Forecasting	OER Text	Prep Guide	Ticket out	Worked expl		
	Fcst Models	OER Links	(CT, C, CTM, CM)	Quiz	BOM game		
Demand Planning		Lecture Prep Guide		HW	(CT,C,CTM,AA,L)		
	Decisions/Costs	OER Text	Prep Guide	Ticket out	Worked expl		
	Characteristics	OER Links	(CT, C, CTM, CM)	Quiz	Distribution game		
	ABC	Lecture		HW	(CT,C,CTM,AA,L)		
	FOQ/EOQ	Prep Guide					
Inventory	FPO						
	Resource Planning	OER Text	Prep Guide	Ticket out	Worked expl		
	Aggregate Planning	OER Links	(CT, C, CTM, CM)	Quiz	(CT, AA)		
Resource Mgmt	Disaggregation Capacity Req Plan	Lecture Prep Guide		HW			
	Scheduling	OER Text	Prep Guide	Ticket out	Worked expl		
	Sequencing	OER Links	(CT, C, CTM, CM)	Quiz	(CT, AA)		
Ops Scheduling	Monitor and Control	Lecture Prep Guide		HW			

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Preliminary study on the awareness of the SDGs in future primary school teachers

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Abstract

This preliminary study has been carried out with the objective of knowing the sensitivity and implication of future primary school teachers regarding the 17 Sustainable Development Goals. The questionnaire used was translated from the work of Niklas Gericke et al. (2018), some questions elaborated on the basis of UNESCO's definition of sustainable development, aimed at knowing the awareness that people show towards sustainability. In the proposal of these authors, knowledge, attitudes and environmental, social and economic behavior were measured. In our study, whose representative sample has been 3rd grade students in primary school teacher, of the Jaume I University, the same parameters have been used. The results we found were positive to the extent that we showed that the sample has an acceptable knowledge, as well as an implication and responsibility on the subject. As conclusions, we can highlight the need to include the subject in teacher training, with the aim of improving, not only awareness and responsibility in the climatic situation, but also in people's quality of life, the use of Material resources in addition to promoting educational, social and personal values, as a way of prevention and positive actions connected with the 17 SDGs. Music should be highlighted as an important factor in the training and awareness of future teachers.

Keywords: *SDG1; university2; sustainable development3; teaching4; music5.*

1. Introduction

Our proposal places music education as a possible tool to implement the Sustainable Development Goals (SDGs) in primary school. However, the first step we take is the teacher training of the future primary school teacher. In our view, SDG number 4, referring to Education, is the basis for the achievement of the rest of the SDGs, understanding that poverty and hunger are fundamental, and education will be the tool that will provide empowerment and employability.

2. Theorical framework

The role that music plays in teacher training, we consider to be crucial, especially from the teaching of musical expression. In addition to being part of the culture of the people, certain investigations, as Moreno Fernández (2018) explains, have been directed to investigate the connections between culture, sustainability, social and economic development. This author points out that there are more and more festivals and events for social promotion and sustainable development. In Sanfeliu's opinion (2010 in Moreno Fernández, 2018), research on climate change from musical responses should be taken into account, highlighting musical and environmental activism, both in urban and traditional music and in classical music

A proof is found in the Ecoarte project, which links the scientific field with art. In this sense, Sanfeliu (2010) explains that, in order to fight against environmental problems, it is necessary, in addition to science, creativity that brings the future assumptions of the planet's situation closer to the imagination, therefore, the Arts can contribute to the Improvement of the overall quality of life.

Another example is found in the quality of life and sustainability, such as the orchestra of recycled instruments, which in addition to including social and educational inclusion, art and culture, raise awareness of the responsibility in the use of materials and their recycling, joining together music and sustainability. As Gómez (2016) explains, orchestra composed of children and young people with a complicated situation of risk of social exclusion has been able to improve their situation thanks to Favio Chávez, its director. With the motto The world sends us garbage and we return music, they have been able to give a clear example of how SDGs and music can unite their potential.

As Gutiérrez Martínez (2016) explains, sound can affect the therapeutic level, changing aspects that affect the physical, mental or spiritual realm, providing an improvement in the state of well-being. But, in addition, the musical activities that require a group, provide the acquisition of values such as participation, cooperation, respect, empathy, companionship or synergy. This means empowering people to acquire resilience, turning music into a tool that facilitates resilience, through sound and to overcome adversities. In this line, R. Williams,

emphasizes that hegemony is achieved when the dominant culture uses education, philosophy, religion, advertising and art, thus allowing the heterogeneous groups that form society to be included in a natural way (Miller, T. and Yudice, G., 2004).

Taking the principles of UNESCO (2012) on sustainable development, we rely on culture as an underlying dimension to the three pillars on which sustainability is based: environment, society and economy.

Areas of the school that contribute to teaching and learning about sustainability, according to the UNESCO document (2012), would be:2.1. Example of Subsection

Documents should have no more than three levels of headings, which will be numbered with Arabic numerals starting at 1. The title of the paper should be printed in Times New Romab 13pt bold. The heading of each section should be printed in Times New Roman 11pt bold. The heading of each subsection should be printed in Times New Roman 10pt italics.

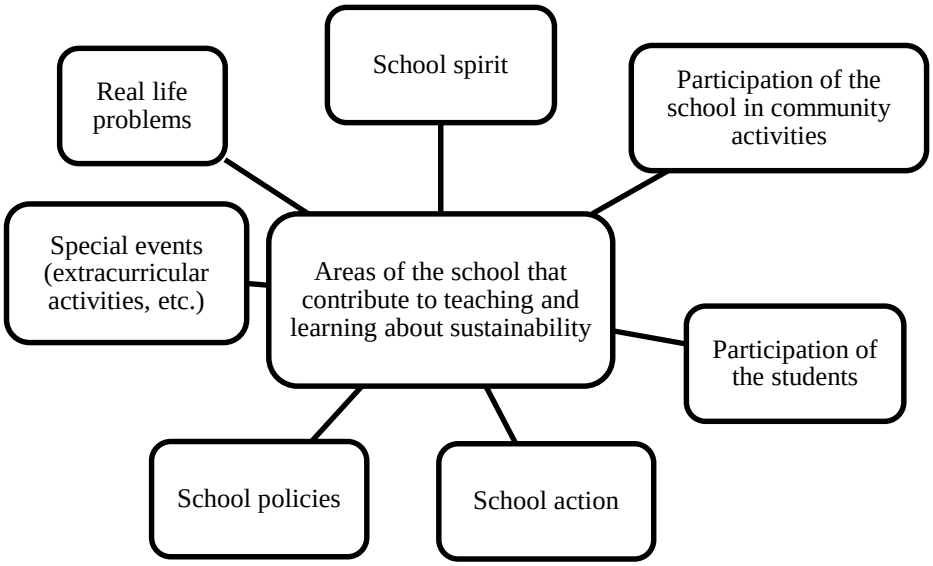

Figure 1. Areas of the school that contribute to teaching and learning about sustainability, according to the UNESCO document (2012)

3. Methonolgyc framework

The questionnaire used was translated from the work of Niklas Gericke et al. (2018), some questions elaborated on the basis of UNESCO's definition of sustainable development, aimed at knowing people's awareness of sustainability. In the proposal of these authors, knowledge, attitudes and environmental, social and economic behavior were measured. In our study,

whose representative sample has been 3rd grade students in primary school teacher, of the Jaume I University, the same parameters have been used.

The resulting sample n33 was randomly selected, from a total of more than 80 third grade students in primary school teacher. The students had access to googleform, translated and adapted by the research team. Participation was voluntary and anonymous. I do not know gave any previous information to the participants, regarding the importance of the 17 Sustainable Development Goals (SDGs).

3.1. Analysis of the results

Although for the most part, the student body has an awareness that you could qualify as normal, considering that this normality would be a concern for sustainability and the environment, we detected some issues. Controversial, for example, in the concern about natural disasters or quality of life. Also in the exercise of democratic rights or infectious diseases, which do not consider a connection with sustainability. On the other hand, we highlight the economic understanding, as relevant in 57% and the eradication of poverty with approximately 46%, although when it comes to attitudes, they do consider reducing poverty by 85%.

Addressing the actions, it is remarkable the consideration, in 76%, of the usefulness of natural resources, as well as the need for stricter laws in this regard. 97% believe it is important to take action against climate change. Releasing the use of water. Regarding knowledge on these issues, 94% consider it necessary, and in this same percentage the need to have the same opportunities is recognized, both for men and women. On the other hand, they only consider in 22% very important that those who pollute more, also contribute more, economically.

As for behaviors, only 42% consider it very important to use vehicles that do not contaminate. They also acknowledge not making good use of water, nor are they aware of garbage in spaces other than their own, they do not reflect on their behavior regarding the environment, by 37%. However, the lifestyle has been changed, with respect to waste reduction. Another important aspect is the awareness of the behaviors related to health, almost 9% consider it relevant. Also the behavior towards other people who live in poverty, is only very important in 17%.

Both the option of second-hand purchases and avoiding purchases in stores or brands with a bad reputation, is an option that is considered, not with a high percentage, but if it is taken into account. Based on the results, we consider, on the one hand, to modify the questionnaire and validate it, to adapt to the reality of the 17 SDGs and the information that needs to be known, both by the student body and the teaching staff. On the other hand, the training and awareness of the SDGs is considered necessary, in order to be reflective and to be able to

reach the implementation in the teaching guides and in the study programs, of the importance in knowledge and behavior.

Below, we can see some of the 44 figures that are part of the results:

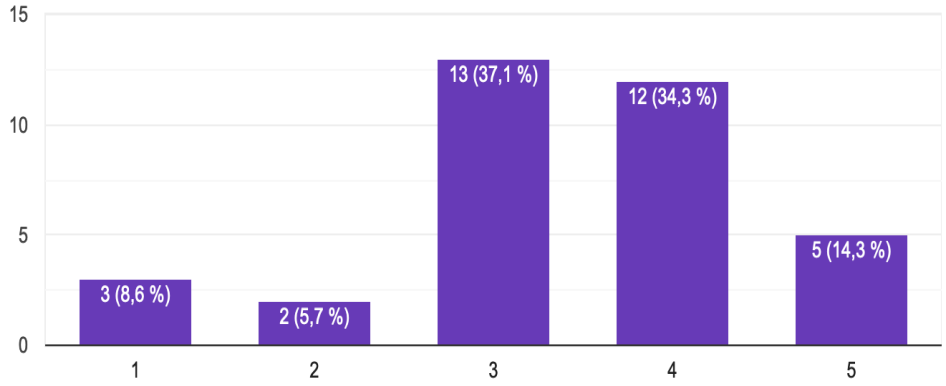

Figure 2. Relationship of sustainable development with natural disasters

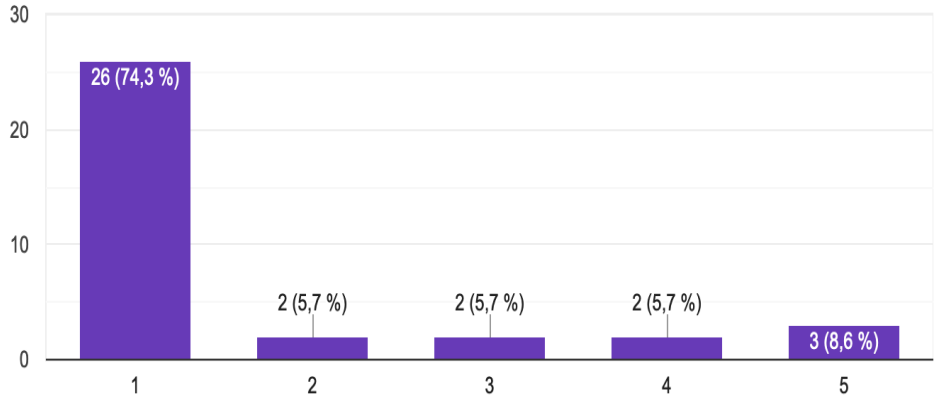

Figure 3. Untilization of natural resources for health and well-being

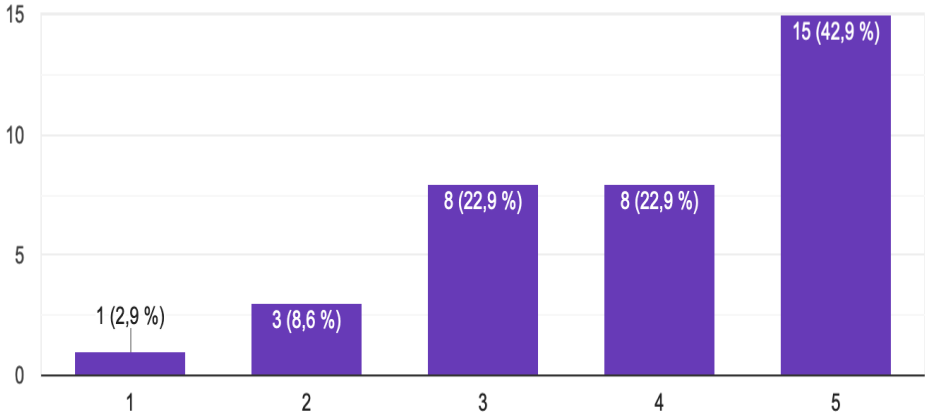

Figure 4. Use of non-polluting vehicles

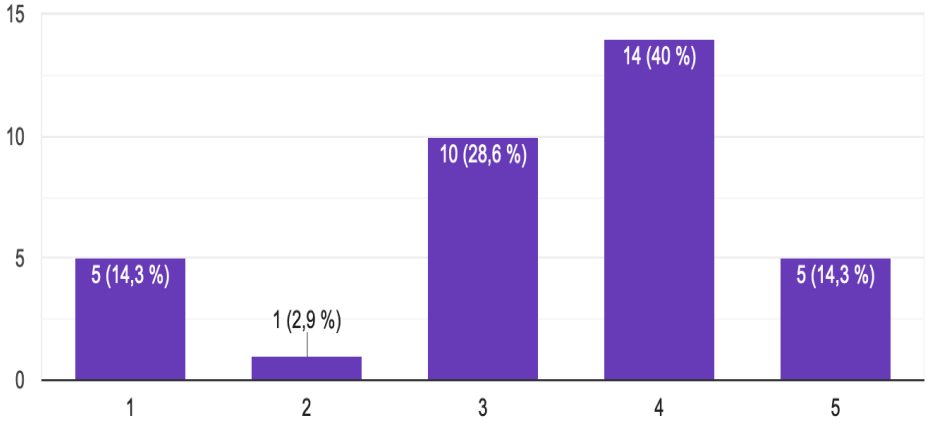

Figure 5. Garbage collection

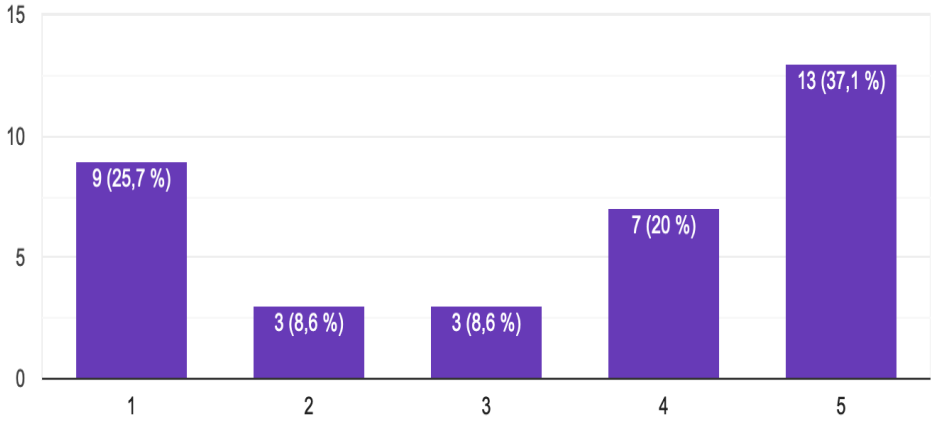

Figure 6. collaboration with humanitarian organizations and the environment

4. Conclusion

In conclusion, we can say that education, in our view, is the perfect tool to raise public awareness about responsibility for the accomplishment of the SDGs. Music, meanwhile, can be the main thread and connecting element for the education and training of future primary school teachers. The need for quality training includes creativity, critical spirit and the promotion of cultural manifestations that can be approached by teachers and students from music education. In addition, music drives responsible education, generates new behavior habits and recovers values of commitment and solidarity.

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Information skills and library knowledge for higher education teachers

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Abstract

The explosion of information, not only in print, but in a digital context has become a fertile area for exploring, transmitting, and disseminating information, enabling learning and teaching, transforming and creating new knowledge. Higher education teachers need to be aware of how to train and guide their students in multiple ways to knowledge, including the ability to deal with information in print and digital contexts, so information literacy training should be a priority. This paper aims to list the skills to be developed by these teachers, preferably integrated into their professional development. Starting from the framework of tried-and-tested models, a flexible and comprehensive content structure is proposed, considering the need for their transfer to students. The importance of collaborative work with higher education libraries is stressed.

Keywords: *Higher education; Teaching skills; Information Literacy; Information Skills; Academic libraries.*

1. Introduction

On November 11, 1997, UNESCO issued the Recommendation concerning the status of higher education teaching personnel (UNESCO, 1997) which addressed the main definitions and concepts of the area, guiding principles, objectives and educational policies that should frame it. This recognized that advances in higher education are based on the qualifications and knowledge of higher education teachers, as well as their human, pedagogical and technical qualities, supported by academic freedom, professional responsibility, collegiality, and institutional autonomy. In Portugal, the Portuguese Education System's Basic Law establishes three areas: research, the understanding of the world and the dissemination of culture and the training of professionals (Esteves, 2011). These three areas have been competing for the attention and interest of teachers, in a somewhat contradictory or even competitive way. Higher education teachers' education emerges under various organizational modalities around the globe: postgraduate training, whether or not integrated into basic training, optional or compulsory training, more focused on pedagogical aspects or distributed over different themes (Aramburuzabala, Hernández-Cesario, Castilla, Angel-Uribe, 2013; Ó, Almeida, Viana, Sanches, Paz, 2019). Zabalza (2007) addressed the importance of competences in higher education teacher, synthetically organized around knowledge (disciplinary contents to be taught and related teaching-learning processes), specific skills (communication, didactics, assessment) and teachers' attitudes as trainers (availability, empathy, intellectual rigor, professional ethics, among others). More recently Rivilla, Cabezas, Navío, and Domínguez (2019) list some of the skills required of university teachers, and highlight planning, communication, digital / media design, assessment, innovation, and research. They detailed that continuous updating is fundamental, namely in the research processes that involve the updated knowledge of bibliography and the reading and consultation of scientific articles. In the wake of these goals, Peres, Miranda, Simeão (2015, p. 219) highlighted the importance of preparing students and teachers for "access, creative use of information in various media, promoting the strategic use of basic knowledge in academic tasks". Silva and Farias (2019) also focus on the competences to be developed by higher education teachers: in the supervision chapter it is urgent to master a series of competences to provide effective support to their students, namely "bibliographic search, readings, debates, collection of data, written production, seminar presentations, etc.", that require the mobilization of "a set of knowledge, skills, and attitudes related to an effective interaction with information that makes it possible to solve problems and make decisions", sustaining information skills (Silva & Farias, 2019, p. 52). Analyzing the perspective of the advisors regarding the informational skills needed to carry on the research work, they conclude that the advisors consider as fundamental in the research process those concerning the "recognition of information sources that make it easier to search, besides the correct use information" (Silva & Farias, 2019, p. 65).

2. Aligning information literacy with teaching and learning

Student-centered learning requires the use of learning resources based on print, digital and multimedia information. Digital libraries, databases, and repositories facilitate the reuse of research content, providing access to a variety of sources and enhancing the formation of critical thinking and the creation of more complex ideas while encouraging students to use resources, and reinterpret them (McGill, 2017). To develop all these skills, information literacy is used, a theoretical-practical construct that involves the skills to handle information appropriately and meaningfully, particularly within the academic context. The concept (ALA, 2000) explains that a skilled person with information skills should be able to determine the need for information and its extent, access information efficiently and effectively, evaluate information and its sources critically, incorporate selected information into its knowledge base, use information effectively to meet a specific objective, understand the economic, legal and social implications surrounding the use of information and know-how to access and use it, ethically and legally. More recently the concept has been updated. In 2016, the Association of College and Research Libraries (ACRL, 2016) adopted the Framework for Information Literacy for Higher Education. Product of intense work to redefine the content and skills required to handle information adds reflective discovery of information, which comprises how information is produced and valued by using it ethically and legally, creating new knowledge. In this framework, six conceptual frames are introduced, representing broad ideas applicable to different academic disciplines (ACRL, 2016; Fisher, 2017; Swanson, 2017): Authority Is Constructed and Contextual; Information Creation as a Process; Information Has Value; Research as Inquiry; Scholarship as Conversation; Searching as Strategic Exploration. In the context of higher education, the need to develop information literacy skills is unavoidable, given the underlying objectives of this level of education (Lopes, Sanches, Andrade, Antunes, Alonso-Arévalo, 2016). One of the main challenges of teachers is the awareness of their role in guiding the careful selection of information, which is based on the development of critical thinking (Cruz, Nascimento & Dominguez, 2019). It is from the awareness of the social environment and their personal and professional capacities that teachers must act, transmitting knowledge while developing students' research skills, promoting better learning, investing in the teaching of research strategies, contributing for the ethical and informed use of knowledge and inducing authorship and communication experiences in the students. Thus, it is legitimate to consider information literacy as a fundamental competence for teachers. This outlook is not new (see, for example, Ödalen, Brommesson, Erlingsson, Karlsson & Fogelgren, 2019; Sanches, 2017; Schrum, Niederhauser, Strudler, 2016). Student mentoring and supervision often includes tutoring for their research, and close monitoring of the student during the preparation of his academic work, involving research and in-depth use of information. Shipman, Bannon, and Nunes-Bufford (2015) relate in-service teachers' information seeking and use habits with

previous training, thus stating that the results of information literacy training are persistent, accompanying teachers throughout their professional performance. There is thus a recognition of the importance of information literacy as competence to be integrated into the training of teachers, trainers, and educators. This is expressed not only in the report of experiences and studies such as those mentioned, but also in the further questioning of interveners, and in the theoretical reflections that this theme has triggered. Godbey's (2018) practical study is an example that focuses on improving the literacy proficiency of future teachers. Perzycka (2015) theoretic reflexion underlies the importance of the study and application of information literacy in a more consistent way, from the deep analysis of the conditions that constitute it, as well as from the dialogue with theory, from which practices can benefit. The inspiring work of Maybee, Bruce, Lupton & Pang (2018) explains curriculum design whose contents are intertwined with intentional involvement with information. Although higher education teachers may use information in sophisticated ways to teach their subjects, maybe they are not used to teach students to use information creatively and reflexively in academic work. This is also the role of teachers in soaking information literacy in their teaching programs.

3. Study description

Observation of previous studies supports the integration of information skills in the curriculum of higher education teachers. The reflection thus aims to highlight the impact of information literacy on the educational and learning context, analyzing paths to be explored by teachers. In this line of thought, Cowan and Eva (2016) show that by equipping higher education teachers with tools and skills to teach their students' information literacy more holistically, it encourages them in their teaching tasks, and research. Communicating, encouraging, educating and infiltrating information literacy are multifaceted contributions to meeting the needs of teachers, and this approach is advantageous in that it contributes significantly to moving from gathering information to creating knowledge.

The University of Lisbon is the largest Portuguese University. Located in the capital, it brings together 18 Schools (Colleges and Institutes) and serves a population of about 50,000 students, with nearly 3,500 teachers and 2,500 staff. This large university has teaching and research areas in autonomous units. The Institute of Education is one of the schools, dedicated to research and education, in education and training in Portugal, and currently has about 900 students. Institutional defies include innovation in the teaching and learning process.

3.1. Objectives

In line with the competencies required of teachers and the new principles of information literacy in conjunction with academic writing, we sought to design a curriculum proposal integrated into a Postgraduate Degree in Pedagogy of Higher Education, taught by the

Institute of Education of the University of Lisbon. The proposal is based on a reflection on the importance of academic writing as a result and product of intellectual reflection and the use of information. It is therefore intended to support teachers in guiding students towards the pursuit of their work, from research to publication, particularly using information literacy.

3.2. Methods

A discipline was designed, framed in the Postgraduate Pedagogy of Higher Education, offered in the academic year 2019/2020 at the Institute of Education of the University of Lisbon, concerning the theoretical-conceptual framework of the ACRL Framework. The objective was to develop and update the skills related to knowledge of tools and strategies for dealing with information through the exercise of academic writing. The process aimed to incorporate learning activities, tasks and assessments that require learners to articulate information needs; use resources in digital environments; organize, process, analyze and interpret information; and critically compare and evaluate the credibility and reliability of information and its sources; understanding the academic context and how they can contribute to the scientific community through written production and academic publication.

4. Results

According to the project of implementation of this proposal, it is presented, briefly, the characterization and structure of the new curricular unit.

Table 1. Information Literacy for Academic Writing contents.

Learning objectives
Incorporate learning activities, tasks, and assessments that require learners to articulate information needs; find information and resources in digital environments; organize, process, analyze and interpret information; and critically compare and evaluate the credibility and reliability of information and its sources; understanding the academic context and how they can contribute to the scientific community through written production and academic publication.
Content
a. *Begin academic work* - Develop students' skills around information literacy (skills, dispositions, and attitudes towards information; how and why to get and give back contributions to the scientific community) b. *Search to write* - How to choose a topic, what to look for, where to look, how to develop a search strategy, how to find the full text, how to evaluate the information found? c. *Writing ethically* - Understand and apply strategies to cite and reference, understand and avoid plagiarism. d. *Construct and publish a scientific article* - How to organize and present the information resulting from an investigation, where to publish, what style of writing to use, what to consider before submitting, dealing with rejection of an article, publishing. e. *Understanding the context of Open Science* - digital identity, predatory journals, fallacies and dangers in fake news, data sharing, scientific repositories
Teaching and assessment methodologies
The methodologies used to assess and consolidate knowledge include the exposure of the main concepts in the classroom context. Explanation, reflection, and application of the contents about the research process in resources, selection, and organization of information, articulation, and textual construction, and application of APA norms in the writing. Case studies, with expository and participatory methodologies, will be used.
Demonstration of the coherence of teaching methodologies with the learning objectives of the curricular unit
The practical classes will be used for close monitoring of the writing process and training of academic skills, particularly in information literacy, using the associated tools. The teaching methodologies will involve the reading of original articles that constitute case studies that can be discussed and worked in groups by the students. To better address the issues under analysis, practical examples will be used to demonstrate the different stages of the processes.

5. Discussion and conclusions

The transdisciplinary nature of information literacy, particularly when coupled with writing in the academic context, allows us to anticipate appropriate practical applicability. Similar to the case studies already analyzed, those by Yevelson-Shorsher & Bronstein (2018) or Dawes (2019) show that information skills education programs that seek to combine these characteristics seem to be successful. Furthermore, the important collaboration of librarians, underlined by these same studies, has significant advantages in the knowledge of information resources in depth so their experience should be harnessed to build significant insights. Effective information literacy skills are sought through information search to locate, select, retrieve and evaluate information using a variety of sources and tools, distinguishing between academic and non-academic sources, compiling, categorizing and managing citations during the information search process, applying an ethical and legal standard to the use of information, critically evaluating information sources and resources. By promoting the work of systematization and communication of information, the search for sources in various formats, both written and oral, enables us to understand the research process, including the use of error as a learning strategy. By demonstrating dispositions such as the investigative spirit, resilience, and confidence to apply knowledge to new problems and situations, we will be developing skills to safely use technologies in research, and to develop an attitude of trust in problem-solving, valuing student-oriented learning concepts. This case can be used to stimulate reflection and inspiration in the education of higher education teachers, particularly those that seek to facilitate and promote improvements in university students learning', especially concerning information literacy, integrating strategies and tools adapted for the development of information skills.

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Employability skills of graduates: Insights from job advertisements

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Abstract

This paper examines online job advertisements to identify the type of skills and other attributes required for higher education graduates in European countries. The data were collected from European job websites in 2019 (n=1,752) for any country and occupation having a job offer requiring higher education. The empirical analysis starts with a fuzzy clustering to identify typical skill patterns required by employers. Six clusters emerge from the data; five can be labelled as adaptability skills, foreign languages, specific skills, work attributes, and managing skills. The remaining one is referred to as null cluster with no distinctive required skill. Subsequently, we examine the occupation and employment conditions associated with each fuzzy cluster. Despite the demand for graduates, the service and sales related occupations prevail in the null cluster. In other five well-defined clusters we find a mix of skills of some high-qualified occupations, and search for specific skills acquired through work experience.The findings raise the question about the assignment of graduates in less qualified occupations.

Keywords: *Employability skills, higher education graduates, job advertisements, European countries, fuzzy clustering.*

1. Introduction

Higher education institutions (HEIs) are being pressured to prepare graduates for the world of work and develop skills and other attributes that help to fit graduates to economic and labour market imperatives. Stakeholders from HEIs should then know those requirements to find appropriate responses, notably through the supply of particular courses. In recent decades researchers have devoted much attention to studying job requirements, especially through public information provided by employers. Job advertisements have an important role to play in this discovery. This paper contributes to this research by examining the contents of online job advertisements in Europe. The goal is to ascertain the qualifications, skills, and abilities required in occupations for which a job offer exists.

This method of exploring job advertisements has been applied in several studies, but mostly focusing on a single job, such as the CEO (Ahmed, 2005); an academic field, notably management (e.g. Bennett, 2002; Arcodia & Barker, 2002) or health (Messum, Wilkes and Jackson, 2011); and occupations that have been affected by technological change, the digital library (Choi & Rasmussen, 2009; Henricks & Henricks-Lepp, 2014). Kureková, Beblavý, Haita-Falah, and Thum-Thysen (2016) compared three countries and limited their study to low and medium level occupations, while Kennan, Cole, Willard, Wilson, and Marion (2006) compared skill requirements of a single job in Australia and the US. To the best of our knowledge, a comparison across European countries and occupations is still missing in the literature. In fact, Kureková *et al.* (2016) notes that comparative studies based on job advertisements are still scarce. Furthermore, Beblavý, Akgüc, Fabo, Lenaerts, and Paquier (2017) emphasise the relevance of job advertisements as a valuable source to examine both labour market and occupations skill needs.

Nevertheless, some studies claim the lack of clarity on the attributes required by employers (Kennan *et al.* 2006). Kureková *et al.* (2016) address the representativeness of job advertisements, while Walsh, Johnson, and Sugarman (1975) note a lack of information. Walsh and colleagues question, in addition, whether those advertisements reflect the local labour market, since small employers are less likely to use job advertisements because of their negligible job openings. Despite the drawbacks, job advertisements provide easy access to information on the labour market; other qualitative techniques to obtain data are significantly time and resource consuming for both the researcher and employer.

Available literature on job advertisements shows that a long list of skills and other attributes are required by employers. Nevertheless, communication and interpersonal skills are the ones most required (e.g. Choi & Rasmussen, 2009), but some advertisements express the need of foreign languages, team work, and working under pressure, among others (e.g. Wellman, 2010).

We attempt to answer the following research questions: are job offers for graduates or non-graduates? What does the information included in job advertisements provide about graduates' jobs? What type of occupations, skills, and other attributes are in high demand? To answer these questions, our empirical research explores 1,752 online job advertisements limited to graduates and post-graduates (masters), collected in 2019, and available on European Union websites. We compare countries and occupations for which there are job offers in Europe and apply a fuzzy cluster analysis to identify types of skills and the countries, industries, and occupations associated with each set of skills.

The rest of paper is organised as follows. Section 2 provides information about the data and the methodology used to decompose them; the empirical findings are presented in Section 3; and Section 4 concludes.

2. The data and methodology

The data were collected in 2019, on the European Union website EURES and private website Monster.com. We limited the number of advertisements to 150 per country and excluded countries with fewer than 40 advertisements. Table 1 shows the proportion of online job advertisements collected from European websites for the countries meeting our criteria.

Table 1.Proportion of job advertisements.

Country	%
Germany	8.56
Belgium	3.60
Croatia	3.71
Slovakia	8.56
Spain	8.56
Greece	8.56
Netherlands	8.56
Luxemburg	8.56
Malta	4.57
Portugal	8.56
Czech Republic	8.56
Romania	8.56
Sweden	8.56

We found 230 different skills and other attributes. The first step of our analysis consisted of a content analysis of advertisements to create a categorisation of terms based on frequency, literature review, and self knowledge. It should be stressed that around 40 skills specified the foreign language demand in job advertisements; given their frequency, those were recoded in “other foreign languages”. Some skills are reported with slightly different names e.g. orientation towards outcomes, goals, business, solutions; these were aggregated in “orientation towards results”. A set of skills was clustered in “work attitudes”: iniatiative, commitment, proactivity, motivation, positive attitude, persistence, loyalty, and caring. The “personal qualities” include open mind, dynamism, ambition, confidence, and persistence. Finally, a set of skills remained just the way they appeared in the ads.The subsequent analysis is based on 19 skills and attributes. To examine the skills by occupation, we used ISCO and converted each occupation of job advertisements into a one-digit occupation.

3. Empirical evidence

The data were decomposed in fuzzy clusters by means of a grade of membership (GoM) analysis (Woodbury & Clive, 1974), which revealed six clusters. Table 2 gives a qualitative overview of skill set categories we can expect to find in each of those fuzzy clusters. At

first glance, we notice that English and work attitudes appear to be transversal attributes that are relevant in most skill clusters. On the other hand, some skills are relevant in only one cluster: analytical skills, adaptability, and IT.

Table 2. Fuzzy clusters: the skill sets in job advertisements.

Job requirements	I	II	III	IV	V	VI
Specific skills			*			
IT skills			*			
English	*	*	*			*
Other foreign languages	*	*			*	
Interpersonal skills					*	
Autonomy					*	
Problem solving						*
Quality						*
Work attitudes	*		*		*	*
Communication	*					*
Planning and organisation	*					
Stress					*	
Innovation	*					
Responsibility	*				*	
Personal qualities						*
Leadership	*				*	*
Orientation towards the results					*	*
Analytical skills						*
Flexibility and adaptability	*					

We then labelled the skill sets according to the mix of skills and other attributes that prevail or are distinctive for clusters. Accordingly, we label cluster I as adaptability skills; cluster II as foreign languages; III as specific skills; IV as undifferentiated; V as work attributes; and cluster VI as managing skills. The evidence reported in Table 2 shows that in cluster IV there is no distinctive skill required by employers, while in all other clusters a particular mix of skills prevails. The clusters of adaptability skills (I), work attributes (V), and

managing skills (VI) include a large number of skills. Work attitudes and leadership are found across these clusters.

Table 3 reports occupation and employment conditions associated with each cluster of skills.

Table 3.Characteristics associated with skill sets.

	Cluster I **Adaptability skills**	**Cluster II** **Foreign languages**	**Cluster III** **Specific skills**	**Cluster IV** **Undifferentiated**	**Cluster V** **Work attributes**	**Cluster VI** **Managing skills**
Occupation	Managers Clerical support	Clerical support	Professionals Technicians Associate Professionals	Services and sale Craft and related trades	Professional	Managers
Contract	Direct hire1		Direct hire	Fixed term	Internship Temporary	Direct hire
Working time	Full time	Full time	Full time	Part time		Full time
Experience	1-3 years	>10 years	4-9 years	<1year	<1year	4-9 years >10 years

As can be noted, services and sale occupations have no particular skill requirements. Employers demand graduates but we are uncertain about the need of highly skilled workers for those jobs. The results suggest that for high qualified occupations, employers indicate a mix of skills, but also specific skills acquired through work experience.

Furthermore, the employment conditions differ among skill sets. While for occupations having no particular required skill set, employers offer flexible and part-time job; for others they are concerned with transaction costs and tend to protect their investment in searching for and recruiting the best candidates.

4. Concluding remarks

This ongoing research seeks to identify the skills required from higher education graduates in different European labour markets. Unlike previously published studies based on job advertisements, our research examined job offers of EU countries and for any occupation.

[1] "A direct hire refers to a situation in which a company that intends to hire a candidate offers them the job directly […] As a direct hire involves action and investment from the hiring company, direct hires are usually made when filling permanent roles as opposed to a temporary or contract-to-hire roles", https://jobadder.com/glossary-term/direct-hire

The empirical evidence indicates that a demand for graduates exists for qualified and non-qualified occupations, but in this latter case no particular skill is required.

The results show that no distinctive skill or other attribute prevails in the cluster that we labelled as undifferentiated. This is the case of job offers for service and sale workers. On the contrary, a particular skill set is required for high qualified occupations, which includes cognitive (analytical skills), interpersonal (communication), and organisational abilities (orientation towards results). For these occupations, employers additionaly require specific skills acquired through work experience.

Our preliminary results raise the question about the need of graduates for certain occupations. In other words, do employers really need graduates for services and sale occupations? This question deserves further scrutiny.

Further research should compare the results from the two internet sites (EURES and Monster). We question whether public and private sites differ in the occupations sought and the contents of advertisements.

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Baltic – Nordic Universities in the EU Research and Innovation Programme Horizon 2020

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Abstract

This study looks at the research education in universities and is aimed at assessment of the Baltic – Nordic Higher Education Establishments' participation to the EU Horizon 2020 Framework Programme on basis of the open source data. The author analyses university interest in Horizon 2020 support for doctoral students' training, correlation between university PhD intensity and involvement in research projects, correlation between Horizon 2020 success and World university rankings, participation comparison of Nordic universities versus the Baltic ones. A brief overview of universities' commitment to Sustainable development goals is also included.

The study concludes that Nordic universities are more thoroughly engaged than the Baltic ones and are taking advantage of the Horizon 2020 opportunities; however, Estonia has a remarkable success. Although Nordic universities are looking for collaboration partners further into Western Europe than to the neighbours across the Baltic Sea, for teaming activities Baltic universities choose Nordic mentors. Nordic universities are more involved in activities leading to excellent research. On contrary – in many cases participation of Baltic universities is limited to coordination of research activities without a direct access to the leading European science communities and respective possibilities for students.

Keywords: *Scientific and research education; Horizon 2020; Baltic – Nordic universities.*

1. Introduction

Fundamental principles laid down in the Magna Charta of the European Universities (Magna Charta Universitatum, 1988) emphasise close relationship of tuition with research: 'Teaching and research in universities must be inseparable'. Therefore, in parallel to academic education, universities involve students also in research activities thus enriching their level of knowledge.

The major research and innovation programme Horizon 2020 is open to everyone. Higher Education Establishments (HES) are top beneficiaries of this programme for both participations (33%) and EU contribution (39%) received.

This study is targeted at assessment of the Baltic – Nordic HES participation to the Horizon 2020 activities based on open data: Dashboard (2020), Cordis (2020), Eurostat (2020), and ETER (2020). However, online databases are updated regularly, and the current study reflects results as of March 2020.

Earlier correlation for Horizon 2020 participation success and 15-year old students' mean performance in OECD Programmes for International Student Assessment was analysed by Geske and Bērziņa (2017) concluding that there are no decisive factors responsible for success in the Horizon 2020.

2. Data Sample selection

A multi-level selection has been chosen for analysing HES performance according to country group, performance in Horizon 2020 and university's research profile.

This survey focuses on Baltic – Nordic country group. In terms of Horizon 2020 it means: three 'old' member states (Denmark, Finland, and Sweden), three 'new' member states (Estonia, Latvia, and Lithuania) and two associated countries (Iceland and Norway). All of them are participants of the Nordic – Baltic space for higher education and research.

The top-500 Horizon 2020 performing HES have been selected (Dashboard, 2020): 52/51[1] organisations fit the sample requirements: 8 establishments in Denmark, Estonia – 4, Finland – 10, Iceland – 1, Latvia – 3/2, Lithuania – 2, Norway – 8, and Sweden – 16.

Further, according to the ETER – European tertiary education register (last data from 2016), only universities identifying themselves as research ones have been chosen for the study. Two universities in Norway and one in Sweden are excluded.

[1] Horizon 2020 data for University of Latvia and Institute of Solid State Physics, University of Latvia are merged

Considering the three above-mentioned prerequisites, 48 universities would form the study sample. However, due to space limitation only up to three (according to H2020 ranking) per country are included in the current study (Tab. 1). All Nordic HES (with exception of Iceland) rank among the top-100 universities according to Horizon 2020 ranking; two Estonian universities are in the second hundred. The list ends on Latvian and Lithuanian universities.

Table 1. Baltic – Nordic universities chosen for the study and their international ranking.

H2020[2]	THE[3]	QS[4]	CWUR[5]	Institution Name (English)	Country	Acronym	National rank[5]
5	101	81	39	University of Copenhagen	DK	KU	1
11	184	112	213	Technical University of Denmark	DK	DTU	3
20	115	145	95	Aarhus University	DK	AU	2
21	41		42	Karolinska Institute	SE	KI	1
23	96	107	134	University of Helsinki	FI	HY	1
25	96	92	141	Lund University	SE	LU, SE	4
32	131	119	56	University of Oslo	NO	UiO	1
34	201-250	98	118	KTH Royal Institute of Technology	SE	KTH	3
48	184	134	310	Aalto University	FI	AYO	2
58	401-500	359	162	Norwegian University of Science and Technology	NO	NTNU	2

[2] Dashboard, 2020

[3] The Times Higher Education World University Rankings 2020

[4] Quacquarelli Symonds World University rankings 2020

[5] Center for World University Rankings 2019-2020

H2020[2]	THE[3]	QS[4]	CWUR[5]	Institution Name (English)	Country	Acronym	National rank[5]
69	201-250	163	261	University of Bergen	NO	UiB	3
78	251–300	395	376	Tampere University[6]	FI	TaY	4
104	301-350	301	502	University of Tartu	EE	TÜ	1
190	801-1000	601-650	1273	Tallinn University of Technology	EE	TTÜ	2
214	351-400	---	508	University of Iceland	IS	HI	1
~207	801-1000	801-1000	1490	Jniversity of Latvia	LV	LU, LV	1
301	801-1000	801-1000	---	Tallinn University	EE	TLÜ	
307	1001+	701-750	---	Riga Technical University	LV	RTU	
361	1001+	751-800	1631	Kaunas University of Technology	LT	KTU	3
385	801-1000	458	703	Vilnius University	LT	VU	1

3. Horizon 2020 activities

The latest official evaluation of the Horizon 2020 is available from 2017, and separate flash sheets from 2018 - 2019 (EC Horizon 2020 programme analysis, 2020). Published survey data differ from today's; although, some trends remain throughout the programme. This study looks at Baltic – Nordic HES participation in early 2020 for several selected topics.

3.1. Country collaboration and success

Figure 1 reflects relative collaborations (i.e., percentage of project partners from the respective country). Obviously, that for all selected counties Germany is the most frequent

[6] Tampere University was created in January 2019 by merging the University of Tampere and Tampere University of Technology

partner due to its size (1st line: around 10% of collaborations), but for Germany Baltic countries is a minor partner (1st column, collaboration below 1%). But noteworthy is the country self-cooperation (highlighted diagonal boxes): the 'big-5' countries go for projects with more involved participants form the country (collaboration ~9%), while for majority cases participants from Baltics are included as single country representatives in the projects.

Although Sweden is the most retained (above 3% of EC total contribution) Baltic – Nordic country as the largest one (Worldometer, 2020), other Nordic counties are more successful with respect to EU contribution per capita. Iceland, the smallest country in the sample, has the most successful participants (21%) and the highest EU contribution per capita (338 €). Also, Iceland is the 'most Baltic – Nordic' country: 19% of its project partners come from the region. Baltic countries are far behind the Nordic neighbours. However, Estonian success is remarkable – contribution per capita is higher than in UK, France, Spain and Italy.

	DE	**UK**	**FR**	**ES**	**IT**	**NL**	**BE**	**SE**	**DK**	**FI**	**NO**	**EE**	**IS**	**LV**	**LT**
DE	9	14	13	12	12	14	12	13	12	13	11	9	9	9	10
UK	10	8	9	9	9	9	8	9	10	7	8	7	9	5	6
FR	11	11	9	11	11	10	10	10	9	10	10	7	9	8	9
ES	10	10	11	9	12	9	10	10	9	10	10	9	6	7	8
IT	10	10	10	11	9	9	9	9	8	9	8	9	8	7	9
NL	7	7	6	6	6	6	8	6	7	6	6	6	5	6	5
BE	5	5	5	5	5	6	4	5	5	5	4	5	4	5	5
SE	4	3	3	3	3	3	3	4	4	4	4	3	4	3	3
DK	2	2	2	2	2	2	2	2	4	2	3	3	3	2	2
FI	2	2	2	2	2	2	2	3	2	4	3	3	3	3	3
NO	2	2	2	2	2	2	2	2	3	2	4	2	5	2	2
EE	0.4	0.4	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.7	0.6	2	0.7	1	1
IS	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.4	0.3	0.6	0.3	3	0.3	0.2
LV	0.3	0.2	0.3	0.3	0.3	0.4	0.5	0.4	0.5	0.5	0.4	1	0.6	2	1
LT	0.4	0.3	0.4	0.3	0.4	0.4	0.5	0.4	0.5	0.5	0.5	1	0.5	1	1
Total for B–N, %								**13**	**15**	**14**	**15**	**17**	**19**	**16**	**14**
H20 application success - 17%	19	17	21	16	15	19	20	17	16	15	18	15	21	15	15
EU contribution, %	15	13	11	9	8	8	5	3.4	2.6	2.2	2.2	0.38	0.23	0.15	0.14
EU contribution per capita, €	1318	95	84	99	70	229	220	171	226	207	207	144	338	41	25

Figure 1. Relative collaboration, success and contribution for selected countries (%). Source: Cordis (2020).

3.2. Excellent science and Enhancement of educational programmes

Projects under Excellent science consolidate research and promote competitiveness on a global scale. The best HES invest efforts for this pillar; however, Baltic universities are seriously lagging behind the Nordic neighbours (Fig. 2). Hereinafter data are provided in percentage of the 'reference' projects against the total number of projects.

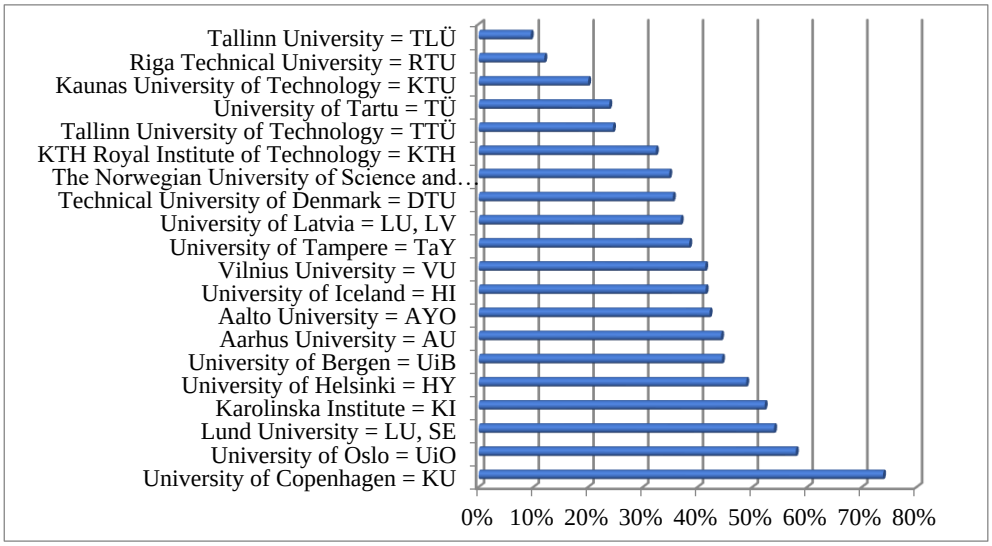

Figure 2. University involvement in Excellent science projects (%). Source: Dashboard (2020).

Horizon 2020 foresees a special activity co-funded with national governments for advancing national/regional/international programmes for Doctorate and Post-doc researchers' training. By early 2020, 87 such projects have been supported (Dashboard, 2020); about a quarter of them have participants from Baltic – Nordic countries (mainly Nordic): Finland – 20, Sweden – 19, Denmark – 7, Iceland and Norway – 2 for each, Estonia – 1. The top-listed universities (Tab. 1) are also the most engaged for this activity. Based on participation intensity in Excellent science projects, it is obvious – Nordic HES have more opportunities for promotion of students' scientific and research education.

3.3. Research and innovation versus Coordination and support activities

Research and innovation projects (RIA) are aimed at development of a new knowledge versus coordination and support actions (CSA), which do not enclose any research activities; therefore, scientists are more interested in the collaborative research. There is no significant difference in the share of research projects among Baltic – Nordic universities (grey bars, Fig. 3). However, when involvement in Excellent science and research projects is aggregated (Fig. 2 and grey bars Fig. 3), Nordic universities are far ahead. Therefore, it could be concluded that scientists (and thus also students) from Baltic universities are less integrated into the European Research Area. The said is reflected also by considerably lower citation index (THE, 2020) for Baltic researchers.

Yet, Baltic participants are thoroughly involved in research supporting activities – CSAs, i.e.: establishment of thematic research networks, conducting of studies, etc. (blue bars, Fig. 3).

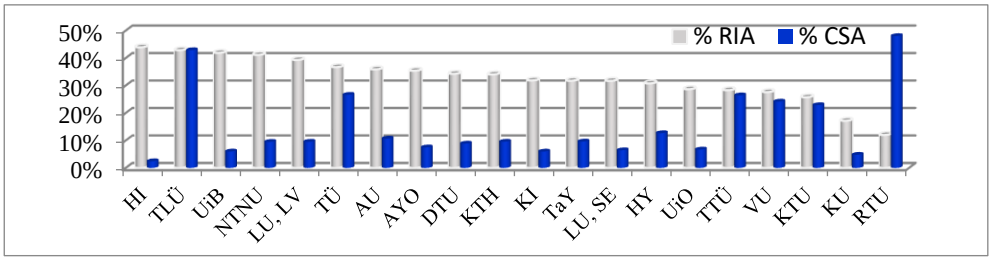

Figure 3. Involvement in research (RIA) and coordination-support (CSA) projects (%). Source: Dashboard (2020)

3.4. Spreading excellence and Widening participation

Estonia, Latvia and Lithuania belong to so called 'widening countries' eligible for special Horizon 2020 support actions. The most influential of them are Teaming activities aimed at consummating existing research centres in 'widening countries' through coupling with leading European research institutions.

Baltic countries' efforts have resulted in 2 teaming projects for Latvia (3 universities) and one for Estonia. Two of three Baltic teams have chosen mentors form leading research centres Nordic countries (Tab. 2): here Baltic – Nordic neighbour links work well.

Table 2. Baltic – Nordic Teaming activities

Project	Baltic participants	Nordic participants	Other participants
CAMART[2]	Institute of Solid State Physics, University of Latvia, **LV**	KTH Royal Institute of Technology, **SE** RISE ACREO, **SE** RISE Research Institutes of Sweden, **SE**	
BBCE	Riga Technical University, **LV** Latvian Institute of Organic Synthesis, **LV** Riga Stradiņš University, **LV**		AO Research Institute Davos, **CH** University of Erlangen-Nuremberg, **DE**
FINEST TWINS	Tallinn University of Technology, **EE** Ministry of Economic Affairs and Communications, **EE**	Aalto University Foundation, **FI** Forum Virium Helsinki, **FI**	

Source: Dashboard (2020).

3.5. Doctoral students and Horizon 2020

Doctoral students in science and technology fields for Estonia and Finland are at 0.7% and 1.3% of the 20-29 years aged population (Eurostat, last data from 2012). These countries have improved the performance in comparison to the previous EU research programme (FP7, Dashboard). For example, Estonia accumulated around 0.2% of total FP7 EC contribution, but in Horizon 2020 it has doubled its share (0.38%, Fig. 1). Also, Finland has slightly improved from 1.9% to 2.2%, while Latvia and Lithuania (0.3% doctoral students for both) remain at the previous around 0.1% level. Draft trend: countries with higher Doctoral students' ratio have higher potential for future growth – a topic for study in Horizon Europe.

There is a correlation between Horizon 2020 funding attributed to one Doctoral (PhD) student and the number of total PhD students enrolled and graduated (Fig. 4). According to Lehman et all. (2013) Spearman's correlation coefficients are respectively 0.50 (moderate) and 0.68 (strong). One can conclude – a university investing more in research can attract more students and provides more possibilities for research education.

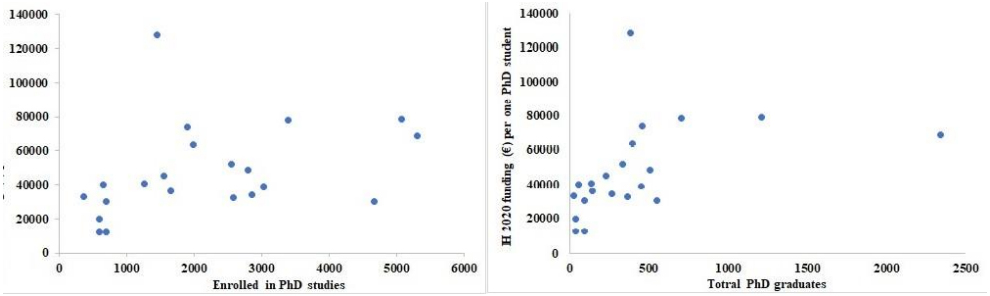

Figure 4. Correlation between Horizon 2020 funding and PhD intensity. Source: ETER & Dashboard (2020).

4. Universities and Sustainable development

The next Horizon Europe programme is aimed at achieving Sustainable development goals (SDG, 2015). Therefore, it is interesting to look how universities cope with these goals today. In 2019 THE has published a ranking focusing on how HES are contributing to the Sustainable development goals. The list reflects 4671 HES performance against SDGs.

Fifteen Baltic – Nordic HES are included, half of them among top-100 (Fig. 5). The best are Swedish universities; from Baltics, only Latvian have submitted data on SDGs. A university's final overall score is calculated by combining its score for SDG 17 (mandatory) with its top three scores of other SDGs; therefore, all are not assessed against the same SDGs.

It is certainly worth emphasising the University of Gothenburg (Fig. 5, grey highlighted, not included in sample of this paper as ranks 7th for Sweden). Hypothesis: mission based Horizon Europe programme could become a game-changer for university participation.

Rank	*Name*	*Country*	*SDG3*	*SDG4*	*SDG5*	*SDG8*	*SDG9*	*SDG13*	*SDG16*	*SDG17*
6	University of Gothenburg	SE	8	1	3	101–200		30	38	30
7	KTH Royal Institute of Technology	SE		37	101–200	2	3	9		14
15	University of Helsinki	FI	93	101–200	31	42	90	11	4	9
19	Aalto University	FI	201–300	87	101–200	101–200	10	27	101–200	5
53	University of Bergen	NO	39	201–300	87	101–200	101–200		74	59
75	University of Eastern Finland	FI	81	201–300	101–200	101–200	101–200	101–200	84	101–200
92	University of Latvia	LV	301+	201–300	101–200	32	101–200	97	80	49
97	Aalborg University	DK	77	19	45		34	48		201–300

Figure 5. Baltic – Nordic universities' commitment to SGDs. Source: THE (2020).

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Effective integration of computational tools into Chemical Engineering studies at an international level

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Abstract

Current Higher Education students have grown up in a society characterized by the massive use of information technologies, which affects the way they expect to acquire new knowledge. In Chemical Engineering studies, in particular, traditional problem solving methods tend to bore students and, as a result, do not yield efficient learning. Fortunately, there exists a large list of software packages with specific Engineering application which, if properly used, may help create a better learning environment.

Under the above premise, a project is being conducted, between 4 Higher Education institutions from 3 different countries (Spain, Portugal and Romania), on the effect that the integration of computational tools may exert on the students' knowledge acquisition and predisposition to learn. We also aim to establish a comparative evaluation of the advantages and drawbacks of different computer software when facing typical Chemical Engineering problems. From our survey results and students' comments we conclude that, in general, the new methodological approach engaged their interest more than the traditional one, and helped them gain knowledge on the working principles of simulations. Moreover, the use of computer software in the classroom is acknowledged by the great majority of the students as a key skill which may improve their employability prospects.

Keywords: *Chemical Engineering; educational computer software; ICT competences; internationalization.*

1. Introduction

It is well known that our society is ruled by an increasing and generalized use of information technologies at all levels, a situation which has also reached the Higher Education level. In fact, most students expect to use electronic devices as the only way to access information when learning. Traditional masterclasses tend to bore them. Thus, a successful integration of technologies into their courses seems a very good approach to engage them. Moreover, in the Chemical Engineering discipline, the use of computers in process control, simulation and design has become an essential technical competence that must be acquired by all future professionals (Gillett, 2001).

The matters which constitute the core of Chemical Engineering studies, such as Unit Operatations, Chemical Reactors, Fluid Mechanics, Process Control and Optimization, etc., involve a great load of complex and tedious calculations. Traditional problem-solving by hand makes the students feel uncomfortable and does not always facilitate a deep understanding. Fortunately, the integration of commercial software in the classroom may help design more appealing teaching programs. Use of software enables more realistic open-end problems, which yield a better comprehension of the fundamentals, and allows the students to investigate the effect of the process variables with more flexibility. Table 1 gathers some information on the software packages used in the present experience. The selection is based on two issues: a) as one of the project's target is to compare strengths and weaknesses, it was necessary to provide a list of software with different characteristics in terms of graphical interface, difficulty, relative widespread use, programming, etc.; b) availability and expertise of the teaching staff participating in this project.

Table 1. List of software package used in this project.

Software	Company	Availability	Type	Programming	Difficulty
MS Excel	Microsoft	High	Spreadsheet	Optional	Low/medium
Python	Python Soft. Foundation	Free	Programming language	Yes	High
Mathcad	PTC	Low	Engineering maths	Optional	Medium/high
Aspen Plus	Aspen Tech	Medium	Process simulator	No	Medium

The use of individual software packages in Chemical Engineering teaching has been reported (Binous, 2008; Parulekar, 2006; Roman and García-Morales, 2019; Wankat, 2006). However, to the best of our knowledge, there is still a lack of studies which compare their adequacy for specific matters. A comparative evaluation on the use of different

computer software carried out on core matters of Chemical Engineering by a coordinated team of academics would allow discovering the specific features that make each of them more suitable than the others for a certain type of problem in this field.

Under the above hypothesis, a project on the integration of computational tools into core matters of Chemical Engineering studies is being developed between 4 Higher Education institutions from 3 different countries (Spain, Portugal and Romania), aimed to:

- Establish a comparative analysis of the strengths and weaknesses of each software package.
- Find out whether the approach enabled a more efficient learning.
- Assess the students' predisposition to learn with the application of the method.

2. Methodological approach

One of the most positive aspects of this project is the constitution of a work team composed of 7 academics from Spain, Portugal and Romania, all of them working in the field of Chemical Engineering. Due to different affiliations, the team was organized into 5 groups. In any case, the methodology herein described corresponds to the joint project and not to the individual activity carried out at every institution.

2.1. Preparation of proposals and surveys

In September 2019, each group was required to propose 2 activities, involving the effective integration of computer software for improving the students' comprehension and strengthening ICT competences. A preliminary videoconference enabled the participants to agree on both topics and software packages.

The project coordinator prepared two different surveys: a) the first one was aimed to know about the students' satisfaction; b) the second survey was intended to gather information on the teachers' background. Both students and teachers were asked to rate every item between 1 (completely disagree) and 5 (completely agree). At the end of the documents, a blank for additional comments was provided. Finally, an editable MS Word template was also provided for the participants to report the results.

2.2. Activities implementation and evaluation

Each lecturer was free to decide whether the activities should be conducted individually or in groups; in the classroom, computer lab or at home; with one software or several, etc. In most of cases, a previous software training was necessary because the students only had basic knowledge of them. Both transversal and conceptual competences should be assessed through the corresponding assignments, which should be marked between 0 (lowest grade) and 10 (highest grade).

2.3. Project framework and analysis of the results

In brief, the following questions have guided the process of evaluating the software implications on the learning process: a) did it give the chance for an easy graphical solution?; b) did it provide any professional skills?; c) did it allow for natural notation in terms of writing equations?; d) did it enable accuracy and time-saving as compared to the traditional hand problem-solving method?; e) did the creation of code/worksheet entail a big concern to the students?; f) did it allow for easy editing of existing code/worksheet so as to vary the variable of study?; g) was the analysis of both experimental data and theoretical models possible?

Moreover, in relation with the two other goals, surveys and assignments grades have also contributed to collect information on students' satisfaction and performance.

2.4. Final report

At the end of the project, the coordinator will have to submit a final report to the funding organization (Vicerrectorado de Innovación y Empleabilidad, UHU) so they can evaluate whether the project has yielded effective learning and has fulfilled the stated objectives.

3. Results and Discussion

3.1. On the teaching staff

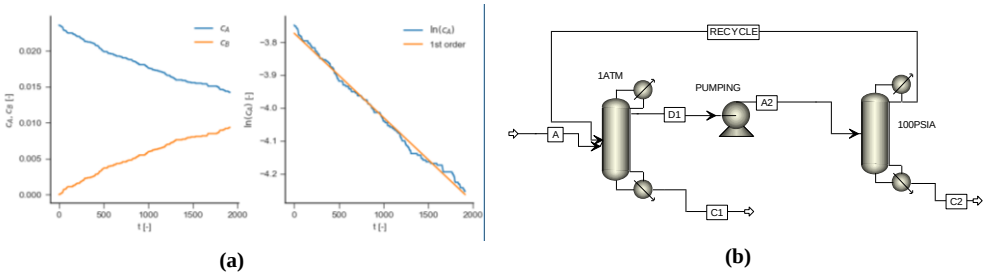
From the lecturers' survey (7 lectures), we highlight the following information:

- In general, all the participants have previous experience on the integration of computational tools into Chemical Engineering courses, and they have learnt how to use use all the software by themselves.
- However, some of them have never participated on a teaching project on this topic, and the majority of the team has never published results on this type of methodological approaches.
- Most of them admit that using software has implied more effort than traditional problem solving.
- Fortunately, there seems to be a common perception that the project has been well received by the students and has enhanced their interest and participation.
- In general, their home institutions provide the computational facilities needed, although sometimes they make use of the students' own laptops.

3.2. Adequacy of the software used in specific applications

A Python code based on elastic collisions between gas molecules was developed for one of the activities. It enabled the students to run a set of simulations on the chemical kinetics

laws from which they were asked to analyze the results in the context of the kinetics theory of gases. Figure 1a illustrates the simulation of a first order reaction. As a drawback, programming the code was not an easy task. So, the instructor had to develop the code and then make it available to the students. Fortunately, the code can be transformed into executables for the students to download and use at home. In this way, Python allowed the creation of a tailored application, commercially unavailable, for the simulation of a specific process with educational purpose. Also, it is possible to edit the code so that the application is run in "game" mode, which would increase further the students' motivation. Other positive aspects of Python are that it is open source and there is a large number of specialized libraries available. For the students to acquire a more solid knowledge, the lecturer who wrote the code recommends to use Python in a coordinated way with a more traditional approach.



(a) **(b)**

Figure 1. Selected examples of the digital teaching material developed for the project.

Another activity, involving the separation of azeotropic mixtures by fractional distillation, was carried out using the process simulator Aspen Plus. One example, for a separation of water and methy-ethyl-ketone by the pressure-swing method, is shown in Figure 1b. Aspen Plus provided great flexibility for implementing a "sensitivity" analysis aimed at an easy and fast manipulation of the key process variables, and for exploring "what-if" scenarios, with reduced learning time. Another positive feature is the availability of the latest thermodynamical models and data libraries, which provide accurate designs. However, given that the students do not perceive the details of the calculations, there exists a big concern about the so-called "black-box" effect, that is, a superficial understanding of the problem. To minimize that, the Mathcad software will be used in parallel with Aspen Plus simulations in a further activity next semester. It will allow us to create a more efficient learning environment in the computer lab. The main disadvantage about Mathcad is its typically low availability in Higher Education institutions.

MS Excel was used to implement three other activities. It proved to be successful in applications which involved repetitive calculations and which required to organize a big amount of data, obtained from lab experiments, in a simple way. In our project, for example, MS Excel was used to determine the surface tension coefficient of three

surfactants at three different concentrations, by the gas bubble method. However, MS Excel is a very versatile tool which enables more advanced applications if used conveniently. This is exemplified by one of our approaches consisting in the design of a stationary single or multi-effect evaporator through the implementation of a solving algorithm involving the powerful logic functions. The tool provided flexibility for the study of the main process variables and allowed fast editing, thus enabling easy understanding of the evaporator performance. Finally, evidences of the above reported flexibility of this tool are manifested by another proposal consisting in a transient process taking place in a double tube heat exchanger, for which the time dependent temperature profiles were examined. Some other advantages of MS Excel are: it is always available at the University computer labs; almost all the students have some previous knowledge on this software, what facilitates a lot the activities implementation; everyone has MS Excel installed in his/her own laptop. However, if compared to previous software packages above described, its graphical interface is less user-friendly, lacks of natural notation and it has more limitations to develop complex calculations. A summary with the 5 activities so far completed is shown in Table 2.

Table 2. Summary of activities developed during the Winter semester 19-20.

Activity title	Matter	Year	Software	n*
Unsteady-state operation of a concentric tube heat exchanger	Heat transfer	3rd	MS Excel	56
Improving the understanding of chemical kinetics using an application created with Python	Chemical kinetics	1st	Python	70
Complex Distillation Methods for the separation of azeotropic mixtures	Unit operations	3rd	Aspen Plus	6
Interactive design of an evaporation unit using Excel	Unit operations	3rd	MS Excel	15
The influence of some surfactants on the surface tension coefficient	Applied chemistry	4th	MS Excel	6

* number of students who filled in the survey

3.3. Students' feedback and main implications on their learning process

The results of the students' survey (a total of 159 participants, 57.9 % male and 42.1 % female) are summarized in Table 3, in terms of average score ± standard deviation. All the students belong to Bachelor's Degrees in Chemical Engineering and, as specified in Table 2, most of them are in the last two years of their study programs. In the overall calculations the same weight was assigned to each activity, no matter the relative number of participants. The surveys evidenced that:

- In general terms, the use of software catalyzed a better understanding of theoretical contents and made the course more attractive.
- Regardless of the digital tool used and of the home institution where the activity was carried out, the great majority of students considered computer skills as very important for their professional career as well as for their final project.
- Students do not accept as valid the statement "I prefer to solve problems by hand", and they consider that computational methods are easier. In fact, they propose to extend their use to other subjects in their study programs.
- With respect to the previous knowledge of the software, statistics by software type (not shown) showed that Excel got the highest score and Python the lowest.
- The opinions coincide on that the load of digital tools during their studies is only medium.

Table 3. Students' survey results.

	Questions	$\mu \pm \sigma$*
1.	The software used enabled a better understanding of the theoretical contents	4.05 ± 0.68
2.	The software used made the subject more attractive	4.26 ± 0.67
3.	The software used was familiar to me. I did not need any previous training	2.93 ± 0.41
4.	The software used enabled to analyze different alternatives and to decide which one is best	3.99 ± 0.55
5.	The software used can be applied to other subjects	4.24 ± 0.66
6.	I do not like computers, I prefer to solve the problems by hand	2.20 ± 0.82
7.	To solve problems by hand is much easier than with software	2.54 ± 0.64
8.	To gain computer skills is important with a view to my final project	4.29 ± 0.40
9.	Most of my teachers make use of computer software to solve the problems	2.99 ± 0.41
10.	To gain computer skills is important with a view to my professional career	4.66 ± 0.24
	Please, indicate overall impression of the experience	4.03 ± 0.69

* average ± standard deviation

Additionally, the most relevant comments provided by the students are presented:

- "For us to carry out a everyday use of Excel, we'd need more training".
- "I enjoyed the team work. It offered me the chance to get to know my classmates much better".
- "The activity helped leave the usual daily routine".
- "The assignment was ok, but we had some problems handling the software".
- "The graphical interface (Python) was useful to understand the reaction which was taking place".

4. Concluding remarks

This is a good example of internationalization of teaching practices at the University level, following one of the priority lines of work of the European Higher Education Area. It is also in line with the promotion of the digital culture.

With regard to the teaching staff, they were qualified in the use of computer software and had previous experience on their integration into Chemical Engineering subjects. Even so, the majority of the team had never published results on these methods. In general, the Engineering lecturers recognize their lack of theoretical formation on the issue as the main concern which makes them feel uncertain and prevent them from taking a step further. They also admitted that preparation of the material took more time and effort than traditional masterclasses.

As for the students, in general they acknowledge whichever digital tool that teachers are willing to use. One of the key phrases was "the activity gave us the chance to leave the usual daily routine…". This summarizes very well the students' feeling, who are annoyed with the traditional learning methods that are most of the times used in the lecture room. Gaining skills which they consider really useful for getting a job (ICT skills) is one of the things they care most. However, the use of digital tools during their studies is less than optimal. Moreover, using computer tools also promoted interpersonal relationships.

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The Digital Learning Laboratory Model to Catalyze Change in University Teaching and Learning

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Abstract

This paper outlines a unique model catalyzing change in teaching and learning known as the Digital Learning Laboratory (DLL) model that a large research university in the northeastern United States currently employs. We focus here on the MOOC work that the individuals in the DLL lead that have spread to improvements in teaching practices and learning experiences across departments beyond MOOCs. We discuss the MOOC development process and the ways in which this process can differ greatly from the development of an in-person course creating the initial and continued need for the DLL. Then, we describe the Digital Learning Laboratory, a community of practice of academics with advanced degrees in their field of specialization and housed in the relevant departments across our university. Finally, we discuss potential advantages of this model, including having a person with subject-matter expertise leading MOOC and hybrid projects and not requiring a different tenure-track faculty member to learn MOOC development skills for each new course.

Keywords: *MOOCs, online learning, learning design, digital learning.*

1. Introduction

It has been over seven years since the New York Times declared 2012 the "Year of the MOOC" (Pappano, 2012). In this time, Massive Open Online Courses have matured. Though the initial hype associated with MOOCs has died down, these online courses have started to take a central role in a variety of higher educational opportunities. Through the MicroMasters program on edX, learners can complete graduate-level coursework, add to the credentials of their admission application portfolios, and earn credit from a partner university accepting that student (Barbosa De Almeida Cabral, Ribeiro Jorge & van Valkenburg, 2017). Fully online Master's degree programs at scale are increasing educational access while decreasing degree cost (Goodman, Melkers & Pallais, 2019), and MOOCs are expanding how we think about hybrid education (Pérez-Sangustín et al., 2017) and continuing education (Zipper, 2016).

This paper outlines a unique model to transform teaching and learning in higher education known as the Digital Learning Laboratory (DLL) model that emerged as a result of the initial excitement over MOOCs and sustained due to the success and broader impact in departments and across a large research university in the northeastern United States. We begin with a general overview of the MOOC development process, and then describe the DLL approach and the reasons that this approach is particularly well-suited for facilitating change in teaching and learning in the university.

2. Why MOOCs Initiated a Need for Embedded Cross-Disciplinary Academics in Departments

MOOC development frequently remains a time- and resource-intensive process. Though exceptions certainly exist (Nissenson & Shih, 2015), MOOC development budgets are generally high and may not include costs from the time spent by faculty or other existing university staff on the project. The following section outlines a number of considerations that one must address when developing a MOOC, identifying areas where MOOC development differs substantially from in-person course development.

2.1. An Overview of MOOC Development

There are a variety of different steps and considerations to address when developing and running a MOOC. The following list outlines many of the steps in course development, though not exhaustive:

- Determine the goals and learning objectives of your course and develop an overarching course plan aligned with those goals and objectives

- Make design choices for your course that incorporate evidence-based best practices.
- Develop video resources from storyboarding to recording, editing, and animating.
- Develop text-based resources.
- Create original figures/diagrams/artwork.
- Secure intellectual property rights to use third-party charts/images/readings.
- Incorporate universal design for accessibility.
- Plan how to assess student learning.
- Write assessments that align to the objectives.
- Create interactive demonstrations, simulations, and visualization tools for the learners.
- Beta-test all course materials before making them available to the general public.
- Monitor discussion forums and provide learner support while the course is running.
- Analyze course data after the course run is complete.
- Revise the course during and after the course run to incorporate learner feedback and data for future runs of the course.
- Manage a team and complex project of many parts on time and within budget.

2.2. How does MOOC development differ from the development of an in-person course?

A number of the steps of MOOC development are not wholly or partially necessary when developing an in-person course, but many steps should also happen for an in-person course. However, there are a number of ways that MOOC development differs significantly from the development of an in-person course due to the public nature of the final products, scale of access, and self-imposed standards for publication-level quality that are not often to the same level for in-person teaching.

Many of these differences relate simply to the scale of MOOCs. The challenge of developing a learning experience where learners have their needs met and feel connected to the wider course community is a larger challenge at scale. MOOC instructors and institutes must determine how they will provide support for a large number of learners, ensuring that these learners have resources available when they have questions about or struggles with the course material.

Assessment is a particular challenge when considering education at scale. The easiest approach to online assessment—multiple choice questions—is also the most challenging at developing and assessing higher-level cognitive skills. Looked at through the lens of Bloom's taxonomy, multiple choice questions do a good job of assessing skills relating to knowledge and comprehension, but alternative assessment techniques need to be considered

to develop and assess skills relating to application, analysis, synthesis, and evaluation. Instructors often turn to peer-evaluated grading to assess and assign grades to MOOC learners, and there is limited research that supports the ability of peers to relatively accurately assign grades to their classmates (Peich, 2013). Questions, however, of providing meaningful, expert feedback to MOOC learners remain.

In addition to preparing for a large number of learners, MOOCs also tend to consist of a particularly diverse set of learners. This diversity can prove to be one of the exciting benefits of MOOCs; learners from around the world can learn together and support one another on course forums and social networking sites related to the MOOC. However, to meet the needs of our learners, when developing and running a MOOC, it is important to consider that learners 1) are of a wide variety of ages, 2) have varying educational backgrounds, 3) have a variety of levels of comfort with the language of instruction, 4) may have physical or learning disabilities, and 5) come from a variety of different cultural backgrounds. This is a much different situation than a typical university classroom, where students have a smaller range for demographics like age or backgrounds and represent diversity from one or two of these categories at a time. MOOC design has to include the diverse needs of the learners from all five of these categories that fall within a wider range in the same course at the same time.

Finally, managing the use and reuse of third-party materials in MOOCs matters much more than in-person classrooms. Instructors preparing for an in-person course show video and images in class or assign readings from copyrighted sources under fair use guidelines, benefiting from university library resources, or aligned with the historical practice of the burden of purchasing a textbook being on the student. Requiring learners to purchase course materials like textbooks or access to a research paper behind a paywall diminishes the no- and low-cost benefit of MOOCs and adds a barrier to access. This means that instructors need to either 1) secure the rights to third-party resources, 2) search for open source alternatives to these resources or 3) take the time to develop a course that is self-contained and can stand alone without the incorporation of any third-party materials. All of these alternatives tend to consume significantly more time and/or resources than assigning a chapter in a textbook or assigning students to read a journal article available through the university.

The simple educational potential of this online environment can also complicate the process of course development. An online learning environment can provide students with a rich variety of resources, such as virtual field trips (Quintanilla-Terminel, Pec, and Jagoutz, 2019), three-dimensional video animations, and interactive online demonstrations. Furthermore, an online learning environment can provide an extensive amount of data to course instructors, allowing them to revise and update course materials to best serve the learners in the course. All of these examples represent exciting opportunities to provide a

rich experience for online learners; however, they also represent a significant time investment and require particular expertise on the part of the course developers. Given the demands on tenure-track faculty time already, the ability to prioritize or dedicate time to learning new skills specific to MOOC or hybrid initiatives were unlikely. So instead, individuals rose to taking on these responsibilities in close collaboration with those faculty when MOOCs started.

3. The Digital Learning Laboratory

3.1. An Overview of the Digital Learning Laboratory Model

The Digital Learning Laboratory is a community of practice consisting of academics who are housed in and reporting to different departments and take responsibility for MOOC development, hybrid learning initiatives, and research related to these projects. These individuals hold advanced degrees in their field of specialization; for example, a DLL member in the Department of Physics will hold an advanced degree in that discipline, typically a doctorate. The DLL members lead the production of MOOCs in their department, and they work closely with the faculty to develop these courses. The specific professional tasks of each DLL members vary by department and is deliberately kept flexible so that the position can be customized to their department's needs; however, all DLL members devote either all or a significant portion of their time to digital learning initiatives. The members of the Digital Learning Laboratory meet on a regular basis to discuss best practices in digital education and to support each other with course development. Members of the Digital Learning Laboratory are divided into two main categories:

Digital Learning Scientists: The Digital Leaning Scientists are responsible for the MOOC development efforts of an entire academic department. They are employed only in departments that have a substantial MOOC development program, and typically hold an appointment as Lecturer within their departments. The DLL scientists are responsible for overseeing the execution and helping to develop the digital learning strategy of their academic department. They manage teams and projects to coordinate course development of a variety of different MOOCs and hybrid learning efforts of their departments on campus, as well. Digital Learning Scientists also conduct research to better understand engagement and learning design in MOOC development.

Digital Learning Fellows: Digital Learning Fellows are most often postdoctoral associates who also have a strong background and interest in the field of education. The role of the Fellows tends to be somewhat more focused than the role of the scientists, leading the development of a single course or course series, for example. Like the Scientists, the Fellows also support residential education at our university, and many conduct educational

research as well. In departments with established online learning programs, the Fellows tend to work under a Digital Learning Scientist, while in departments with smaller programs, they work independently.

3.2. Alternatives to the DLL model of course development

To our knowledge, the DLL approach to MOOC development is unique to our university. There are a number of alternative methods for approaching MOOC development, including 1) having faculty take the lead, reaching out to specialists as-needed in the course development process and 2) coordinating course development through a centralized MOOC/technology/teaching and learning center that includes instructional designers and technology experts, but no subject-matter experts.

3.3. Advantages of the Digital Learning Laboratory model

We believe that the Digital Learning Laboratory model has several important advantages to alternative models of MOOC development or efforts to improve teaching and learning.

Most importantly, the DLL academic who is responsible for overseeing course development has expertise in the field in which they are developing a course and a strong background and interest in teaching, which provides a number of advantages over a centralized system with no such experts:

- Because faculty collaboration is essential in this process, it is very useful to have a colleague who "speaks the same language" as the faculty and who the faculty can trust to understand the critical learning objectives and teaching approach of the course.
- The DLL academic has a strong understanding of the material that they are charged with teaching, and they understand how that material fits more broadly into their field of specialization. They can make course design decisions that reflect the learning and ideas that are most important to their field of practice.
- The DLL academic can independently develop assessments, videos, and other course materials with only minimal input from the faculty. This lessens the obligation and time of the faculty to develop all of the course materials on their own.
- The DLL academic can directly support the learning objectives of the course and serve as the instructor running the MOOC when live.
- The DLL academic serves as the resident expert on topics outside of the discipline that faculty feel receptive to getting advice on for their teaching. These topics

include educational technology, best practices for pedagogy, and the research behind the learning sciences to implement in digital projects.

- The DLL academic prioritizes teaching and learning without the pressures of writing for research funding or publications compared to their tenure-track colleagues.
- The DLL model organically developed out of solving needs and problems within departments rather than setting up a structure first for others to fit into.

If instead, we compare the Digital Learning Laboratory model to an individual faculty member directing MOOC development, we see a different set of advantages emerge:

- DLL academics possess or quickly develop a diverse set of knowledge and skills necessary for MOOC development. DLL members are not degree-holding experts in the following fields, but they have a strong working knowledge of the following areas is necessary for successful MOOC and hybrid learning projects: 1) best practices in learning experience design, 2) learning management system platform knowledge, 3) video production and editing, 4) intellectual property regulations, 5) best practices to create accessible course materials, 6) emerging trends in ed tech for higher ed, and 7) data analytics skills to study and evaluate courses once complete.
- This specialized MOOC or hybrid project development knowledge becomes integrated within departments, and individual faculty no longer need to learn these skills to develop MOOCs.

4. Conclusions

We have presented the Digital Learning Laboratory model as a catalyst for transforming teaching and learning via MOOC and hybrid learning initiatives. In this model, academic departments employ advanced degree holders in their fields of study to oversee MOOC and hybrid initiatives within their departments. These academics are in turn part of a community of practice known as the Digital Learning Laboratory, where they can work with and learn from other digital learning practitioners throughout the university. This model for improving teaching practices and student learning experiences has several advantages, including the benefit of a person with subject-matter expertise leading course development and the benefit of not requiring a faculty learn skills outside of their area of research expertise every time a department wants to create a new MOOC or hybrid learning experience.

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Improving international student transition to professional employment

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Abstract

This paper draws its data from two sources: a literature review of the enablers and barriers to a successful transition by migrants and international students to a professional career; and a case study of 14 post-graduate students in an Australian public university. The case study includes interviews with two students of their perception of the transition to employment. The paper identifies ten considerations for universities and students seeking to maximise success, and to minimise the time taken, to transition to a career in the Australian workforce.

Keywords: *career transition, graduates, international students.*

1. Introduction

Australia is increasingly reliant on international education as a revenue stream (Blackmore et al., 2014), making up 1 in 5 students in Australian universities (Norton and Cherastidthan, 2018). Fees from international students in Australian universities are the single biggest source of university revenue (Norton and Cherastidthan, 2018); and international students injected A$32 billion into the Australian economy in 2018 (Australia Universities, 2018).

Australia's appeal to many international students includes accreditation and rankings along with the ability to apply for a post-study work visa for between two and four years for themselves and immediate family members. Some use this time to apply for Permanent Residency (PR) and subsequently citizenship. Some graduates see time in Australia as a 'temporary stop' (Aten et al, 2016) taking low-skilled work, however, others want to use their degrees to transition to professional work in Australia. In Australia, most immigration is employment-based (Chand and Tung, 2019). Therefore, for those wanting to remain in Australia, there is a strong desire to win professional work.

Against this backdrop, international students under-perform their domestic counterparts in the transition to work (Gribble et al., 2016). A 2015 study identified that 40% of internship providers (potential employers) were unhappy with the 'work readiness' of international student placements with respect to business acculturation, ability to handle unfamiliar problems and communication skills (Jacking and Natoli, 2015).

The aim of this research is to explore what universities may do to help improve international students' transition to professional employment. The paper describes some of the barriers and enablers facing international students seeking a transition to employment in Australia. A case study is provided, including interviews with two Indian alumni who have self-identified career success. The themes of their perceived success is compared to the literature and eight suggestions are offered for universities.

2. Literature Review

Career success may be defined as a perception of accomplishment and performance (Turchick et al., 2010). This can be viewed objectively, where a career shows tangible progression through roles and positions; or subjectively, where a career reflects the individual's sense of their optimal career path (Connell et al., 2009). Thus career success is largely self-assessed without clear a definition of what constitutes a right or wrong path. However, we know that migrants experience barriers to starting, or re-establishing, their professional careers in a host country (Connell et al, 2009). The following sections outline some of the barriers and enablers to career success.

2.1. Barriers

This section outlines four key barriers, identified in the literature, facing international students and migrants attempting to transition to their new country's workplace. The literature chosen is largely drawn from Australia and Canada. First, some students have an expectation that a higher education degree will automatically lead to professional employment (Chen, 2014). They rely on improving their human capital without a commensurate improvement in their social and/or cultural capital (Blackmore et al. 2015). Blackmore et al. (2015) suggest that employers expect good qualifications along with other employability skills such as communication, teamwork and problem solving; and community experience and travel are also valued for higher status roles.

Second, a lack of network connectivity is a barrier. An international student seeking to transition to work in a host country may lack access to a network of associates from school, work, family, or their own social relationships. Ibarra (1993) discussed the difficulty of students building homophilious networks among their peer group because of the relative lack of cultural diversity in organisations, whether universities or employers. Yet we know that jobs are more likely offered to 'people like me' or to those with whom employers can identify (e.g. Minefee et al., 2018). A small or limited network contributes to a lack of access to high-status individuals who may be able offer work directly or through an acquaintance (Turchick et al, 2010).

Difference is third issue, and refers to the different language and cultural norms, and to the discrimination that may occur as a result of a difference, or the perceived difference. Turchick et al. (2010) discuss employers believing a local accent to be advantageous and that some employers being uncomfortable with ethnic minorities, especially those from non-European backgrounds. Blackmore et al. (2015) suggest that, 'International students are excluded from the employment due to their perceived cultural dispositions, lack of experience in the field, inability to acquire or act in particular forms of strategic knowledge or rules of the game' (pp 73).

Finally, the concept of 'Transition Penalty', or the period of adjustment required for a migrant to establish himself or herself in a new country (Connell et al, 2009 pp 473). This can be seen as wasted talent (Aten et al, 2016), or underemployment (Turchick et al, 2020; Connell et al, 2009) where a skilled migrant may experience a lack of recognition of existing qualifications and experience and be employed in low-skilled roles with limited work experience and mobility, leading to underemployment and less working hours than desired (Chand and Tung, 2019).

2.2. Enablers

On a positive note, three key enablers of transition are noted from the literature; their order below does not reflect importance. First, the personal qualities of individuals seeking work in a new country. These include being able to establish and maintain career motivation, resilience and positive self-identity (Turchick et al, 2019, Zikic et al., 2010). Several authors discuss the importance of career self-management (e.g. Jackson & Wilton, 2017) and the need for students to be proactive in finding the right job. Both Turchick et al, (2010 and Hawthorne, (2006) amongst others, discuss 'blindness to racism' as an enabler. This occurs when a migrant uses cognitive buffers to manage and minimise negative effects of discrimination. In Australia and Canada, a clear enabling skill is to acquire English language competence and cultural capital. This is likely to happen when individuals mix with others from a variety of cultures, but especially the host country (Blackmore et al. 2015). Students with the discipline to navigate this process for attaining a visa shortly after graduation are able to transition quicker than those who do not.

Second, personal networks are vital for a transition to work. Just as a lack of networks and extended social capital may be a barrier, their presence is seen as an enabler (Blackmore et al., 2015, Zikic et al., 2010). Aten et al. (2016) also point out that these networks may extend from people in their home countries that have connections or influence in the new country.

Finally, participating in development opportunities in a new country assists the transition to work. These include enrolling in local training, and education to acquire local credentials and develop a network (Aten et al., 2016; Zikic et al., 2010). These might include mentoring from local residents where cultural awareness, and an introduction to a network had greater significance than skill development. Likewise, gaining meaningful work experience in the host country increases the migrant's ability to apply for higher-level roles (Connell et al. (2009).

Al Ariss (2010) outline four modes of engagement that migrant professionals may use for managing the contextual barriers of winning work: Maintenance, refers to migrants who recognise the barriers to success and work within them to reach their desired role; Transformation refers to those migrants who see the barriers and seek to alter them; Entrepreneurship refers to those migrants who start up their own businesses to avoid the barriers; and Opting-out refers to those migrants who return home or work purely for income but not in their target career. Against this backdrop, we introduce and compare our case study participants.

3. Participants

The case study was of 14 postgraduate alumni from a public sector Australian university. They came from Finland, the USA, Vietnam, Iran, and Hong Kong with most from India. Different alumni had different reasons for studying in Australia, varied Australian career aspirations and varied plans to remain in Australia. All participants engaged in a three-month university-coordinated internship. Five of the 14 participants won professional roles within 3 months of graduating. Two of this group participated in semi-structured interviews of around one hour each. They were both Indian and selected both as self-identified career successes; and because Indian students were in the majority for the case study group. Indians were also the second largest proportion of onshore international students in Australia in 2016 (15%) following China (Dept. of Education, 2017; ABS, 2017). The two graduates were both engineers, approximately 30 years of age with significant Indian work experience and they wished to become consultants. Both were offered contract work with their internship employer. They have continued to work with this employer, amongst others, on a contract basis as consultants. To date, their clients have been drawn from their networks, and their goal is to continue as private consultants until they have an opportunity to join a large consultancy firm.

4. Findings

Anecdotal feedback from the broader case study group and the two in-depth interviews revealed perceptions of the biggest obstacle to gaining employment in Western Australia (WA) was their **visa** status and immigration position. Their experiences suggested that most organisations required clear proof of a right to work in Australia. They noted that jobs on the *LinkedIn* platform, even with no applicants, had the same requirement.

A second barrier they identified was **time** devoted to building **networks** and understanding local norms. Grad 1 suggested that '*The amount of time spent by an international student in WA is directly proportional to the employment opportunities created for oneself.'* The two interviewees perceived that that the more time international students and graduates devoted to attending network events and gaining social skills, the easier the transition to work. For example, Grad 2 suggested,

> '*The wider the culture differential between the international student and the WA way of life, the longer the adaptability to social cues and the work culture of the organisations. International students who are more open to change, and embrace it to socialise easily, are accepted into the workforce faster. For some internationals, it takes a lot of time to pick the necessary social skills.'*

Of the 14 students in this case study, those who invested time in developing local networks were more successful in winning professional work and at a faster rate than those who did not. One of those interviewed suggested that time barriers limited the development of valuable network connections. Grad 1 reported, '*WA (Western Australia) is a close-knit work community. … establishing a valued network of individuals who can help you transition into employment is a huge and time-taking task which international students are short on while studying.'*

Having a plan to transition into the workforce was seen as an enabler. Many international students had a linear approach to winning work that was sub-optimal in that they waited until recuperating from completing their degree before starting the visa application process. Whereas, those students who developed a plan to counteract the visa issue and other barriers to work, not only built self-confidence but also saved time. All five of the graduates who were successful in winning professional work had started their visa application process prior to graduating. Grad 1 cited one international student who did not plan his work visa application process post degree: *'The organisation which offered him a position contingent on a visa, rescinded the offer after waiting for several weeks*.'

Personal characteristics of pro-activeness and perseverance were cited as reasons for success. Grad 1 suggested that, "*As an introvert, I had to make a conscious effort to become an extrovert in social events. This was done to be able to sustain networks established in the class and to expand the number of valuable external network connections'.* Perseverance was another personal characteristic identified. Graduates discussed that applying for jobs can be demoralising generally, so for the international graduate who needs a high return on their investment it can seem even more daunting. Several graduates spoke with the researcher sharing their frustration and the effort required. Grad 2 suggested that, '*We have persevered through difficult projects, at lower pay to prove our worth and make our work speak louder than our race, ethnicity and English-speaking abilities. One international student … struggled for months, every day after graduation, but landed a job five months after graduation. … the ideal position can take months …'.*

Finally, good performance was also considered an enabler. Across the 14 students, there seemed to be a positive correlation between students with good grades and those who successfully transitioned to work. Grad 2 suggested '*Performing well in individual areas of interest not only increased subject expertise but also built up our confidence to perform better for interviews and formal interactions'.*

5. Discussion and Recommendations

Many universities have active Work Integrated Learning (WIL) programs, and the literature and findings from this research indicates many of the issues of transition are known. Yet, international students continue to underperform against their domestic counterparts when transitioning to professional employment. The following discussion outlines eight insights into what universities can do to improve career success for willing students, whilst also acknowledging that students need to participate in their own career self-management.

First, acknowledge that students have varied reasons for studying in a foreign country and not all will want to transition to professional work after graduation, therefore, there is value in identifying students who plan to apply for a visa and a professional career and to invest extra effort with this group.

Second, it is important that students are encouraged to multi-task in transitioning to professional work. Explain that the transition to work is not a linear process and that they need to build their networks at least 18 months out, and start the visa application process in their final semester.

Third, assist students with a strategic career planning, including networking. Such plans should aim to engage with people outside the student's cultural group, especially were local language is spoken; and with industry and recruitment companies. This can be achieved through recruitment events, career fairs, industry guest speakers and industry forums.

Fourth, provide wrap-around workshops and activities on strategies for winning work. These might include workshops or online resources for building capability with LinkedIn, CV writing, interview skills, networking with industry and communication with non-peers.

Fifth, invite immigration authorities to speak on the process for post-study work visa applications. The focus of these presentations needs to be on content and clarity around timelines.

Sixth, highlight that good grades alone will not guarantee a job. Employers are looking for quality and breadth in their talent search, which includes at least communication skills, teamwork, and problem solving skills; and may also include signs of commitment to their new community through evidence of volunteering and other community involvement.

Seventh, employers are looking for students with meaningful project-based work experience not tick-the-box internships where the work may be menial. A university that offers opportunities for significant work experience to final year students will have a marketing edge.

Finally, council students to consider various modes of engagement with work open to them. Some students may be unrealistic about their options, while others are prepared and plan to work their way to their preferred role, or to start their own business.

6. Conclusion and future research

A literature review of largely Australian- and Canadian-centric research has been contrasted with a small case study from one Australian university. The outcome is eight considerations for universities seeking to improve student success in a transition to professional employment. There is scope to enlarge the case study, complete more interviews and work with international colleagues interested in this area to expand the field of participants and the international focus of the work.

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Transforming YouTube into a valid source of knowledge for Anatomy students

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Abstract

YouTube is a free and easily accessible tool, with growing importance in the teaching field due to the content of the videos and their interaction options through comments, responses and insertion in social networks. However, some limitations can reduce the value of this tool in University teaching if institutional control is not carried out. Our project consists of the search for experiences based on learning Anatomy on YouTube to be able to incorporate this tool in our department. Almost all researchers found that most of students use YouTube as a source of anatomical knowledge, despite limitations and criticism based on ethical and privacy issues, the video experience itself, the YouTube search algorithm, lack of quality control, advertising purposes or excessive video offer. Researchers experienced that most of the available videos had a poor quality and many mistakes, so professors must be involved in the search and selection of the best appropriate videos. We conclude that YouTube can be used as a source of knowledge for anatomical learning. However it is necessary to inform students of the inconveniences and risks, and make a critical selection by the professors of the videos that best fit in the teaching program.

Keywords: *YouTube learning Anatomy videos reliability dissection.*

1. Introduction

The teaching of medicine has followed a practically constant pattern during centuries until the emergence of Internet that have provided doctors, educators and students with smartphone applications, social networks, blogs and media exchange (Farnan et al., 2008). Multimedia resources had a special impact, especially video, which allows students to control the extent of assimilated knowledge and the way of presenting it, with a series of tools that allow them to pause, rewind and re-view the topics according to their own rhythm of content acquisition (Patel et al., 2015). Conventional Anatomy teaching methods have evolved into combined learning that incorporates multimedia and other technological advances that support different formats of combined learning (Barry et al., 2016). The aim of our reseach focuses on dissection videos for teaching Anatomy in medical schools, because the face-to-face dissection courses do not represent a uniform learning experience, with different students directing the practice in a different way of dissection, sometimes in divergent ways (Bergman, 2015). There are virtual models that allow students to navigate instantly and remove layers of tissue to observe for example the path of a nerve, however they require expensive licenses that not all universities are willing to assume (Bergman, 2015).

These new technologies pose challenges for professors and educators, but also opportunities (Farnan et al., 2008). The creation of models and videos represent an additional time and effort for teachers that is not always possible to face by the institution (Jaffar, 2012). Teachers should recognize the importance of video sharing sites like YouTube in education and invest in the use of Web 2.0. to apply their possibilities in teaching (Azer, 2012). Unlike the tools described above, YouTube is a free of charge and worldwide available webpage, for which access is enough with a computer, tablet or smartphone with an Internet connection (Bergman, 2015).

Our Anatomy Department asks whether it is useful or not to recommend certain YouTube videos to students. The aim of our research focuses on perform searches with an institutional filter to incorporate this tool in the learning of the structure of the human body.

2. Objectives

Our goal is to conduct a bibliographic search for research on student/teacher experiences in the last decade of using YouTube to learn/teach Anatomy,to be able to incorporate this tool to the teaching of Anatomy in our department.

3. Material and Methods

We conducted a bibliographic search in Pubmed and Google Scholar including the keywords "youtube", "Anatomy", "videos", "learning" to find experiences of incorporating the video portal to anatomical teaching. The detailed reading of the results allowed us to establish conclusions to consider incorporating YouTube videos in the teaching of Anatomy in our department.

4. Results

4.1. YouTube use by Anatomy students

YouTube is able to offer updated educational resources aimed at medical students by adding not only the multimedia content itself, but the additional functionality of providing interactive media among users: students can add comments, answer to them and exchange videos with each other (Rabee et al., 2015). Students of the new generations actively interact with social networks to integrate them into their educational experience, participating with the course materials and sharing their knowledge, often waiting for immediate responses and comments (Barry et al., 2016). There have been several studies that have explored the percentage of Health Sciences students who use YouTube as an educational resource:

- Rapp et al. (2016) conducted a study in the state of Iowa where 90% of respondents reported watching videos for their surgery classes, being YouTube the most used source among respondents (86%).
- Hulme et al. (2017) cite that 78% of the students who used web platforms to obtain information used YouTube as their main source of video.
- Patel et al. (2015) asked to 91 second-year medical students if they used Internet-based resources as a teaching source for the Anatomy subject, stating that 98% used YouTube as a source of information, and 92% found Anatomy videos beneficial for their learning.
- Rodriguez et al. (2018) reported that 95% of surgery residents used YouTube to face surgery and investigate cases, especially when learning a specific technique; compared to 25% who used the SCORE website. However, they confessed that most of them did not investigate beyond the first options shown on the first page of the search engine.
- Jaffar (2012) found that 98% of their students used YouTube as a source to gain knowledge of Anatomy applied to medicine.
- Barry et al. (2016) asked their students about the method they used to learn Anatomy, finding that 34% of students watched anatomical videos once a month, 26% once a week, 16% once a semester, 14% always and 10 % three times per

week. The utility found by the students was very high, with 78% qualifying them as useful, although 22% indicated that the utility varied depending on the content.

4.2. Challenges and disadvantages of YouTube as a learning tool

The main criticisms found in the literature can be grouped into:

- General criticisms of video Anatomy learning:
  - Self-study is not always beneficial for the student, since it is necessary to have the guidance and guardianship of experts in Medicine and Anatomy (Bergman, 2015).
  - The video is not able to report on the texture of the tissues and the kinesthetic aspects that corpse dissection does (Patel et al., 2015).
  - The Anatomy videos available on the Internet do not always raise awareness about the ethical problems inherent in the filming of corpses, such as the origin of the videos, the subject's permission for filming and distribution online. It is necessary the discussion in classroom of this ethical issues (Barry et al., 2016).
  - On many occasions, the students themselves record these videos to upload to their social networks. Even if the intention is educational, it is questionable whether these students have had the permission of the institutional authority for these recordings. Therefore, students should be cautious to avoid these non-professional behaviors (Raikos & Waidyasekara, 2014).
- Criticisms regarding the use of social networks for learning:
  - Many students and teachers do not feel comfortable using social media platforms, which can disturb the teacher-student relationship. In many cases, privacy issues also arise with the accounts associated with these platforms (Barry et al., 2016).
- Criticisms regarding how YouTube works as a platform:
  - YouTube videos are shown by popularity when applying a patented algorithm that includes the count of visits, user history and comments, without taking into account the quality, usefulness or veracity (Rodriguez et al. , 2018).
  - Videos are usually uploaded without quality control, finding unregulated, inaccurate, misleading or biased content (Raikos & Waidyasekara, 2014).
  - The indiscriminate upload of videos by any user prevents new generations from knowing the ethical problems related to the use of web-based videos whose origin is unknown (Barry et al., 2016).
  - In many cases, YouTube videos aim to promote and publicize teaching institutions or hospitals, rather than teaching students (Lee et al., 2015).
  - Overcrowded feeling, with too many videos, many of them of low quality, confusing students without knowing where to look (Rabee et al., 2015).
  - Some students may find YouTube as a challenging, slow and frustrating platform (Bergman, 2015).

4.3. Reliability of YouTube anatomical videos

Is it reliable to adress students to YouTube for use it in their knowledge acquisition? Without a guide to specific links to certain videos, it is risky due to the uncontrolled and potentially erroneous content available (Hulme & Strkalj, 2017). The publication of a list of reference links could overcome the credibility challenges of YouTube, which is one of its main drawbacks, as well as saving a lot of time for students and encouraging them to go to this platform: it was reported a 19% increase in the use of YouTube after the publication of the list of links provided by the professors in a study performed by Jaffar (Jaffar, 2012).

In addition, today's students should be taught where to find information and how to discriminate between thousands of sources what is appropriate for learning, so it is needed to provide students with skills to critically evaluate resources such YouTube (Rodriguez et al., 2018). It is important that professors carefully examine the suggested links to determine their adequacy to the content of the subject and their absence of errors (Jaffar, 2012). Several studies have analyzed the videos about Anatomy available on YouTube (some of them had a surgical orientation) to perform a critical analysis on them:

- Lee et al. (2015) evaluated 100 YouTube videos covering 25 hours of content on ten specific topics, observing the first ten videos to appear on each topic. Only 1 video of the 100 analyzed could be classified as "good". 60% of videos about venous puncture or cardiopulmonary resuscitation were classified as “satisfactory”, showing a need for a rigorous evaluation of the quality of medical videos on YouTube. Lee also analyzed 73 videos of laparoscopic cholecystectomy, of which 11 (15.1%) were evaluated as good, 40 (54.8%) moderate and 22 (30.1%) poor. Despite these results, they highlighted the great potential educational value that these videos can have on students, doctors in training, patients and their families.
- Fischer et al. (2013) analyzed videos on knee arthrocentesis. 13 videos met the inclusion criteria, but only 8 were considered useful for didactic purposes (62%). Surprisingly, 6 videos (46%) had a deficiency in the sterility of the technique. The team concludes that it is necessary to improve the teaching materials based on YouTube before recommending them to students
- Azer (2012) performed the search by minutes, analyzing 216 minutes of surface Anatomy content available on YouTube, finding that only 59 minutes (27%) were useful for their students' learning. As optimistic data, the most useful videos had an average views that doubled that of the unhelpful videos. Azer also analyzed 356 comments to check if they could be useful to other students, finding that only 151 were useful, raising some clues for the creators to improve their presentations, for example in technical sections (background noise, camera type), etc. Most of these comments stood out for their brevity.

- Bergman (2015) found that only 25% of the videos analyzed included an adequate and valid anatomical content, considering that the professor must be involved in the search and selection of the best appropriate videos related to the subject.
- Derakhshan et al. (2019) studied videos on facial surgery concluding that they are deficient with respect to the criteria for surgical indication, patient selection or possible complications, with notable absence of intraoperative reference points (for example, the facial nerve or the type of incision was not adequately discussed) or discussion of the key principles. They concluded that until the quality of these videos was improved, they could not recommend them as a complement to their students' learning.
- Rodríguez et al. (2018) analyzed the videos of laparoscopic cholecystectomy available on YouTube and were optimistic to find that the techniques were adequate and with reasonable levels of technical competence.
- Raikos & Waidyasekara (2014) observed that the videos of the Anatomy of the heart that were on YouTube poorly transmitted the anatomical knowledge, Only 25.9% of the videos were able to approve according to their scoring system. The authors attribute it to the fact that many of these videos are made by the students themselves with lack of planning, without a narrative script and with insufficient anatomical knowledge. Therefore it is recommended to underestimate the educational use of YouTube to improve student learning.

4.4. Student experience with the guided use of YouTube videos for anatomical learning

Some institutional YouTube channels can improve the teaching experiences. Jaffar stated that 92% of the students who used the "Human Anatomy Education" channel agreed that this method helped them in anatomical learning, increase understanding of structures, remembering 3D images, and valued availability 24 hours a day (Jaffar , 2012). Numerous studies advance in this line:

- Mukhopadhyay et al. (2014) uploaded 40 videos on dental Anatomy and local anesthesia available to students for more than a year, with a total of 71,000 reproductions especially from the United States and Australia, with an increasing number of visits originating in developing countries.
- Azer et al. (2013) They found 20 relevant videos for cardiovascular system exams and 36 for respiratory system exams. After further screening, the number fell respectively to 9 and 7. Although it is a small number, they can be used by medical students in their autonomous learning.
- Students also recommended video lists including their guidelines for when to use them, such embedding them in blogs or personal pages. Students valued that the videos were among the first to appear in the searches and assessed that the list improved semester after semester (Berk, 2009).

- Welbourne & Grant (2016) highlighted the difficulty of capturing the attention of the public to reach as many students as possible, so it was necessary to understand the factors contributing to the growth of the popularity of channels and videos to ensure that the message is distributed to consolidate long-term success . It is important that communicators present their real face and communicate with the community, avoiding the error of thinking that YouTube is a mere video store since interaction with students and their participation is their true essence.
- Michael L. Wesch, a professor at Kansas State University, wanted to demonstrate the scope of a video about a conference, publishing a video that reached 400,000 views, compared to the few dozen people who attended his lesson in a master class, or a few thousand readers in the case to have been published in a journal. YouTube must be seen as a new way for teachers to communicate and reach a larger audience. "It's easier than people think," Wesch said about making videos online (Young, 2008).

5. Conclusions

After the contrast of the experiences, we conclude that YouTube can be used as a source of knowledge for anatomical learning, but for this it is necessary to inform students of the inconveniences and risks, and make a critical selection by the professors of the videos that best fit in the teaching program.

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From Times Square to Eyre Square: Hackathons as Authentic Learning for Information Systems Students

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Abstract

In order to ensure students meet the learning outcomes for a module in user experience design, an authentic learning approach was used to design a User Experience (UX) Hackathon, called Empathy Jam. UX hackathons are short events where participants work in groups on a challenge, using user-centred design techniques. The learning from the hackathon comes through the process of taking part, as well as collaborative learning from their team members. An important feature of Empathy Jam is collaboration with industry partners who act as mentors to guide the participants through the process. Assessment of learning was done through the use of video and reflective journals. The groups created a video record of their day, demonstrating their engagement and participation as a group, as well as the group learnings. Individual learnings were assessed through reflective journals. Feedback on the event was obtained through the journals, vox pops on the day, a feedback survey and feedback from the mentors.

Keywords: *hackathon; Empathy Jam; authentic learning; user experience design.*

1. Introduction

As part of a review of a Master's level module in user experience design (UXD), Biggs' (1999) constructive alignment approach was used, whereby teaching and learning activities, learning outcomes and assessment techniques are aligned to ensure students meet the learning outcomes through appropriate teaching and learning activities. Assessment techniques can be used both as an aid to learning and to assess whether learning has taken place. This paper will focus on the re-design of the continuous assessment (CA) component of the module.

The previous CA consisted of a group assignment whereby students completed a series of development tasks while engaging with typical users to inform each stage of the process. While some groups fully engaged and used the output from each stage to inform the next, not all did. It was apparent that, similar to groups identified by De Hei, Strijbos, Sjoer, and Admiraal (2014), some groups simply divided the tasks and attempted to fit the results together to produce the final submission. As a result, students were not achieving all the learning outcomes for the module. To rectify this, it was decided to use assessment *for* learning (Nicol & Macfarlane- Dick, 2006) rather than assessment *of* learning.

2. Learning Approaches

2.1. Authentic Learning

A common approach to ensuring students develop necessary employment skills is *authentic learning* (Black, 2019). *Authentic learning* requires an environment with real-world challenges where students use their developing skills and knowledge to solve problems. This often takes the form of work placement or internships. For this module, it was decided that a simulated approach to real-world challenges could be used to provide authentic learning.

According to Wilson (2017), authentic learning requires: authentic, complex and rich problems; an environment that resembles a real-world situation; encouragement of the learner to take ownership of the process; provision of opportunities for realistic interactions; opportunity for reflection on the part of the learner; guidance and facilitation by the instructor. Mejías and Monereo (2017) state authentic learning should motivate students to "become actively involved in the tasks and connect them to the world outside the classroom". They stress authenticity and reality are not necessarily the same thing. Authenticity refers to the extent to which the tasks presented to students are realistic, relevant and socialising.

As most work environments involve a level of collaboration with co-workers, an authentic learning experience should reflect this. Knapper (2008) also suggests collaborative team learning can improve individual student learning. In addition to contributing to an authentic learning experience, collaboration can enhance individual learning (De Hei et al., 2014). Laal and Ghodsi (2012) identify a number of social, psychological and academic benefits to

collaborative learning, including social support for learning, increased self-esteem, improved critical thinking skills, improved motivation and ownership of the learning process.

2.2. Hackathons

The term Hackathon is a combination of hacking, defined as "a usually creatively improvised solution to a computer hardware or programming problem or limitation" (Merriam Webster, 2020) and marathon, which suggests an endurance event. The aim of a hackathon is to bring together people from a variety of backgrounds who will work on a problem for a specified period of time (Calco & Veeck, 2015). They will generally produce some form of prototype to visualize a potential solution to the problem. Coding or technical hackathons are commonly held, but the concept has extended to other areas such as marketing (Calco & Veeck, 2015) and science (Groen & Calderhead, 2015).

According to Komssi, Pichlis, Raatikainen, Kindström, and Järvinen (2015), all hackathons have certain key characteristics: they begin with generation of ideas and team building; they are time-bound, with teams producing a concrete vision of their idea; teams present their idea to the audience; some ideas are judged worthy of further development; participants experience personal development. Some of the key benefits of hackathons to participants are: enhancement of skills, creativity and critical thinking; personal development; innovation; and networking (Calco & Veeck, 2015; Groen & Calderhead, 2015; Komssi et al., 2015).

2.3. Hackathons in Education

As hackathons enhance participant skills and knowledge by allowing them to actively engage with a problem, there is potential to use them as a learning tool for students. Gama, Alencar, Calegario, Neves, and Alessio (2018) state hackathons are a useful tool for experiential learning as they provide the practical, contextual and social aspects required. They are also useful as a mechanism for peer learning. Kienzler and Fontanesi (2016) recognised the hackathon as an approach that, through inquiry, facilitates collaborative learning. Through the use of a one-day classroom hackathon, they applied an Inquiry Based Learning (IBL) approach to facilitate Global Health students gaining knowledge through independent inquiry and the development of transferrable skills. Similarly, Gama et al. (2018) used a 24-hour classroom hackathon for an Internet of Things class while Page, Sweeney, Buruce, and Baxter (2016) held a 5-day hackathon for Product Design and Digital Interaction education.

When using hackathons for educational purposes, Page et al. (2016) suggest: using icebreakers for the teams; providing teams with sufficient wall space for display and collective discussion; providing guidelines on team formation; discouraging the use of technology at the early stages; provision of guidelines to assess progress; provision of similar facilities to all teams; and provision of a relevant and future-oriented conclusion.

3. Empathy Jam: From New York to Galway

Empathy Jam (https://www.empathyjam.com) originated in New York in 2016. Their tagline is "Empathize, collaborate, and design a better New York". It is a day long user research and design hackathon, similar to a coding hackathon but focusing on the User Experience (UX) process, rather than technical development. Participants perform user research with people in the locality, use the information to create design solutions and then test these solutions.

In November 2018, the inaugural Empathy Jam Galway took place just off Eyre Square, in the city centre. Mentors, judges and speakers, all well-versed in the skills needed for UX design, came from industry and academia in order to give a broad perspective to participants. Prizes, refreshments and lunch were sponsored by local organisations. External to the MSc class, the event was promoted through mailing lists, a press release, Twitter, LinkedIn, the University calendar and on screens in the University. In total, there were 40 participants, 25 from the MSc class and 15 external participants who came from industry, a research background, or just thought "it would be a fun thing to do".

Prior to the event, the participants were given helpful links to similar events and to UX sites and stories. Twitter, Facebook and LinkedIn were all used to engage the participants. The challenges were presented on the day, but hints were tweeted in advance. The challenges the participants addressed were based on issues that affect the citizens of Galway.

The day provided an authentic learning experience by following an accelerated approach to user research and design. The guidance by Page et al. (2016) on using hackathons for education purposes was followed. Additionally, talks were given by experts on empathy and user research prior to the initial exploratory and user research sessions. A talk on low-fidelity prototyping was given before the next phase, which required participants to consolidate the results of their user research, create paper prototypes and test them with potential users.

4. Empathy Jam Galway

4.1. Background

The students who participated in this UX hackathon were studying for an MSc in Information Systems management. The cohort involved in this exercise had varied backgrounds. Some progressed directly from a variety of undergraduate programmes (e.g. Arts, Business, Engineering) while others were mature students who had already spent a number of years working in a technical role. None had a background in UXD.

The skills taught in the module are those of user-centred design. Students need to understand the importance of:

- User research as a way of understanding what the user needs.

- Design skills to determine the best approach to create the user experience.
- Evaluation skills so they can hone and perfect the design.

Empathy, which facilitates understanding the user, is a key requirement to building an effective user experience. However, research (Lunström, Åberg, & Blomkvist, 2015) has found people, particularly males, working in the technology field tend to have lower empathy. The demographics in the MSc class described in this study has always been more skewed towards males with a technical background. They tend to be strong students technically but often lacking in the softer skills needed to design an effective user experience.

As part of the re-design of this module, it was decided the assignment should provide the students with an authentic learning experience to enable them to fully understand the importance of user involvement. Empathy Jam Galway was considered an ideal approach to facilitate this. The day was a collaborative effort, including mentors and judges from academia and industry, thus exposing students to experience from both. Industry involvement was considered an important feature of the authentic learning experience for students.

4.2. The Process

On the day itself, participants arrived at 9am for registration/refreshments/networking. They formed groups of 5. The participants were given templates for empathy maps and user flow diagrams. They were also given tips on how to conduct user research effectively. Guerrilla user interviews, which are short and quick, were encouraged. The challenges were presented, and the day began in earnest. In order to maximise the engagement of the public, locally relevant challenges were chosen:

- How might technology ease the issue of traffic congestion in Galway City?
- How might elderly people engage with technology to prevent loneliness and social exclusion?

The teams were encouraged to explore their chosen challenge with the guidance of mentors, who helped the teams to understand the importance of planning and research. Mentors were particularly good at pulling back teams who just wanted to start designing, by helping them to tackle the challenge in a holistic way. The teams explored their chosen problem and planned how best to engage potential users and to gather data relating to the problem. They then went out into the city and conducted user research.

The teams, many of whom were nervous about the prospect of approaching strangers in the street, arrived back from the sessions excited and enthusiastic. They now seemed to understand the importance of engaging with users. Their preconceptions were challenged. Suddenly they were no longer dealing with a technical problem but a human one.

4.3. Prototyping and testing

After lunch, participants were given a talk on prototyping. The emphasis was on low-fidelity approaches. They then spent time synthesising their research findings and creating prototypes with the variety of materials (paper, pencils, sticky notes etc.) provided to them. The mentors were again on hand to offer help and advice. The next step was testing the prototypes. With help from the mentors, the participants planned how best to conduct testing. Quick and dirty approaches, which are suitable for low fidelity prototypes, were encouraged. The participants again had a good response from people on the street. Once they synthesised the feedback, they updated the prototypes and presented on their experience.

4.4. Presentations and judgement time

Each team had 3 minutes to present their project. It was interesting to see how the teams progressed. Some had false starts and some pivoted on their ideas. The key was each team was open to change and feedback, which is required to create an empathy-driven solution. Prizes were awarded for the most civic minded solution, the most innovative solution, and best user research. A summary of the day can be seen at https://gopro.com/v/KRRedn7kDa19D. It was obvious teams now recognised the importance of user involvement and empathy in the design process, thus fulfilling the main aim of the re-designed assignment. Their confidence was also enhanced in the use of the process.

4.5. The assignment

Previous assignments for this module were in a traditional written format. As part of the module review, it was decided to explore alternative approaches, with a video record of the day being chosen as the most appropriate format. Hawley and Allen (2018) state the main benefits of video creation for assignments include learning digital and communication skills and increased learning on the subject matter. Students also enjoy the process and it motivates them to learn. However, it is important to ensure the assignment aligns with the learning outcomes for the module. It is also necessary to provide students with support for the process as it is a relatively innovative approach.

The groups were asked to produce a 7-minute video to demonstrate what they did, and what they learned, on the day. The videos were then posted on a YouTube channel (https://www.youtube.com/playlist?list=PLc5frCfH2v_DU62LFYZZIHFv12r_ieQD-) for assessment. For inspiration, they were pointed to some vlogs created by attendees of hackathons. They were provided with advice on copyright, as well as pointers to potential tools. The university has a MakerSpace resource where students can borrow equipment such as drones, gimbals and cameras. They also provide training sessions on mobile phone video production. Students were also required to submit a 1-page reflective journal detailing what went well, what could be improved, and what they felt were their main personal learnings.

The videos demonstrated the enthusiasm and engagement of the students. From the videos, reflective journals and discussions, it was clear they had met the learning outcomes. Several students asked could more events of this nature be organised, as it really helped them to understand the importance of user involvement and how user involvement improves design. Additional feedback was also obtained through vox pops on the day, a feedback survey and feedback from mentors. The feedback was predominantly positive, but some changes were made going forward. The expert talks at the beginning of the sessions were streamlined and some additional tools were suggested to participants for user research and testing.

5. Learnings from Empathy Jam Galway

Empathy Jam Galway was very successful, with learnings for students and the lecturer. Students learned vital skills for user experience design and developed an understanding of the importance of empathy and user involvement for product development. Additionally, they learned valuable communication and teamworking skills. The lecturer learned the importance of adding realism to assignments, in order to ensure learning outcomes are met.

The event was a success for a number of reasons, not least because of the involvement of industry partners who provided mentors with real world experience. Students felt this added additional realism. The mentors were also essential in guiding participants and ensuring they approached the challenges in an appropriately user-centred manner. The careful planning of the day, following an authentic learning approach, was important to ensure a well-managed event that allowed the participants to complete the challenge in the timeframe allowed.

For events of this nature, the author recommends: careful structuring of the event, using an authentic learning approach; industry partnership; mentors who can keep the process on track; and provision of resources, such as talks, tools (e.g. empathy maps) and materials for brainstorming and design. It is also important the challenges are relevant to the local community in order to ensure willingness on the part of the public to co-operate with participants. Engagement via social media in advance of the event also helped generate excitement and enthusiasm amongst the participants. While the video assessment was very successful, it is essential to provide adequate guidance and tools to allow the students to complete the videos successfully. Requiring a reflective journal is important to give the students an opportunity for personal reflection to consolidate their learnings. Overall, the use of a UX Hackathon for a class of this nature was very successful. It could also be easily adapted to other subject areas, such as coding, market research and product design.

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The development of soft skills among students during a business game

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Abstract

The growth of competitiveness of university graduates in the labor market is growing due to the development of soft skills. The purpose of this article was to identify the most rational form of practical training for the development of soft skills among students. The paper used an analysis of the effectiveness of the application of the author's methodology for conducting a business game. The empirical basis was the results of a sociological survey of students based on the results of practical exercises in the form of the business game "Search for Truth". The opinion poll was attended by 487 students from 39 study groups. As a result, it was found that this form allows students to increase the development efficiency of creativity, the ability to go out to innovative knowledge, communication skills, the ability to work in a team, fairly evaluate their colleagues, leadership qualities, and stress resistance. The growth of excitement in achieving victory, a sense of responsibility for collective actions as part of multilingual and multicultural groups is revealed. Ways of neutralizing negative phenomena during and after classes are proposed. The study showed that the business game contributes to the development of soft skills among students.

Keywords: *Soft skills; business game; efficiency; educational process; innovation.*

1. Introduction

The effectiveness of student learning in modern higher education largely depends on the professionalism of teachers and the technologies that they use in the training. Their activities should ensure that students are taught the skills that are most in demand on the labor market (Buley et al, 2018). Recently, there has been a tendency to increase the importance of soft competencies in business and government institutions. The most difficult to develop and strengthen such ones as creativity (Matraeva, et al, 2020), communicative skills in a multilingual and multicultural team, the ability to work in a team, and fairly evaluate their colleagues (Nikiporets-Takigawa, 2018). They seek to solve this problem through the use of gaming techniques, the gamification of education (Marti-Parreno et al, 2016; Lumsden et al, 2016; Vinichenko et al, 2019), and the use of coaching (Dunbar, 2019).

In the academic environment, there is a search for creating conditions for the exchange of knowledge, experience in improving the effectiveness of training (Al-Kurdi, et al, 2019), creating favorable conditions for learning (Laseinde et al, 2019). The issues of using artificial intelligence are considered (Shakhovska, et al, 2019), ways to solve the problem of employment are discussed (Demchenko et al, 2017).

There are various approaches and techniques for identifying and developing soft competencies. However, a universal technique does not exist. A search is underway for the most acceptable approaches and methods for achieving the learning objectives. This study seeks to become a link in the chain of success in the development of soft competencies among students.

2. Methodology

The purpose of the study is to identify the most rational form of practical training for the development of soft competencies. In order to identify the most optimal form of conducting practical exercises, a technique was developed. It was tested in the operating mode during the pedagogical experiment for 12 years with various changes and additions based on the identified problem areas. In its present form, it is called the "Search for Truth." In a formal simplified form, this is the technology “Question-answer with assessment by an expert group”. The study group is divided into two opposing groups and an expert group. They are seated in a special way (Figure 1). Opposing groups are located opposite each other (face-to-face), an expert group is between them.

Figure 1. Options for a business game. Source: Designed by the authors

Opponent groups organize themselves in a team with a leader and choose their name. They prepare 5-10 questions on the basis of material studied during the lecture. Questions are written on paper in duplicate. One copy is given to the expert group for evaluation. It takes 15-30 minutes.

Then the competition begins. One member of the first opposing group asks a question. The second opposing group prepares an answer within 1-3 minutes. After the collective development of the answer option, one of the members of the second group answers the question posed. The expert group online estimates both the question and the answer and notes in the table (Table 1).

Then the second opposing group asks its own question and receives the answer in the same way. This procedure continues until all questions are asked. Then the expert group summarizes the points of the opposing groups for both questions and answers, then announces the winner. The group that scored the most points wins. The expert group also determines the best question and the best answer. Then the teacher evaluates the work of all groups, starting with the opponents. He also analyzes the quality of questions and answers, points to the positive aspects and shortcomings.

Table 1. Expert evaluation table discussion.

1 opposing group					**2 opposing group**				
questions					**questions**				
	expert	expert	expert	Overall score		expert	expert	expert	Overall score
1					1				
2					2				
3					3				
4					4				
5					5				
answers					**answers**				
1					1				
2					2				
3					3				
4					4				
5					5				
total					total				

Source: Designed by the authors.

(Assessment of questions: 0 points - there is a direct answer in the text of the lecture; 1 point - causes discussion on the topic; 2 points - leads to a systematization of knowledge; 3 points - forms innovative knowledge; Assessment of answers: 0 points - the answer is taken in the text of the lecture; 1 point - discusses the topic of the lecture; 2 points - systematizes the acquired knowledge; 3 points - forms the answer in the form of innovative knowledge).

During the pedagogical experiment, 185 classes were held with 39 study groups (487 students). They were, 27 multicultural groups and 12 multilingual and multicultural groups. At the end of the course, soft skills were evaluated with students, and a survey was conducted on the effectiveness of this form of training. Students took part in a sociological survey to identify the effectiveness of the development of soft skills during the business game "Search for Truth."

During the course, feedback was organized to improve the preparation and conduct of the business game. The teacher took into account the wishes of students to improve the class.

Many skills were measured using this technique. There is a difficulty in measuring skills such as creativity. You can't rate it in points. We always rated it as "Amazing!" and encouraged by praise and appreciation.

The article draws conclusions based on student surveys during and after the course. Statistics were given at the end of the course. The rating scale was based on the Likert methodology using a 5-point system. Also, these data were discussed at a focus group with the involvement of teachers, specialists, and methodologists.

3. Results and Discussion

In the course of the study, it was found that when studying the "Human Resource Management" course using a business game as a form of conducting practical (seminar) classes, the effectiveness of the development of creativity, the ability to enter innovative knowledge among students increased by 27%, communication skills - by 41%, and the ability to work in the team - by 43%, fairly evaluate their colleagues - by 35%, leadership qualities - by 23%, stress resistance - by 31%.

Sustainability of skills was determined after completing the course, the university using feedback from graduates and their employers.

Resistance to stress was determined by constantly monitoring students' behavior during the game and in everyday life.

During the survey of students, it was possible to establish that the development of excitement, the desire to win in a business game, which activated students' creative potential, became characteristic features. There was an increase in maturity in assessing the essence of the

issues discussed and the ability to conduct a discussion correctly. The sense of responsibility for collective actions was aggravated, leadership qualities were formed during the allocation of an informal leader, as well as trust in team members. The most active and ambitious students, even being the leader of the group, sought to get into the expert group, considering membership in it to be of a higher status. Students of different cultures, religions, languages sought to combine their efforts in achieving victory over the opposing group. Sometimes it was necessary to use a double translation: English-French-Russian for a more complete understanding of the essence of the question or answer.

The emergence of negative emotions and attitudes towards their opponents against the background of the duration of competition after the end of the business game was noted as problem areas. Sometimes sharp discussions arose not on the topic of a business game, but on the quality of the assessment of questions and answers. It should be noted that the main part of the negative phenomena manifested itself in the initial stage of practical training in this form of a business game. In subsequent classes, the negative consequences were eliminated by replacing the experts, changing the composition of the opposing groups, and explanatory work of the teacher. A rare occurrence (less than 1%) was the refusal of students to participate in the next business game due to poor knowledge of the language in which the business game was conducted (Russian, English).

The most effective ways of developing soft competencies among students were identified:

- Free, creative atmosphere.
- Involving students in the search for urgent problems, competitive ideas.
- Providing an opportunity to assess the essence of issues and speaking skills.
- Development of the ability to find the right answer quickly.
- Skillful use of the students' potential of various faiths, races, ethnic groups, language groups.
- Identification of students' leadership qualities required in managerial activities.
- Formation of an effective creative team.

4. Conclusion

Improving the effectiveness of the educational process in the interests of business lies in the application of modern pedagogical technologies. The use of gaming methods contributes to the development of soft competencies in demand on the labor market. The search for the most rational form of conducting practical exercises for the development of soft competencies made it possible to identify one of them - the business game "Search for Truth". Its

implementation allows you to develop such competencies as the development of creativity, the ability to reach innovative knowledge among students, communication skills, the ability to work in a team, fairly evaluate your colleagues, leadership skills, stress resistance. The solution of identified problem areas is in the field of pedagogical skills, the level of development of soft competencies. Using innovative forms of conducting classes will improve the quality of training.

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"Post-it mapping": analogical disruption in the classroom

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Abstract

Educators need to prepare students for an increasingly complex andinterconnected world, and traditional teaching methods can fail to help students develop some of the needed skills. We set up to combine flipped-calssroom strategies and mapping techniques with the aim to encourage creativity and adaptability while ensuring deep learning of complex theoretical concepts. A simple analogical disruption was added, in the shape of post-it notes used to build concept maps, to disturb an otherwise heavy technology-based course. Our teachinginnovation has been pilot tested in a range of groups and theoretical concepts with preliminary positive feedback being reported by students. They have described the innovation as "an entertaining change", but also referring to improvements on their information searching and critical thinking skills. Students also found that the analogical mapping activity through post-it notes encouraged participation and an active attitude in class. Overall, they reported an improved understading of complex concepts and to their independent learning skills, which appears to support the literature linking visual representations and summary exercises with high student satisfaction and improvements in meaningful learning.

Keywords: *concept map; analogical disruption, critical thinking; flipped classroom; creativity; business education.*

1. Introduction

The current ever-changing global economy demands Higher Education institutions to add a wide range of adaptation-building skills to the specific competences needed in professional fields. Educators in general, and those in business-related fields in particular, need to prepare students for an increasingly complex and interconnected world. It has been shown that traditional methods fail to help students develop some of these essential skills, and the need to adapt teaching methods accordingly has been widely discussed (Juaneda, 2019).

In such context, we have been investigating new approaches to teaching complex theoretical concepts in business-related courses. We had previous experience adapting flipped-classroom strategies in our courses' toolkit, where instructors act as advisers, experts, facilitators or supervisors, depending on the needs. We had also occasionally applied different types of mapping techniques as visual aids to assist deep learning for elaborated concepts (see below). Lastly, we set up to combine both approaches adding a specific characteristic that we thought might be relevant in the current teaching environment ominated by Information Technologies: an analogical disruption. We attempted this by swapping software-based mapping with an analogical version using post-it notes, trying to encourage creativity and adaptability to limited resources. Our aim was to disrupt the classroom with a handmade activity that will alter the static and low participation we sometimes find associated with computer-based teaching.

1.1. Concept maps and analogical disruption

We initially set up to work with Novakian concept mapping (Novak & Cañas, 2006) as a tool to display complex information visually, including the possibility to add structured concept associations amongst statements/propositions (connective terms and labelled linking lines). The main benefit of concept maps has been described as turning hidden implicit concepts into externally explicit structures (Albherg, 2013). Our aim was to visually hierarchize relationships between elements, considered building blocks of complex theoretical concepts. However, we prioritized flexible organization of ideas and discussion of concepts over formal aspects of the finalized maps, so the students' creations might loosely resemble classical concept maps.

Most mapping techniques present a common goal: to promote "deep" and not "surface" learning and encourage independent learning (Svinicki, 2004). Also, most students find it easier to follow maps than verbal/written descriptions, and map-making has been shown to require more active engagement improving learning outcomes (Albherg, 2013). This is due to the dual coding process involved in the mapping process: verbal (propositional form) as well as pictorical (visual). Some disadvantages have also been reported, such as the need for some training, idiosyncratic designs and lower than expected memorability in complex cases (Davies, 2011).

Nowadays, formal visual representation of difficult theoretical statements can be greatly facilitated with the use of information and computer technology, and computer-assisted mapping has been shown to be effective to teach and develop critical thinking skills (Clarke et al., 2006). On the other hand, old-fashioned "crafty" methods can be used to disrupt heavy technology-based classrooms in unexpected ways (Coker & Whalen, 2019). We thought that the extra manipulation and physical activity involved when working with analogical tools and presentations, could improve student attention, focus and retention (Haapala, 2012). In this regard, post-it notes are inexpensive, widely available and could take part on a variety of educational dynamics with little preparation, such as brainstorming or creative visual activities. The fact that they are colour-coded and can be found in a variety of sizes and shapes makes them especially suited for categorization and mind-organization activities, such as creating concept maps.

1.2. Creativity and learning styles

One of the key tasks for educators in business-related programs is to prepare learners to be capable of participating creatively in an innovation economy. Therefore, teaching innovations should require the strengthening of individual and group thinking to define, produce and select creative ideas. Creativity can be understood as the ability to challenge assumptions, make connections and finding new solutions (De Bono, 1995), and in the current innovative society success depends as much on competitiveness as it does on creative problem solving. Maps can be considered among a range of teaching techniques useful to build creativity: they can assist with problem definition, idea generation, decomposing and analysis,
and require brainstorming, which in turn improves idea formation, especially in a group setting. Another factor to take in consideration is the reported shortage of critical thinking skills in business-related curricula (Jance & Morgan, 2013). And mapping techniques have been shown to improve these highly sought-after skills (Kunsch, 2014).

Support of the various students' learning styles is paramount for an effective business-related education, and instructors are required to use innovative techniques that cater for this diversity of learning styles. Visual learners remember pictures and diagrams best, while verbal learners prefer written or spoken words. In this context, maps and concept diagrams are valid methods to reach the visual learner who has been traditionally overlooked in higher education (Clarke III et al., 2006). Furthermore, all these factors are especially relevant to teach today's "Net Generation" learners, who process information in a randomized or networked pattern, which makes them especially suited to building concept maps (Matulich, 2008).

1.3. Objectives

This paper aims to present a teaching innovation we have applied to different scenarios and tested at a pilot stage. The internal feedback received from students and our own experience after years teaching similar concepts, has made us decide to set up a research project to evaluate this innovation during the next semester (fall 2020) with at least 4 groups of students to systematically assess their satisfaction and compare perceived learning outcomes. We think Head20 could be the perfect environment to discuss and refine our innovation.

2. Teaching intervention

Motivated by the twin goals of using active learning and responsiveness to a diversity of learning styles to enhance learning, we decided to use concept mapping as a creative problem-solving activity to teach different theoretical concepts composed of various items or phases (e.g.: market research design, product development, macroenvironment or web analytics 2.0). We have so far used this approach to teach 2nd and 3rd year undergraduate marketing students (4 years degree), gender and age ranges showed in table 1, in a range of different modules (e.g.: market research, strategic marketing, fundamentals of marketing, product management, etc.), all entitled to continuous assessment, what means completing a final exam (60%), group coursework (25%). The main learning objects for the intervention were, apart from those related to the assimilation of the specific theoretical concept being taught, to improve students' information searching skills and to increase critical thinking capacity towards selection and integration of complex ideas. The intervention was divided into four steps: online information search, assessment and summary of information, presentation of results in map format, and feedback. The time frame was set to five sessions,120 minutes each,working with groups of around 25 students (smaller groups should require less time).

Table 1. Distribution of student by gender and age group.

Ages	Men	Women	Total
17-19	15,8%	28,1%	20,2%
20-22	71,9%	56,3%	66,3%
23 or more	12,3%	15,6%	13,5%
Total	64,0%	36,0%	100,0%

Source: own elaboration

2.1. Session 1: Instructions and information search

The instructions were presented to the students, including the number of sessions, steps involved and the main goals and learning objects of the activity. Students were provided with access to the internet, a board, post-it notes and markers. The theoretical concept was then briefly introduced by the instructor, and the students allowed to search for initial information on the topic online. The aim during this session was to find key definitions and identify the main items/components related to the theoretical concept.

2.2. Session 2: Further in-depth information search

The second session started with a quick overview by the instructor on the topic, reviewing the key definitions and the main items/components as found in the previous session (we would recommend working with four to seven components).

Figure 1. Initial overview presented by instructor at the beginning of session 2, based on the main items/components found during session 1.

An example of such overview can be seen in Figure 1. Then students were asked to each choose a component and proceed with a deeper information search (ensuring all components were searched by at least three or four students).

The instructor guided the students to ensure appropriate information was collated by suggesting four generic questions to answer: What is it?; What is its main purpose?; What tools?; What Key Performance Indicators? The instructor refined the questions according to the specific theoretical concept being researched in each occasion.

2.3. Session 3: Critical assessment and post-it notes summarization

In this session students needed to critically assess the information collected in the previous session, individually, and organize it and summarize it using post-it notes. Post-it notes were colour-coded according to the different components being analyzed. The aim was for students to focus on meaningful ideas, but they were not constrained in the format to do so (text, keywords, drawings, etc.) to spur their creativity. Students were also encouraged to use links or connectors between notes if they felt the need to do so.

2.4. Session 4: Mapping and in-class presentation

Session four involved the presentation by students of each component to the rest of the class. First all students researching the same component worked together tocompare and discuss their individual work. They need to reach a consensus about the information to be presented to the class and rearrange their notes accordingly (or create new ones as needed). Each team was then asked to create a post-it "branch", for the general concept map, on the specific component they had researched. Then, one team at a time, students stick their part of the map in the class board and presented their findings to the class (see Figure 2).

Figure 2. Example of in-class presentations during session 4 showing several post-in "branches"(colour-coded) of the finalized concept map.

2.5. Session 5: Feedback

During the last session, the instructor asked students to provide feedback on each team's presentation. They were asked to focus in constructive criticism pointing to unclear concepts or ideas, potential improvements and further illustrativeexamples. Any correction suggested

by the students had to be previouslyresearched and referenced accordingly (to prove solidity of the evidence). The final session ended with a summary and recap by the instructor, reviewing all relevant topics, strengthening the main components needed for a deep understanding of the proposed theoretical concept and validating the students' work.

3. Students reactions and future work

We have not been able to objectively measure the effectiveness of this teaching innovation, but we have consistently asked students about their feedback relatingtheir impressions about the activity. Students were always asked to answer twoopen questions at the end of the final session: Did you like or dislike the activity? Did the activity improve or enrich your learning experience in any way?

In general, students had reported high levels of satisfaction with the mapping activity, labelling it as "entertaining" and "a new change". Regarding their learning experiences, students reported an improvement in their searching skills (especially the flipped-classroom idea that active information search improves retention) and they found the mapping activity encouraged participation and an active attitude in class. They also reported improvements to their teamwork abilities, arguing the need to listen to classmates and keep an open minded to select the best contributions for the map. Especially competitive students found the activity very engaging, as it encouraged them to work harder to be "proud of your own work being presented to the class". An unexpected outcome was the repeated reference to the improvement of individual information searching skills by students, who reported this helped them improve their understanding of complex concepts and even the quality of their final presentations. This fact reinforces the idea that current undergraduate students benefit greatly from flipped classroom approaches,as it encourages independent learning and critical thinking skills, which might belacking in traditional teaching approaches.

The educational literature has for long reported that meaningful engagement is a critical factor in promoting deep learning (Davies, 2011).

Several studies have found that visual representations and summaries are especially effective improving academic success and providing high student satisfaction (Clarke et al., 2006). Similarly, measurable improvements in meaningful learning having reported using concept mapping under test conditions with control groups (Hay et al., 2008), which is what we have set to evaluate for the next semester. This ads support to the idea than concept mapping promotes meaningful learning, and we hope that its combination with analogical disruptors and a flipped classroom approach would prove to be a successful combination to add adaptability and creativity skills into our courses' curricula.

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Using Virtual Reality to promote pre-service teachers' classroom management skills and teacher resilience: A qualitative evaluation

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Abstract

Many novice teachers have difficulties with selecting and applying effective classroom management strategies to prevent or diminish disruptive behaviors. Negative experiences with classroom management largely determine teacher wellbeing and early attrition. Therefore, more in-training opportunities are needed to prepare prospective teachers to manage complex classroom practices effectively. A Virtual-Reality environment seems promising in developing classroom management skills (CMS) and promoting teacher resilience; however, students' and educators' perceptions towards this technology influence its potential. This study describes four pre-service teachers' and six school-based teacher educators' experiences with and perceptions towards the use of a Virtual Reality learning environment to train classroom management skills and promote teacher resilience. Responses of semi-structured interviews reflect five themes: software- and equipment-related issues; feedback cues; realism and authenticity; instructor proficiency; and added value for teacher training. Results show that, for most themes, pre-service teachers and school-based teacher educators raised similar remarks and/or suggestions for improvement; however, they differed in their perceptions towards the added value of Virtual Reality to teacher training curricula. Our study highlights teachers' needs for highly authentic and realistic simulations aligned with real-life classrooms and presents recommendations to augment the immersive experience needed for teachers to develop effective CMS and become more resilient.

Keywords: *Virtual Reality; Teacher training; Classroom management; Resilience; Qualitative evaluation.*

1. Introduction

Classroom management refers to all measures a teacher takes in establishing a positive and orderly working and learning environment in which effective social and academic learning can occur (Korpershoek, Harms, De Boer, Van Kuijk, & Doolaard, 2016). Effective classroom management entails restoring order by recognizing disruptive behaviors and application of effective classroom management strategies (CMS) aimed at preventing, changing, or disciplining disruptive behaviors; understanding the effect of classroom management strategies on specific behaviors; and teachers' beliefs in their ability to effectively implement classroom strategies (i.e., teacher-efficacy; Tschannen-Moran & Woolfolk-Hoy, 2001). However, selecting and applying effective CMS is one of the foremost concerns in everyday teaching practice and many pre-service and beginning teachers experience difficulties in deciding between preventive (e.g., making eye contact with students) or reactive (e.g., disciplining) strategies when addressing specific behaviors (Korpershoek et al., 2016; Lane, Menzies, Bruhn, & Crnobori, 2011; Putman, 2009), often resulting in a downwards spiral reinforcing disruptive behaviors. Negative experiences with disruptive behaviors and classroom management and low levels of teacher-efficacy are key factors in both teachers' wellbeing and attrition (Brown & Wynn, 2007).

Many pre-service teachers feel that their internship does not provide sufficient opportunities for practicing and developing effective classroom management strategies, as experimenting with CMS to understand what works in which situations could negatively impact the teacher-student relationship (Van Tartwijk, Mainhard, Brekelmans, Den Brok, & Levy, 2014). Even if teachers only once retort to less effective CMS, the negative consequences for the teacher-student interpersonal relationship could last throughout the academic year. Such a disturbed interpersonal relationship could result in lower levels of teacher self-efficacy, wellbeing, and even attrition. Moreover, pre-service teachers' field experiences are often confined to specific days and/or parsed in a relatively short period in which only a limited amount of disruptive behaviors can be observed and managed, leaving little room for putting different CMS into practice. Therefore, it is essential to provide our future teachers with more *in-training* opportunities to develop more (varied) CMS and fine-tune their strategies. An alternative to real world, *in-vivo* training is simulation, for example by means of Virtual Reality (VR).

Lugrin and colleagues (2016) designed a VR-environment in which prospective secondary-school teachers can train their classroom management skills. Such an interactive VR-environment has several advantages as compared to other methods frequently used to promote classroom management skills. The immersive experience simulated by the Head-Mounted Display creates a realistic and authentic learning environment (Burdea & Coiffet, 2003) in which pre-service teachers can interact with students and respond to a variety of pre-programmed disruptive behaviors ranging in complexity levels. This enables practicing with many more (different) disruptive behaviors and CMS as compared to in-vivo

internships. More importantly, it is possible to rerun complex situations multiple times and experience the reciprocal relationship between specific behaviors and different CMS without compromising the teacher-student interpersonal relationship. Using a VR-environment to practice and develop effective classroom management skills could also positively affect teacher wellbeing, and, more specifically, teacher resilience. Resilience can be conceptualized in terms of experiencing positive emotions, self-confidence, and being able to make realistic judgments regarding self-efficacy, interpersonal skills, and behavioral management. We assume that being able to practice a variation CMS in response to many different disruptive behaviors will likely to benefit these aspects, resulting in more resilient teachers who are committed, engaged, and motivated to improve their teaching and to remain in the profession (Mansfield, Beltman, Broadley, & Weatherby-Fell, 2016).

The first evaluation of the developed VR-environment seems promising in terms of essential usability requirements, the effect of feedback cues, and technology acceptance (Lugrin et al., 2016). However, little is known of how pre-service teachers actually *perceive* and *experience* such a VR-learning environment in terms of its potential as an in-training opportunity for developing their CMS. As successful implementation of educational innovations stands or falls with students' and educators' perceptions towards new technologies (Schneckenberg, 2009), we conducted a study to evaluate pre-service teachers' experiences with and perceptions towards the use of a Virtual Reality learning environment to train classroom management skills and promote teacher resilience.

2. Methods

2.1. Participants and Design

In the period between December 2018 and April 2019, we invited two groups of users to test the classroom management VR-learning environment (Lugrin et al., 2016) and participate in a follow-up interview. The first group consisted of four pre-service teachers (one man, three women) as the goal was to evaluate their perceptions towards and experiences with a VR-learning environment to promote CMS and teacher resilience. In addition, we included six school-based teacher educators (three men, three women) in our evaluation, given that classroom management training is often considered as 'too disconnected from everyday classroom practices' (Putman, 2009). Therefore, school-based teachers' experiences and perspectives on the degree of transfer to real-life educational situations as simulated by the VR-environment are highly relevant when evaluating the potential of learning environments aiming to prepare prospective teachers for their future profession.

2.2. Procedure

Participants were invited (in pairs or small groups) to our university's VR-center to test two aspects of Lugrin et al.'s VR-module; the classroom simulation itself and the instructor control dashboard (Figure 1; see Lugrin et al., 2016, p. 7, for a detailed description). The VR-experience was followed by a semi-structured interview. Questions were partially based on the work of Lugrin et al. (2016) and tapped into participants' overall impressions, simulation/user experiences, possible drawbacks, and opportunities or potentials of using VR to support pre-service teachers' development of CMS and resilience.

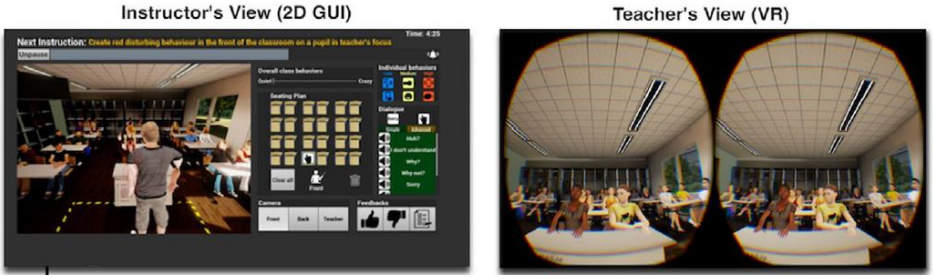

Figure 1. Instructor control dashboard (l) and VR-simulation (r). Source: Lugrin et al. (2016).

2.3. Method of Analysis

All notes taken during the interviews were digitalized. We followed a Grounded Theory approach as we first established sensitizing concepts guiding further in-depth thematic analysis and exploration of our data (Braun & Clarke, 2006).

3. Results

Participants' responses were categorized into five emergent themes: (1) software- and equipment-related issues; (2) feedback cues; (3) realism and authenticity; (4) instructor proficiency; and (5) added value for teacher training. In the following subsections, we will discuss each of the themes in more detail.

3.1. Software- and Equipment–Related Issues

All participants reported bugs and system-glitches that lowered the experienced level of immersion. For example, they mentioned that not all student avatars were visible or responded to the teacher, that some of the disruptive behaviors did not work after activation, and delays in visualization after adjusting the controls. Some of the optional classroom layouts did not enable realistic in-class movement as participants could walk through walls or desks. Participants tended to trip over the cable connecting the Head-Mounted Display to the computer. Pre-service teachers explicitly vocalized the need for a 'software pre-training',

for example, regarding the use of the handhelds, picking up objects, and how to navigate through the virtual classroom. In addition, informing them in advance, on what the VR-environment looks like, would help set more realistic expectations.

3.2. Feedback Cues

The appropriate use and timing of the feedback cues was not clear for all participants. As one pre-service teacher stated: "*How do you use the feedback cues*?" This could stem from the fact that we did not yet run specific scenarios/scripts in our exploration-phase, thus, there was no need to provide specific feedback. In addition, participants deemed the audio signal of the feedback cues as "*rather awkward and disconnected from everyday classroom practices*", which raised debate on the added value of the feedback cues in its current form. Others indicated that a more diverse range of feedback cues could be conducive to the learning experience, especially when more targeted and/or specific feedback on CMS (instead of signaling wrong or right) could be given.

3.3. Instructor Proficiency

Participants from both groups thought instructor skills regarding controlling the interface are essential for establishing effective learning processes. Many participants felt that the instructor him/herself should be highly proficient in CMS, or at least should know which strategies are most effective given a certain behavior, to facilitate effective feedback. One pre-service teacher struggled with aptly fulfilling the instructor-role and mentioned it was rather difficult to having to respond immediately by selecting appropriate student behaviors after observing their peers implementing classroom strategies. Moreover, when multiple avatars displayed disruptive behaviors, it was not always clear whom the teacher addresses. Enabling the possibility to name the students would be helpful, as would presenting the instructor with a live feed of all sounds and conversation occurring in the virtual classroom.

3.4. Realism and Authenticity

Our participants generally held positive perceptions of the experienced levels of realism and authenticity. As one school-based teacher educator mentions: "*the feeling of being in the classroom is real*". However, they do feel some improvements could (and should) be made. For example, one student indicated that the visual experience is highly similar to being in a classroom, but that the software lacks realism when it comes to simulating an authentic auditory experience (availability and display of noises/sounds). Others stress this observation and felt that the current version could be improved as only noises and sounds related to group-level disruptive behaviors are available. Integrating noises exemplifying both individual-level disruptive and non-disruptive behaviors, and background noises (e.g., 'buzz') in the software is thought to be essential in simulating a realistic an authentic classroom. Another way of increasing transfer to real-life classrooms is to reconceptualize the classification and

visualization of behaviors. For example, pre-service teachers mentioned that in real life, some of the simulated 'bad' behaviors such as punching a neighbor could be considered as playful or friendly behaviors. Behaviors that in everyday classrooms would be considered as highly disruptive (such as kicking and punching), were not that well visible in the simulation, suggesting a milder categorization. Several participants mentioned a lack of common movements as wiggling and stretching (i.e., non- disruptive behaviors). Pre-service teachers and school-based teacher educators thought that naming student avatars, enabling a variety of emotional (facial) expressions, and exploring the possibility of programming avatar-specific characters (e.g., behavioral patterns) enhances realism and authenticity. Almost all participants mentioned that the pre-programmed verbal responses of student avatars impeded immersion. More complex interaction patterns, preferably supported with accurate lip movement, are needed. One school-based teacher educator mentioned: "*It would be nice if it would be possible to take phones from student avatars physically*", as this is a valid response in real-life situations. Similarly, being able to relocate students after displaying disruptive behaviors is recommended.

3.5. Added Value for Teacher Training

The pre-service teachers were rather positive about the whole experience and see its potential for training classroom management skills and promoting teacher resilience. Some endorse the added value in the current teacher-training curriculum as they see possibilities for using the VR-software in the context of microteaching (in which pre-service teachers practice with parts of a lesson such as attaining focus when starting a lesson). The pre-service teachers also indicated that the VR-simulation primes all sorts of emotions (for example, when students start jumping on their chairs) that can also be experienced when teaching everyday-classrooms. Another added value for the teacher-training curriculum could be realized by integrating pre-service teacher's PowerPoint or Digi board slides in the VR-classroom as this would enable purposeful content-related practices.

The school-based teacher educators had mixed feelings about the VR-experience, as their perceptions vary from "*finding it fantastic"*, to not being able to see how the application could be used in the near future. School-based teacher educators felt that purposeful integration and implementation in the teacher-training curriculum is impeded by a lack of verbal interaction and the system's and instructor's inability to respond to non-verbal CMS. Especially experienced teachers are highly skilled in effectively using non-verbal CMS; strategies that were not always recognized by the instructor (who tried to figure out how to increase disruptive behaviors instead of observing the teacher wearing the VR-headset).

4. Discussion and Directions for Future Use

We aimed to evaluate pre-service teachers' and school-based teacher educators' experiences with and perceptions towards the use of a Virtual Reality learning environment to train CMS and promote teacher resilience. Five themes emerged from the semi-structured interview data. Participants in both groups felt that *software- and equipment–related issues* lowered the experienced immersion, and pre-service teachers explicitly mentioned the need for a software pre-training. Our participants felt that the non-specific and unrealistically sounding *feedback cues* are not conducive to learning and welcome the possibility of giving targeted feedback. Both groups of participants thought *instructor proficiency* is a two-fold issue. First, for VR-novices, the instructor control dashboard was not intuitive. Second, similar to real-life practice (Ryan & Cooper, 2004), effective CMS can only develop under supervision of an experienced CMS-proficient teacher giving targeted feedback. Both groups hold relatively similar perceptions of *realism and authenticity*. Most of them thought the visual simulation was highly realistic and authentic, but that the auditory experience could and should be improved as real-life classrooms burst with life. Another essential aspect in which the VR-environment differs from real classrooms is the lack of human-like complex interaction. Last, both groups of participants mentioned that the classification, modelling, and visualization of behaviors should be reconceptualized to facilitate transfer to real-life classrooms. School-based teacher educators and pre-service teachers differed in the perceived *added value of VR for teacher education*. Pre-service teachers were unanimously positive regarding the in-training possibilities of using VR to develop CMS and promote teacher resilience, whereas school-based teacher educators' perceptions varied largely. Most were cautious regarding its potential for implementation in teacher education, mostly due the lack of human-like interaction, suggesting that even a realistic, immersive experience in a virtual reality can be 'too disconnected from everyday classroom practice' (Putman, 2009).

Overall, based on our participants' observations, it can be concluded that a VR-environment for training CMS has untapped potential as there are various ways to improve the immersive experience and transfer to real-life classrooms. Therefore, our first recommendation is to improve the module based on our participants' suggestions to increase the level of realism and authenticity and augment the immersive experience prerequisite for purposeful implementation in teacher education. Our second recommendation is to provide meaningful behavioral scenarios simulating complex classroom situations as every-day teaching practices are highly susceptible to micro-level influences. For example, it would be informative for prospective teachers to engage in a scenario in which disruptive behaviors gradually build up if the teacher does not immediately and effectively address (emerging) disruptive behaviors. Or a situation in which many different behaviors occur simultaneously and need immediate orchestration (for example, when a teacher wants to start his/her lesson while some students are talking to each other, others are engaged with their cell phone, and

some even are asleep). Third, we recommend exploring possibilities for providing authentic, less intrusive, and targeted feedback on specific CMS, for example by integrating just-in-time voice coaching in the software. Last, we recommend examining the degree to which VR-supported *in-training* opportunities have a long-term impact, for example by monitoring beginning teachers' resilience and CMS. This project is the first step in an ongoing exploration of the potential of using VR to support teachers' development of CMS, self-efficacy, resilience, and wellbeing, and we are looking forward to taking the next step in our research and Virtually Realize our participants' recommendations!

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Occupational safety and health education and training: an innovative format and experience

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Abstract

Health begins at home and in community where people live and work, in fact, the World Health Organisation (WHO) defines health as 'a state of complete physical, mental and social well-being'. Experts and professionals, of all sectors and specialities, need to take account the Occupational Safety and Health (OSH) in all aspects of their working lives. Mainstreaming OSH into education concerns integrating one policy area – OSH – into another – education. This study started from a first analysis of an international and national OSH training offer, in which some critical aspects emerged: there are mostly sectoral training courses, qualifying some prevention actor roles, most linked to traditional risks, and primarily focused on the safety aspects rather than the health ones. The current study is related to an innovative format and experience for an integrated management of OSH in the evolution of the world of work. The concept was born from the need to train new professionals figures when the rapid demographic changes and technological innovation are changing the working world and therefore also the required skills to prevention actors. A first test has been conducted on 26 students who attended the first edition of this innovative training.

Keywords: *education, training; occupational safety; health; university courses.*

1. Introduction

The World Health Organisation defines health as ‘a state of complete physical, mental and social well-being’ (WHO, 1948). Health everywhere around the world begins at home and in community where people live and work.

Work-related mortality accounted for 5% of the global total deaths (Global Burden of Disease Study, 2015). Every 15 seconds, a worker dies due to an accident at work or an occupational disease, in fact, the International Labor Organization (ILO) estimates that approximately 2.78 million women and men in worldwide succumb to accidents or work-related illnesses: over 6000 deaths per day. In this scenario, education and training play a fundamental role, since beyond the specific regulatory interventions and the obligations connected to them. Developing, disseminating and concretizing a culture of prevention for OSH, it remains today a stimulating request that involves stakeholders interested in the enhancement of "human capital" as the main resource for the realization of a concrete and continuous process of improving the quality of life, including the working one.

The OSH Community strategy 2007–2012 considered the culture of prevention to be an important area of action; according to this strategy, risk education should be included in all levels of education, University too (Copsey et al., 2010). According to the latest OSH policy, risk education is become more important due to rapid development of the society, new technologies, globalization and changed demographic processes (Reinhold et al., 2013). An important step in training professionalization and education was taken with the establishment of the first University courses in safety, during the 1970s, in some EU countries (Germany, France, United Kingdom and Belgium). Studies conducted by the International Social Security Association (ISSA) Section on Education and Training for Prevention, and later by the European Network of Safety and Health Professional Organisation (ENSHPO) have shown that there is a wide disparity between the definitions of safety professionals and their role and training in the different EU countries. A first point to an European harmonization was boosted by the initiative of the ISSA Safety Training Section, later taken over by ENSHPO, which documented the regulatory schemes and the range of roles and competences of safety experts and professionals across Europe. The European project (2010-2012), so called EUSafe, was taking a further step to develop the standards into exemplary role and task descriptions, learning objectives and teaching protocols which could be used to stimulate further training initiatives and lead to further harmonization of training requirements. Its objectives are to better underpin the definitions of the role and training needs of safety experts and professionals across Europe. This European development has now combined with a parallel development internationally under INSHPO bringing together North American and Asia Pacific countries to share and learn from each other’s certification and accreditation systems (Swuste & van Dijk, 2018).

2. Methods

The analysis and reflections process about good practices, and learned lessons was carried out based on the exchange among the institutional leaders, the team of teachers and students and was complemented by the researcher of these advisory services. First, an analysis of the international and national literature about the OSH available courses has been done, than the study focused on the changes in the world of work, in order to desing and develop a proposal for an innovative training format. The analysis has been carried out into the internet through different search engines using the following keywords: "university", “occupational safety”, “occupational health”, “master”, “post-graduate course”. The structure of the individual courses was deepened through the direct internet links. The analysis of the international educational offer followed this kind of methodology, while national research was developed on the study of the educational offer of the single Universities. The last step of the study was to delivery and evaluate the training format. The assessment of learning process was done through an anonymous questionnaire at the end of the training. The 26 students of the first edition of the Master (14 men and 12 women, aged 28-56yr) completed the questionnaire. The first edition of the Master course took place from February 2018 to December 2019. This first edition was attended by students came only from Italy. The 10 item self-administered questionnaire aim to assess the quality of the purpose, content, timing and mode, using a 5-points Likert scale.

3. Results

3.1. Analysis of international and national University training on occupational safety and health (OSH)

The OSH international offer provides a typically two-year period training. In several cases the period of the Master courses is linked to a frequency mode: such as part-time (two years) or full-time (one year). The training is varied and consists of classroom lessons, distance and online learning, visits to the companies, residential training at University campuses. The main subjects covered are: health and safety at work, occupational hygiene, occupational psychology, ergonomics, epidemiology, risk management and health promotion.

An analysis via internet of the training offer, existing at national level of University courses in the OSH field provided in the last ten years, shows that, since the 90’s in Italy, there has been a growing training offer on OSH subjects, mainly due to an increase in the educational/training needs for prevention actors, due also to the implementation of the regulatory framework. In this context, the University has contributed with post-graduate training offers (1st and 2nd level Masters and Advanced Training courses). At the national level 19 Master's courses were counted and in particular 8 of them were dedicated to the 2th

level of University degree and 11 to the first one. Almost all of them involved collaboration with other Universities, professional scientific associations, Institutions of the National Health Service, as well as the National Institute for Insurance against Accidents at Work (INAIL). The Master courses generally have a duration of one year, with a teaching commitment about 1500 hours totally. Courses are provided through frontal teaching activities and other forms of guided study, distance learning interactive activity (FAD-eLearning mode) or by providing both methods (Blended learning). In some cases the Master's students have obtained the qualifications required by law to perform certain professions such as the person in charge of prevention and protection service (RSPP and ASPP) pursuant to art. 32 of Legislative Decree 81/08.

3.2. Analysis of the changes in the world of work and the training needs for the development of the Master course

In the OSH policy, one of the main goal of the "European Union Strategic Framework 2014-2020" is to face demographic change by requiring adequate working conditions, in order to guarantee a sustainable working life and an active and healthy ageing. In fact, it is necessary to consider the existence of a gap between life expectancy and employment expectation, mainly due to deterioration of health and early withdrawal from work due to illness and/or injury. Moreover, the current scenario of the working world is characterized by important technological innovations - robotics, smart working, key enabling technologies (KETs) - that will profoundly transform industrial processes, offering great prospects for development in terms of productivity and plant quality. This landscape of the future of work will entail further complexities to manage and set in with a view to prevention, in order to increase the sustainability of work, including: new forms of work organisation and new risks, the need to face important changes in the work management (e.g. flexible forms of work, new forms of work organisation, psychosocial aspects), the need to understand the influence of age-related changes in work capacity, particularly in the case of specific strenuous jobs, as well as the impacts on the obsolescence of skills in high-tech jobs. Therefore, there is a need to train new specialized figures, able to respond to the changing of the working world through the integrated risk management, based on a multidisciplinary and participatory approach, which integrates different aspects and specific competences of different disciplinary areas related to the issue of health and safety at work, such as occupational health, public health, occupational psychology, health psychology, psychometrics, management and ergonomics. This approach, however widely expected, was still lacking in Italy due to the absence of a specific recognized interdisciplinary training, which integrates skills in the field of occupational health prevention, including those related to aspects of a psychosocial and organisational nature, with the skills required in the field of safety in the workplaces.

3.3. Design and development of the Master in integrated Health and Safety Management in the evolution of the working world

Public and private sector organizations are increasingly concerned with improving occupational safety and health. The rapid changes in the world of work, combined with the persistence of unsafe or environmentally hazardous working conditions, have served to focus attention on the need to create safe, healthy working environments and OSH professionals with the right skills. According to the analysis of the national training offer up to date, it emerges that the courses activated were mainly conditioned by the formal requirements defined and established by current legislation for the recognition of the role of worker prevention and protection professionals, leaving little room for the development of knowledge and skills related to innovation and work changes. Becoming an occupational safety and health professional requires multidisciplinary training with a broad-based educational background, including specialized knowledge of the medicine, law, chemistry, engineering and social sciences together with an understanding of the principles and concepts of management. The national and international training offers put in evidence some critical aspects: these are mostly sectoral training courses, qualifying some prevention actor roles, most linked to traditional risks, and primarily focused on the safety aspects rather than the health ones. A special consideration deserves the advantages offered by University training programs that can open up opportunities for in-depth study and professional updating to existing prevention figures, on innovative and emerging issues.

The biennial training course in "Integrated management of health and safety in the evolution of the working world" is promoted by Sapienza University of Rome, involving four Faculties (the two-ones of Medicine, Civil and Industrial Engineering and Law) and the research departments and the central and technical facilities of INAIL. The concept was born from the need to train new professional figures when the rapid demographic changes and technological innovation are changing the world of work and therefore also the required skills to prevention actors. The Master has innovative features both for the topics being discussed and for its structure aimed at a multidisciplinary application and professionalization approach. The two-year Master's program has allowed the networking of training, innovation and research, namely INAIL, University and the productive world in order to respond concretely to the increasingly complex challenges of the working world, to grasp all the opportunities in terms of development, research, innovation and employability. Many leading companies in the field of nanotechnology and in the high automation industrial sector and the enabling technologies of Industry 4.0, have chosen to play an active role within the innovative INAIL-Sapienza path, offering to participants the possibility of innovative internships projects. The planning of the internship projects was carried out with a multidisciplinary, innovative and integrated approach, with particular regard to the "prevention through design". Among the most interesting activities carried out

in the first edition these areas were studied in deep: ergonomic assessments aimed at reducing biomechanical overload in the industrial sector; availability, integration and knowledge of data on work-related accidents to develop "road safety" and sustainable mobility methodologies and paths; improvement of safety management systems and application of technology to prevent accidents at work through a proactive and integrated approach; analysis and correlation models between natural and incidental health and safety events aimed at the well-being and global protection of the worker, according to the One-Health conception.

The course has been designed to a limited number (maximum of 30 students), in order to make possible the carrying out of high quality and interactive of the didactic activities. It has lasted two years with a teaching commitment of 1,500 hours overall, of which at least 350 hours reserved to lectures of frontal teaching and 125 hours dedicated to the final exam. The sum of the aforementioned activities corresponds to the acquisition of 60 University credits (CFU) in addition to the credits already acquired for the course of study necessary to access to the course. Each CFU corresponds to 25 hours of study divided into the various training activities (Table 1).

3.4. Assessment of the innovative training format

The main results of the evaluation of the first edition of the Master are summarized in the following table (Table 2).

In summary, the analysis shows the following results for the individual teaching modules: the mean value of the Module 1 is 4.2 (SD 0.8; Likert scale 1 till 5), the mean value of the Module 2 is 4.3 (SD 0.8; Likert scale 1 till 5), the mean value of the Module 3 is 4.0 (SD 1.3; Likert scale 1 till 5).

Table 1. Master Structure

Course Structure	CFU
Module 1.General aspects of integrated risk management and regulatory framework The module is aimed at the development of knowledge and general skills in the following areas: occupational health, legal, insurance, statistics-epidemiology, psychosocial, risk assessment and management, safety at work, able to characterize, manage and develop solutions for an integrated approach to risks with particular regard to the contemporary labor market. Qualification of Head of the Prevention and Protection Service (RSPP) or of Operator of the Prevention and Protection Service (ASPP)	**20**
Module 2. Specialized training focused on the change in the working world The module is aimed at developing skills, knowledge and experiences in areas closely linked to the change in the working world, developed through highly profiled activities towards innovative aspects of health and safety related in particular to demographic changes and technological evolution.	**20**
Module 3. Integrated risk management The module is aimed at developing skills and experiences aimed at identifying innovative measures and techniques for integrated risk assessment and management. The module also provides for further activities, including the training internship in partner organizations rooted in the working/production contexts and in close contact with the health and safety sector and/or at the Sapienza University and INAIL laboratories. Seminar activities related to the themes of the training path, initiatives and training days in collaboration with the partner bodies of the Master.	**15**
Final Exam	**5**
Total	**60**

Table 2. Assessment of the first edition of the Master

	Module 1			**Module 2**			**Module 3**	
	Education -training *(content and mode)*	**Teaching quality**	**Tutoring quality**	**Education - training** *(content and mode)*	**Teaching quality**	**Tutoring quality**	**Training internship** *(content, mode, timing)*	**Tutoring quality**
Mean value	3.9	4.3	4.4	4.2	4.4	4.4	4.0	4.1
SD	1.0	0.8	0.6	0.9	1.1	0.7	1.3	1.4

4. Conclusions

All the actors involved in training and work agree that it is in training process where we should acquire knowledge, develops skills and internalize risk identification and prevention behaviours at work. This Master course, which was promoted for the first time in Italy, has been integrated with advanced training courses that the student during the second year can choose in a modular way. This two-year training course presents innovative features not only for its structure, but also for the topics under discussion focused on aspects related in particular to changes in the world of work (e.g. demographic changes) and technological innovation (e.g. nanotechnologies, industry 4.0, enabling technologies, IoT, process digitalization, automation, robotics, smart working, digital transformation). The innovative features related to its structure, was obtained through the integration of two didactics training offers, the Master, a third cycle, scientific and high specialized course for lifelong and recurrent training, with the advanced training courses (CAF) for a postgraduate specialization or specialist studies.

As the epistemologist Piaget highlighted the collaboration between different disciplines or heterogeneous sectors of the same science, provided real interactions, reciprocity of exchanges, such as to determine mutual enrichments. With this inter-multidisciplinary perspective, the training path of the Master Sapienza-Inail was organized and observed aimed at allowing learners and teachers an innovative experience of an interactive process guaranteed by the loan and the methodological exchange of the various disciplines that carried out the cultural-scientific enrichment and the creation of a transdisciplinary system in OSH area.

The present format seems to be a good practice for the integration of research, education-training, work and innovation, as students refered.

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Students' experiences with learning mergers and acquisition skills in a multi-disciplinary learning community

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Abstract

The aim of this paper is to evaluate the implementation of an extra-curricular multi-disciplinary, multi-level Learning Community (LC) on Mergers and Acquisition (M&A) of Small-Medium-sized Enterprises (SMEs). This LC was developed according to established guiding principles, namely the theme extends beyond the theme of the regular courses, and it should attract both BSc and MSc students of different disciplines, and enhances students' professional preparation and employability. The LC consisted of 8 meetings of 2 hours and one meeting for a whole day during a full semester. During the whole day, students played a game in which they had to purchase a company using all acquired knowledge and skills. In the guest lectures offered, students discussed different aspects of M&A with professionals within the field. The LC is evaluated by students on e.g. the content of the LC, what they have learned, the social aspect and guidance, and what could be improved. Overall, the students appreciated the content and structure of the LCs, especially the game, the guest lectures, and the fact that they worked together with students of different disciplines.

Keywords: *Learning Community; Higher Education; Student-centered Learning; Extra-curricular Activity; Mergers and Acquisition.*

1. Introduction

Owners of Small-Medium-sized Enterprises (SMEs) need support in the strategic processes associated with mergers and acquisitions of their company. In a relatively short time important and far-reaching decisions have to be taken that require knowledge from different disciplines, such as finance, strategy, operations, business administration, and legal affairs. In addition, effective managers need interpersonal skills such as negotiating skills for managerial success.

The topic of negotiation seems to be underrepresented in business school curricula. If present, buyer-supplier negotiation role-plays or games are usually used as teaching methods (Beenen & Barbuto, 2014; Hartley & Eboch, 2017, Page & Mukherjee, 2007). Also at our school, the topic of negotiation is underrepresented. To introduce this topic, we have developed an extra-curricular learning community on Mergers and Acquisition (M&A) in Small Medium-sized Enterprises (SMEs).

Essential building blocks of every LC at the Faculty Economics and Business are: academically challenging topic that asks for a multi-disciplinary approach, focus on developing some specific skills, possibility to network with business practice, and selection of students based on motivation (Ossevoort & Riezebos, 2019). Since, the content of the LC is not embedded in the formal curriculum with its rules and regulations, there is room for testing educational innovation initiatives. Being outside the curriculum, students from different levels (Bachelor and Master students) and students from different disciplines (e.g. finance, economics, business management) can participate, thereby mimicking real-life situation in M&A processes. Since students from different backgrounds participate in this LC, peer learning allows the development of a complex way of thinking with different perspectives resulting in learning at a deeper level (Bransford *et al.*, 2000; Lave & Wenger, 1994). In general, LCs offer active and collaborative learning activities that binds participants together into a social entity (Wenger, 2000), where the focus of instruction shifts from the lecturer to the students.

The aim of this paper is to evaluate the implementation of the extra-curricular LC on M&A in SMEs that is open for all BSc and MSc students at the faculty of Economics and Business. The questions we want to answer are:

1. Do students of different backgrounds participate in this LC?
2. What elements of this LC are most valued by students?

In chapter 2, the description of the LC (context and content) is given. Chapter 3 describes the data collection and analysis. The characteristics of the students as well as the outcome of the students' evaluation is given in chapter 4. In chapter 5, the results are discussed.

2. Implementation of the learning community

2.1. Context

The LC is part of the activities for students organized by the department FEB Careers Services to strengthen students' professional preparation and increasing graduates' employability of the Faculty of Economics and Business (FEB) of the University of Groningen, the Netherlands (Ossevoort & Riezebos, 2019). FEB's educational portfolio consists of four broad bachelor's degree programs, twelve specialized master's degree programs, and one research master program. The topic M&A in SMEs as such is not part of any degree program.

2.2. Organization of the LC

The LC is scheduled during a semester with 8 meetings of 2 hours and a whole day (to play a game). Students' time investments depend on their own ambitions.

Based on a motivation letter and an intake interview, the lecturer gives a positive or negative advice to students for participating in the LC. If positive, students are invited to the first meeting of the LC. The size of the LC is about 20 students.

The educational format of the LC is topic-based, specially designed for a targeted group with a similar academic interest, namely M&A in SMEs (Lenning and Ebbers, 1999). The interactive meetings consist of knowledge transfer by the (guest) lecturer followed by a discussion in the whole group. During the LC, at first the lecturer is in control of what the students should learn, but during the LC the meetings become more and more student-centered. Furthermore, students are in the lead during the day in which the game is played (see below). Since the LC is a non-credit bearing activity, after completing students receive a participation certificate.

2.3. Content of the LC

This LC teaches students the use of knowledge and tools to support the actual decision-making process of entrepreneurs based on the analysis of some recent M&As of SMEs. The topics addressed are knowledge on the M&A process, theory about negotiations, and basics of financial valuation. The skills covered are team work, interviewing, tool development, diagnostic modelling, financial valuation, and negotiation. The content of all sessions of the LC is described below.

Meeting 1 (2 hours): In this introduction meeting, the lecturer invites everyone to introduce themselves and will explain the context and content of the LC. A first discussion on the topic is started. The assignment for students to present in meeting 6 will be explained.

Meeting 2 (2 hours): In this interactive lecture the M&A process will be discussed using a white paper.

Meeting 3 (2 hours): In this interactive lecture, the focus is on the process of negotiation. In addition, the case used in meeting 4 is explained. The game has to be prepared in groups of three or four students. At least one of the students should have some experience with financial models to valuate a company.

Meeting 4 (whole day): This day starts with a test on negotiation style. Afterwards the game is started. The lecturer, also professional in the field of M&A in SMEs, is together with one of the students the 'owner' of the company used in the case. They will have a strategy prepared to sell the company to a new owner. The selection of a new owner is the result of negotiations, not only based on price, but all aspects, even some 'dirty tricks', that are brought into the game. The game will consist of 4 to 5 rounds of negotiation. The students have to make a lot of decisions during the day and learn indirectly also managerial insights. At the end of the day, the 'owners' of the company will decide which group of students may purchase the company and as a result have won the game.

Meeting 5 (2 hours): In this meeting, the outcome of the game will be evaluated and students will reflect on the strategies, knowledge and skills used during the game.

Meeting 6 (2 hours): Students in small groups will present a valuation of companies in a special sector (e.g. internet industry or ICT). The content will be discussed.

Meeting 7 (2 hours): A guest lecture by a professional of an investment company will make students aware of and discuss the current practice of M&A in SMEs.

Meeting 8 (2 hours): A guest lecture by a professional of a fast growing company will make students aware of and discuss the current practice of M&A in SMEs.

Meeting 9 (2 hours): In the final meeting, students will present what they learned and fill out the questionnaire for evaluation purposes.

3. Methodology

This paper presents the results of the LC organized during three consecutive semesters of the following academic years, both semesters in 2016-2017 (LC1 and LC2) and the second semester of 2017-2018 (LC3). As of 2018-2019, the LC is organized once every academic year.

To describe if the group of participants within the LC is diverse in gender, nationality, level of education (BSc/MSc), and/or discipline, the characteristics (gender, nationality, level of education (bachelor or master), discipline) of the participants are analyzed. The LC is evaluated by the participating students by means of a questionnaire consisting of 5-point

Likert scale items (n=45) and open-ended questions (n=13). The 5-point Likert scale items are partly inspired by Ciraj *et al.* (2010) and dealt with students' perception on (1) the content and context of the LC, (2) their improvement of skills and competencies, (3) cooperative learning and commitment to others and themselves, and (4) the social aspect of the LC. The open-ended questions deal with students' expectations, what they have learned, what kept them motivated, guidance, and what could be improved.

Students filled out the questionnaire at the last meeting of the LC on paper. The response rate was 60% in total (three LCs). Since no major differences were found between the data of the questionnaire of the three LC, all data were combined and presented as such. The mean and S.D. of the 5-point Likert scale were calculated. The qualitative data collected with the open questions were analyzed and repeated elements of different questionnaires were grouped and extracted from the data.

Table 1. Students' characteristics.

				Educational level (n)		
	n	**% female**	**% Dutch**	**BSc year 1/2/3**	**Pre-MSc**	**MSc**
LC1	9	29%	44%	1/1/1	1	5
LC2	14	0%	50%	1/6/3	0	4
LC3	29	45%	34%	2/14/3	4	6
total	*52*	*29%*	*40%*	*4/21/7*	*5*	*15*

4. Results

4.1. Characteristics of participating students

The characteristics of the participating students are listed in Table 1. In total 52 students participated in the three LCs of which 29% female students and 60% international (non-Dutch) students. The participants were between 18 and 31 years old (mean age = 22 year (S.D. = 2.8)). Most of the students follow a bachelor degree program. Most students follow a degree program in the field of finance or business economics (Table 2). In conclusion, all three LCs represented a multi-level and multi-disciplinary learning environment.

4.2. Students' evaluation of the LC

The mean mark the participants gave for the LC was on a scale between 1 and 10 equal to 8.2 ± 0.8 (range 7 - 10). The mean hours a week students spend on this LC was 3.7 ± 1.0 (range 1.5 - 6 hours). Overall, students strongly agreed that this LC as a whole worked as an effective learning environment for them (on a scale between 1 and 5, the mean score was 4.0 (S.D. 0.9)), was a good learning experience for them (mean score 4.6 (S.D. 0.6)), and they were very satisfied with this LC (mean score 4.2 (S.D. 0.6)). The students appreciated the content and context of the LC (Table 3). They perceived an increase in negotiation skills and professional skills. The students appreciated the interactive and collaborative character of the LC (Table 3). They also enjoyed working with students of different levels and disciplines (Table 3).

Table 2. The discipline of the degree programme followed by the participating students. Some students participate in multiple degree programs.

	LC1	LC2	LC3
BSc Business Administration	2	-	2
BSc Economics & Business Economics	2	10	15
BSc International Business	-	-	3
MSc Business Administration	1	2	-
MSc International Economics & Business	3	1	-
MSc International Business and Management	-	1	-
MSc Finance	1	1	6
MSc International Financial Management	-	-	3
MSc Supply Chain Management	-	-	1

In the open-ended questions students stated that the mean reason for participating in this LC was to improve knowledge on M&A (n=26). As the most important things learned during this LC, students mention learning about negotiation (n=23), valuation (n=10), M&A processes and modelling (n=11), and the importance of networking and building relationships in M&A (n=10). They stated that they welcomed the cooperation with students from different levels (n=16) ("Good, I think that different levels add their own ideas and way of thinking to the LC"). Students mentioned that they learned from each other (n=16) ("as everyone had their specialty, I learnt about subjects I'm weaker in from group members that were skilled"), and the different view on the topics by students of different disciplines was instructive (n=15) ("I learnt a lot how finance students think and solve problems").

Suggestions to improve this LC were to expand the link with practice meaning more company visits and guest lectures (n=11) and gaining more content knowledge (n=4), such as providing homework exercises, a crash course valuation in the beginning of the LC, and learning about differences between SMEs and multi-national companies.

Table 3. Students' perceived learning and experience during the LC (mean scores on a 5- point Likert scale, range 1 = strongly disagree to 5 = strongly agree).

item	Mean score (S.D.)
Content and context of LC	
The information which I received about the LC was sufficient	4.1 (0.7)
The LC was well organized	4.3 (0.6)
The contact with the external parties during the LC met my expectations	3.9 (1.0)
Cases selected for LC were appropriate	4.3 (0.7)
Student discussion during LC sessions addressed the objectives of the given subject	4.1 (0.7)
The time allotted for the LC was adequate	4.1 (0.8)
The reference material used for LC were useful and adequate	3.9 (0.8)
LC provided a context that helped me retaining relevant information	4.0 (0.6)
The lecturer present during LC facilitated the whole process	4.4 (0.7)
The support I received form the lecturer during the LC was helpful	4.5 (0.6)
Participation of external business people should always be part of the LC	4.6 (0.9)
I could bring forward new topics in LC	3.7 (0.9)
The LC was academically challenging	3.5 (0.9)
I would recommend this LC to other students	4.6 (0.7)
Improvement of skills and competencies	
LC has facilitated my independent (self-directed) learning abilities	3.9 (0.7)
LC helped me gain skills in working with others	3.9 (0.9)
LC has enhanced my communication skills (e.g. writing, speaking)	3.6 (1.0)
LC increased my analytical skills	3.5 (0.9)
LC has enhanced my project-management skills	3.2 (0.9)

item	Mean score (S.D.)
LC has enhanced my negotiating skills	4.5 (0.7)
LC has enhanced my professional skills	4.0 (0.8)
Cooperative learning and commitment to others and themselves	
LC has helped me generate questions that forced me to further investigate the subject	4.2 (0.7)
LC gave me the opportunity to help others in the group understand difficult material	3.7 (0.9)
LC helped me better understand the subject by hearing other participants discuss it	4.1 (0.8)
Explaining information to others helped me better understand the subject	3.9 (0.8)
When working together with students in LC, I achieved more than I work alone	3.9 (0.8)
LC enhances good working relationships among students	4.3 (0.6)
LC focused on collective efforts rather than individual efforts	4.3 (0.6)
In the LC it was difficult getting members to actively participated in tasks	2.2 (0.7)
I was satisfied with my own commitment	4.1 (0.5)
The social aspect of the LC	
The atmosphere in the LC was relaxed	4.7 (0.5)
LC was fun	4.6 (0.6)
LC has helped me to socialize more	3.7 (0.8)
LC fostered team spirit	3.9 (0.8)
By participating in LC, I made new friends	3.7 (1.0)
I enjoyed working with students from different educational levels	4.4 (0.9)
I enjoyed working with student with a different background	4.5 (0.9)
LC has strengthened my societal awareness	3.9 (0.9)
LC has enhanced my intercultural competencies	3.7 (0.8)

5. Discussion and Conclusion

We conclude that the implementation of the extra-curricular Learning Community (LC) on Mergers and Acquisition (M&A) of Small-Medium-sized Enterprises (SMEs) that is open for all students at the Faculty of Economics and Business was a success. The LC was developed to give students the opportunity to learn about this topic in a real-life situation, using a game and working together with students of different levels and disciplines. Being extra-curricular, the LC complements the activities within the curriculum where students of the same levels and disciplines work together. Students learned from each other as well as from the (guest) lecturers who are consultants in M&A. The results let us conclude that the contact with the professional field should absolutely be part of the LC and that the academic character can be intensified. Overall, the great commitment of the lecturer as well as the students led to a successful realization of this multi-disciplinary, multi-level extra-curricular LC on M&A in SMEs.

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Integrating STEMM in Higher Education: a proposed curriculum development framework

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Abstract

Educational systems around the world are trying to grapple with the need for experts in science, technology, engineering, mathematics and medicine (STEMM), who have expert knowledge and can work in collaborative teams to find solutions to local and global issues, including the current pandemic related to the Covid-19 outbreak. Employers seek disciplinary experts as well as people who can act as connectors for groups and ideas and who share and communicate them effectively. Integration of the STEMM disciplines within teaching programmes is in its infancy in higher education, but there is recognition for providing extraordinary experiences for learning that develop collaboration and synthesis of divergent ways of thinking, including crossing disciplinary boundaries. A framework is presented for supporting the design of integrated STEMM course work in higher education. It includes authentic, student-centered, evidence-based, inquiry, problem-based learning through situated, immersive and experiential approaches that can support the deliberate development of skills for integrating thinking, problem-solving and for creating humanistic solutions for local and global issues. This framework can be used as a guide for designing new teaching programs that use transdisciplinary approaches for STEMM in higher education. Refinements of the framework can be generated through rigorously evaluating implementation in specific contexts.

Keywords: *Covid-19, STEMM, transdisciplinary teaching, higher education, employment.*

1. Introduction

Working in interdisciplinary teams already occurs in research in higher education, research institutes and government agencies. However, there are only glimpses of this occurring in teaching programmes or course work in higher education, especially where there is a deliberate focus on inter-disciplinary learning. Integrated approaches in higher education can build on inquiry models and problem-based learning developments in the compulsory education sector (e.g. Corrigan et al., 2015; Sniedze-Gregory, 2018). This paper advocates for a STEMM approach for learning programs in higher education to expand on previous advocacy for integrating STEM (e.g. Malcolm & Feder, 2016).

The importance of science, technology, engineering, mathematics and medicine (STEMM) knowledge and skills could not be more important globally than now. In the current Covid-19 situation, STEMM approaches are required using global collaboration for supporting health systems, decisions about personal health, sustaining creating technological and engineering solutions and understanding how science can contribute to solve problems and enhance life experiences. Integrating STEMM knowledge and skills relies heavily on collaboration, evaluation of knowledge and self-reflection for learning (Conner, 2014). Such knowledge and skills have been highlighted as essential for the future workforce with an estimated 75% of jobs requiring problem-solving, inquiry, critical and creative thinking (World Economic Forum, 2019). These skills have also been identified as being crucial to ensure economic strength, global competitiveness, national security and guardianship of the environment.

While the separate disciplines have served higher education for considerable time, interdisciplinarity is becoming more recognized as providing promising advances to address complex issues such as climate change (Bammer, 2017; Shaman et al., 2013) and to create novel solutions for health. In the current Covid-19 situation, decisions about restricting social interactions at multiple levels must be based on what we know about virus replication, rates of infection, immunity responses, personal hygiene practices, using statistics to convey data, using bioengineering to create vaccines and treatments, using engineering to create or repurpose factories for making products they were not previously designed to make (masks, hand sanitizer, ventilators) and more. Future ways of working will require more localized adapted solutions that leverage off what has been learned globally.

This means that interdisciplinary learning experiences will be more important than ever before, so that students can be immersed in learning experiences that support them to develop critical and creative thinking as well as collaborative and communication skills. Delanty (2001) goes even further and advocates for universities to reappraise what they focus on in terms of developing a new type of citizenship that is responsive to the changing nature of knowledge production and promotes 'the self-transformation of cultures through a critical

self-engagement with each other' (p. 128) in other words, collaboration and co-operation. Universities can provide learning experiences that support the development of technocratic skills (those that serve society through professions or service) and develop cultural capital (citizens who can take socially responsible action to improve society) (Delanty, 2001). The opportunities for how STEMM can contribute to this agenda, are only limited by our imaginations. If students need STEMM knowledge and skills, and employers are demanding them, how quickly are education systems adjusting to this need? Instead of piecemeal reform, this paper advocates for an integrated approach and provides a framework for helping to develop this reform.

2. Previous research on integration of STEMM in undergraduate programs

The Association of American Universities reported on its' work to support the implementation of better teaching and learning in undergraduate programs (Association of American Universities, 2012). This report provides many specific examples of how curriculum is being integrated within STEMM. Further research, as reported by the National Academy of Science, Engineering and Medicine (2018) indicated that there are some promising results of integrating curriculum. These included:

1. Some integrative approaches in STEMM have led to positive learning outcomes e.g. increased critical thinking abilities, higher-order thinking, reasoning and analysis, problem solving, communication, and teamwork.
2. Integrating STEMM content and pedagogies into arts and humanities may improve inter-disciplinary relations, improve scientific and technological literacy, and data analysis used in humanistic inquiry.
3. Where medical students experienced arts and humanities within their program, they increased their communication skills, empathy, resilience, teamwork and, increased their tolerance for uncertainty.
4. Around the world there is an increase in the number of educational institutions that are integrating curriculum.

Research on the integration of mathematics into other disciplines (or data sciences more generally) indicates huge potential promise (Czerniak, 2007). While science and mathematics share common aspects for problem-solving, teaching programs that truly integrate science and mathematics in higher education is rare (Bush & Cook, 2019). It is more likely that combining the approaches to learning, such as design thinking from engineering with problem-based and inquiry-based learning from the sciences and mathematics and including case studies and simulations from medicine, are worth pursuing in real-world contexts.

It seems that there is more likelihood of coherence, depth and motivation when design-based approaches are combined with problem-solving approaches (Miller & Krajcik, 2019).

Therefore it is not just the knowledge from separate disciplines that can be drawn on in an integrated approach, but the approaches to learning used in different disciplines, can be integrated as well to provide knowledge in and for action.

3. Proposed interdisciplinary STEMM curriculum model

The framework in Figure 1 is proposed to support the development of teaching and learning through interdisciplinarity in STEMM contexts. In Figure 1, the *Prior knowledge* dimension implies that faculty and students are aware that students already possess knowledge (both declarative knowledge and knowledge of skills) or know how to find out. This necessitates using teaching methods and creating support materials to help students reveal their emerging understanding. The use of analytic and intuitive thinking can also help manage their learning progressions.

Student support includes providing resources, learning technologies and access to data for continuous improvement. Supporting students to establish clear goals for learning means that students are more likely to invest effort and manage their time effectively, have a positive mindset about their choices and futures, appreciate differences and are committed to serving their communities (Schreiner et al. 2012).

Key pedagogies will be those that actively engage students e.g. design-thinking, problem-based or project-based and inquiry approaches to learning that use scenarios and multiple real-world examples or simulations. The importance of problem-based and inquiry approaches is that they enable specific examples to be investigated. When well-supported, these approaches to learning also assist in the development of students' academic judgement in relation to what knowledge is needed and how to undertake their learning (Conner, 2014). Students need to experience opportunities to critique their understanding and to create, curate and communicate, especially new knowledge they create as part of their collaborations.

Some students may have come through more contemporary learning environments where they have experienced inquiry and cross-disciplinary approaches at senior schools (e.g. see ASMS, Ao Tawhiti Unlimited Discovery). However students may need to be enculturated into new ways of thinking about and managing their own learning especially those who expect to be taught through more traditional teaching and learning approaches.

Through providing *Authentic contexts* for learning, students will gain a range of domain knowledge through using a range of primary and secondary data sources. The knowledge needed will be appropriate to the learning context. Their learning will be situated in projects or solution-focused experiences that value collaboration /teamwork. Therefore the *Learning environments* can be described as immersive and experiential where contributions are made to real solutions. Faculty roles may need to shift from being the *knower* to being the *enabler*.

The knowledge needed by students will need to be reconsidered as to what is appropriate. This may be threatening for some faculty whose identity is bound with expertise knowledge that may no longer be relevant to real-world situations. Students are also encouraged to consider interactions of components, using data sciences and cause and effect analyses, so crucial to tinkering through iterations for the best possible solutions, while taking account of influences and unintended outcomes.

The challenge with assessment when using integrated approaches, is related to what is designated as important for students to learn. Changes to curriculum can be driven by changes to assessment. Good learning designers start with the end in mind and identify what learning experiences will enable students to demonstrate the desired outcomes. If creative and critical thinking, collaboration and communication skills are desired, then these should be assessed alongside the tangible solutions as being feasible or achievable. Assessments could evaluate: How did students connect disparate sources of knowledge or use a range of skills to solve a problem? Have students taken humanistic or contingent factors into account?

4. Limitations of the integrating STEMM

While integrating disciplines has been implemented in some schooling systems for some time (Sniedze-Gregory, 2018), with some exceptions, higher education has been somewhat reticent about taking up more integrated approaches in STEMM. The reasons given for not integrating curriculum relate to: deeply held views by faculty about the value of separate disciplines; the specialist language and technical issues that may be discipline-specific; the availability of resources for teaching using appropriate pedagogies; faculty backgrounds (especially related to how they were taught or learning within their discipline) and an unwillingness to change; time to conceptualize an integrated approach to teaching and learning; and the need to stay productively researching (Malcolm & Feder, 2016).

Students also come to higher education with expectations about what and how they will be taught, often based on reputations and traditions. Institutional strategies for improved instruction and co-curricular support have yielded improvements in students' outcomes. It seems that assessment, course sequences, learning environments, student support and students' self-efficacy, all affect student engagement and progression (Malcolm & Feder, 2016). With the current accelerated shift to teaching in higher education to online environments, considerations of what interaction involves (students with resources, students with faculty and students-students) is of high interest. Students do not necessarily have the requisite self-directed or self-regulating skills sufficient to support their progress (Conner, 2014).

5. Conclusion and Recommendations

This paper is proposing a model to support the development of inter-disciplinarity in STEMM course work in higher education. If designed well, such interdisciplinary approaches can build capability and capacity amongst graduates to solve local and global issues through enacting their knowledge and skills collaboratively. Students will need to be provided with learning experiences for developing skills in design-thinking, problem-solving and interdisciplinary inquiry. They can also benefit from collaborating as emerging, enquiring experts who are ever curious about alternative possibilities and who effectively communicate their new knowledge and potential solutions. This can be a way (as well as research) for universities to generate new knowledge.

Currently most universities around the world are not addressing the need to develop interdisciplinary approaches seriously. Instead there are fragmented interdisciplinary approaches rather than seeking approaches that include iterative changes, reflection, evaluation, synthesis collaboration and authentic assessment. The model proposed in Figure 1 can support this development and the author welcomes feedback on it.

The implications of the proposed framework (Figure 1) is that there may need to be cultural changes for faculty and students to learn within student-centered, active learning pedagogical approaches that use relevant or authentic assessments. There will need to be a shift from delivering factoids to designing rich learning experiences using real-world challenges that require connecting ideas and conceptual mastery as well as developing the skills of collaboration, critical and creative thinking and effective communication. This shift implies that institutions will support staff to rethink how they provide learning experiences, rather than what content they teach. Staff development should be systematic and iterative, where reflection on progress towards effective active learning occurs and is celebrated and rewarded through promotion systems.

Global challenges such as climate change and pandemics, call for working across disciplines that transcend disciplinary silos (Honeybun-Arnolda & Obermeister, 2019). The integration of disciplines can support development and innovation for a more systems-based generative approach to learning in higher education for a more humanistic future. Further research is warranted to investigate how integration of curriculum through a range of pedagogical approaches within STEMM can prepare students for dealing with complex situations that call for evidence-based and humanistic solutions as they negotiate their worlds as workers and citizens.

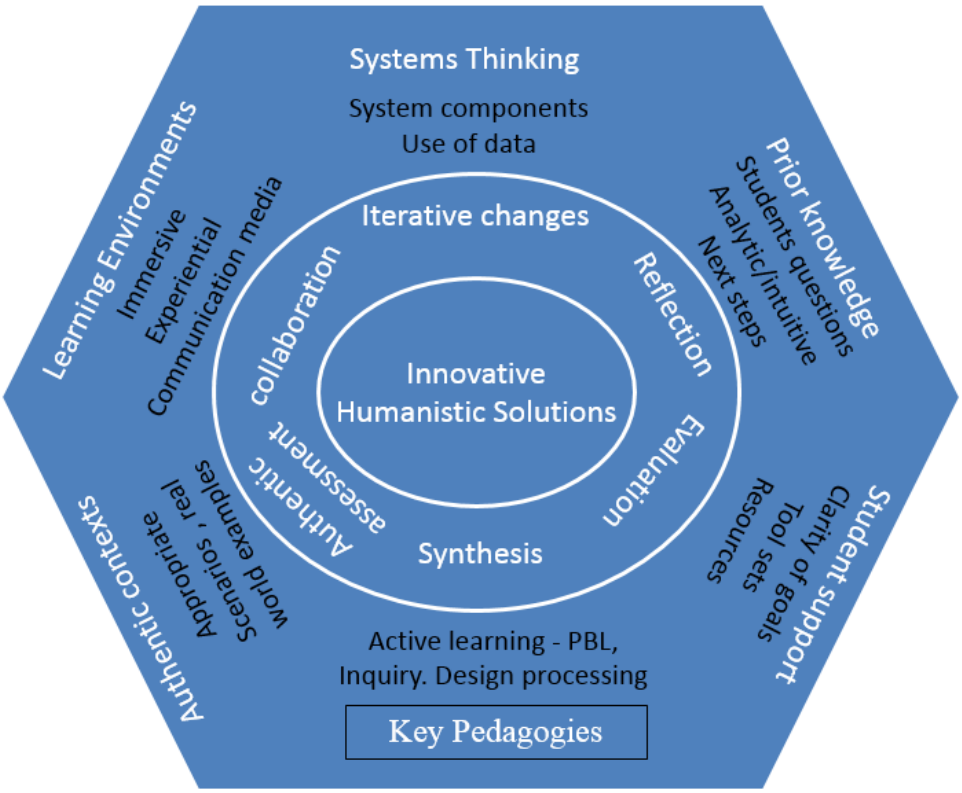

Figure 1. Framework for integrating STEMM in higher education

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Learning Outside the Classroom: A Distinctive Approach to Co-Curricular Recognition in the Australian context

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Abstract

Co-curricular engagement is an essential part of the student experience in Australian higher education institutions. Whilst there is wide acknowledgement of the benefits of students participating in co-curricular activities, formally recognising students for the knowledge, skills and experiences that they have gained through co-curricular learning has only recently emerged in the Australian context. This practice paper will describe one Australian university's approach in developing and implementing a co-curricular recognition framework. UOWx sits at the core of University of Wollongong's (UOW) student experience, providing holistic and transformational personal development of students. The distinctive features of UOW's approach include developing a whole of institution approach; embedding the student voice into continuous improvement cycles; and developing an active strategy to embed UOWx with employers and community organisations. This approach has transformed student co-curricular learning at UOW, by increasing the breadth of student engagement and deepening student understanding of the knowledge, skills and experiences students have gained through their co-curricular engagement.

Keywords: *Co-curricular framework; designing co-curricular recognition; reflection.*

1. Background

Student engagement in co-curricular activities outside of their formal university degree has been widely valued by Australian higher education institutions. Student engagement in activities, such as mentoring or leadership, have been designed in Australian higher education institutions as part of a holistic approach to the student experience, whereby student learning outside the classroom complements the academic curriculum (Kift, Nelson & Clarke, 2010). The benefits of students participating in co-curricular activities have been extensively demonstrated in the literature. Tinto (1987) identifies that co-curricular activities contribute to facilitating peer to peer interactions, leading to a smoother transition for students into the higher education setting. Others have emphasised the role that co-curricular activities have played in increasing the likelihood of students completing their degrees (Maher & Macallister, 2013). Whilst there are institutional benefits in offering co-curricular activities, the literature has also focused on the development opportunities that this provides for students in developing their graduate employability skills (O'Shea, 2019) and sense of active citizenship at a local and global level (Denson & Bowman, 2013). Despite the extensive literature available that highlights the role and benefits of co-curricular engagement in Australian higher education institutions, there is limited research undertaken in exploring the impact of formally recognising student engagement in these activities (Skalicky & Caney, 2010). Co-curricular recognition is the formal endorsement of knowledge and skills that students have gained throughout their university degree. In a study of co-curricular recognition in Canadian universities, Elias & Drea (2013) formed the following definition:

> *"The Co-Curricular Record (CCR) is a multi-faceted program, which in its broadest sense, both encourages and incentivises engagement. At its core, the CCR is intended to enhance students' learning and development, encourage the discovery and reflection of self-awareness, and foster an environment that encourages civic responsibility and engagement"* (pg. 2).

Underpinning this definition are three key principles that Elias & Drea (2013) identify as needing to be adopted in order for an initiative to be defined as 'co-curricular recognition'. These include: (1) defining co-curricular recognition within an institutional context and making this accessible to students through a central platform to incentivise engagement; (2) experience must be connected through learning and underpinned by a reflective framework; and (3) an institution must formally recognise student engagement through official documentation.

More recent work reflects an increasing focus on students graduating with job-ready skills (STARS 2020). In the competitive Australian graduate market, student engagement in co-curricular activities has been demonstrated to increase student's attractiveness to employers, as they have developed 'broadening' skills, such as critical thinking and emotional

intelligence, that employers are looking for (O'Shea, 2019). Elias (2014) argues that formal recognition tools can bridge the gap between students and potential employers in articulating the competencies gained through co-curricular engagement. This practice paper will explore the design and implementation of a co-curricular recognition framework at the University of Wollongong (UOW) in Australia. It will provide an overview of the distinctive design principles of UOW's co-curricular recognition framework and provide insights into the impact on student learning.

2. UOW's approach to Co-Curricular Recognition

UOW is a research-intensive medium sized university (32,953 enrolments in 2019) with a sharp focus on offering students a personalised and supportive learning experience and in developing exceptional graduates who are highly sought after in the workplace. UOW has a large geographical footprint with campuses located on the south coast of Australia, in Wollongong, Batemans Bay, Bega, Shoalhaven, Southern Highlands, Southern Sydney, the Sydney CBD and South Western Sydney, as well as a network of offshore campuses located in Dubai, Malaysia, Singapore, Hong Kong and China. UOW's domestic student cohort is diverse with 48% of students the first in their family to attend university, 2.22% of students are Aboriginal and/or Torres Strait Islander and 29.1% of students come from a regional, rural or remote area of Australia. Whilst UOW has made a strategic commitment to the progression of UOW students into, through and beyond higher education across the region, this has had to be contextualised in order to leverage the knowledge, skills and experiences that a diverse student cohort brings to UOW.

Underpinned by student experience literature (Tinto, 1987), career development learning (Law & Watts, 2003) and reflective learning (Stirling & Kerr, 2015), UOWx was launched in 2015. UOWx was developed as a co-curricular framework that recognised the active contribution students are making to the University, local community, and their own personal and professional development. Led by the UOW Senior Executive and a dedicated Project Manager, three years was spent, prior to the launch, on developing the Co-Curricular Recognition Framework through iterative rounds of consultation with staff, students and industry. UOWx provides students with two formal documents upon graduation:

- UOWx Record: A co-curricular record outlining the activities that a student has engaged with outside of their academic studies; and
- UOWx Award: The UOWx Award recognises students who have demonstrated significant engagement in co-curricular activities.

UOWx is firmly positioned in UOW's Strategic Plan 2020-2025 and 2030 vision, with the aim of recognising transformative learning experiences for students outside of the formal curricula, contributing to UOW's goal of developing graduates who are 21st Century

learners. UOWx is distinctively positioned across the Australian university sector, as it provides a framework for existing co-curricular activities and cultivates new learning opportunities at UOW that promote personal and professional development, as well as active citizenship. Examples of these activities include Club & Society Presidents, Peer Mentors or or Cultural Ambassadors. UOWx provides students with formal recognition of these co-curricular experiences which translates the knowledge and skills gained from these opportunities to the community and graduate employment market.

3. Design Principles of UOWx

UOWx aims to facilitate and recognise transformational learning experiences for UOW students outside of the formal curricula through three distinctive design principles outlined in the following sections.

3.1. An overarching inclusive framework for Co-Curricular Recognition

UOWx is distinctive within the sector as it is underpinned by an overarching and inclusive framework for co-curricular recognition. This approach leverages the valuable learning opportunities already on offer at UOW, as well as embedding the processes associated with UOWx across the university.

At the core of all UOWx recognised activities, is the UOWx Activity Eligibility Framework. In order to meet the UOWx Activity Eligibility Framework all activities must provide students with initial training and ongoing professional development, as well as enhancing student learning in three or more of the learning streams identified by industry, including leadership; mentoring and wellbeing; community and social change; innovation and creativity; global and cultural awareness; and/or collaboration and communication. Activity Coordinators identify the key learning outcomes that underpin each learning stream, which are assessed and attributed to a learning stream by the UOWx Steering Committee. As can be seen in figure 1, 257 activities across UOW have been recognised by UOWx, enabling students to access a wide variety of opportunities to develop a diverse skill set.

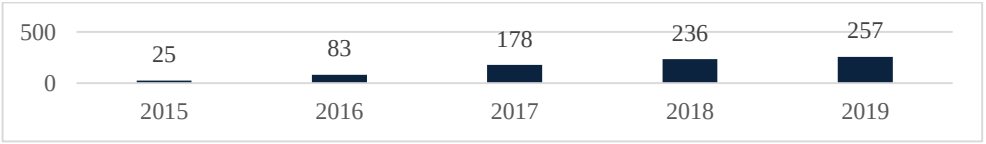

Figure 1: Number of co-curricular activities recognised by UOWx from 2015-2019

Students have commented on the benefit of such an approach, with an Alumni of UOWx describing that "…the diversity in the activities available has enabled me to work on my

weaknesses, develop my strengths, and has taught me how to become more adaptable and versatile in different environments" (UOWx Alumni surveyed in 2017).

UOWx has been positioned as part of the fabric of the institution due to senior leadership support and embedded systems. The UOWx Co-Curricular Recognition Framework is embedded across the university, with UOW Council-endorsed policies and procedures that guide the implementation of the program across all faculties and departments. Embedded systems allow for UOWx to be delivered at scale and included within UOW's formal suite of graduation documents. Many other universities across Australia and New Zealand use manual processes to produce their recognition documents, however UOW has developed a systems solution which allows students to log their co-curricular activity in the university's learning management system (Moodle), which is integrated with the student management platform (SMP). Formal document issuance of the UOWx Record and UOWx Award are issued alongside UOW's suite of graduation documents which is recorded on students' Australian Higher Education Graduation Statement (AHEGS).

3.2. Embedding the student voice into continuous improvement cycles

UOWx has been purposeful in its design in embedding the student voice within its quality review cycle. This approach "is a way of thinking and practicing in higher education that re-positions students and staff as active collaborators in the diverse processes of teaching and learning – empowering students to be actively engaged in, and share the responsibility for, their own education" (Mercer-Mapstone & Marie, 2017, p. 7). When students are valued and engaged as active collaborators on projects related to teaching and learning there are positive impacts on learning, and an increased sense of leadership in, responsibility for, and motivation around the learning process (Mercer-Mapstone et al. 2017). As such, the student voice is strongly featured in the four stages of the quality review cycle as demonstrated by Figure 2. This includes ensuring student representation on UOWx governance committees; opportunities for self-assessment through UOWx; engagement of students as ambassadors who feed into continuous improvement cycles; and formative surveys and focus groups with UOWx participants, Alumni and activity coordinators.

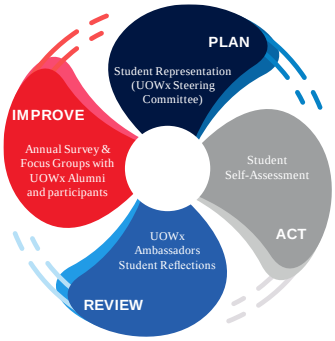

Figure 2: Student voice embedded in continuous improvement cycles.

3.3. An active strategy that aims to embed UOWx with employers

Finally, UOWx has an active strategy that aims to embed UOWx with employers. The strategy was developed to competitively position graduating UOW students in the

recruitment market by enhancing their capacity to articulate the knowledge and skills that they have gained in co-curricular activities during their degree, and ensure that UOWx Record and UOWx Award documents are actively recognised by employers. The strategy is supported by five goals including: developing an integrated communications strategy to raise awareness of UOWx with industry; reviewing the content of the UOWx Record and UOWx Award to better position students to articulate the knowledge and skills that they have learnt outside of the formal curricula to employers; placing a stronger emphasis on co-curricular learning outcomes and reflections; collaboratively developing a suite of opportunities to build student engagement with industry and employers; and regularly reviewing the knowledge and skills that employers value to ensure the currency of the UOWx Co-Curricular Framework.

To date over 100 employers and 8 community organisations have engaged with UOWx. In addition to engaging with networking events and community volunteering placements, industry professionals have provided ongoing mentoring to 129 UOWx student graduates. Through an annual survey of UOWx Alumni, 76% have said that their co-curricular experiences have helped them stand out to employers and 98% have said they feel they can effectively articulate their co-curricular experiences to employers. Students have identified that they are "…motivated to receive the UOWx Award to show future employers" (UOWx Alumni, 2020). Also for many students a "…key reason [he] decided to become involved in a range of extra-curricular activities included the opportunity to increase [his] skills...to become more employable" (UOWx Alumni, 2020). Employers also describe the benefits of engaging with UOWx, with one employer stating:

> *"It's a great initiative and it adds real insight into the mindset and personal traits of the graduating students, something that can be difficult to gain when reading a standard resume or job application." – Illawarra Employer 2015*

4. Transforming Students' Engagement

Student involvement with co-curricular activities has been transformed by the introduction of UOWx, in terms of the level of their engagement with co-curricular recognition and the development of self-reflection and self-awareness.

4.1. Student engagement with co-curricular recognition

UOWx currently has 3310 students logging their co-curricular involvement each year. The initiative has experienced significant growth since 2015 in terms of both student engagement, as well as the numbers of students graduating with the UOWx Record and UOWx Award (see fig 3).

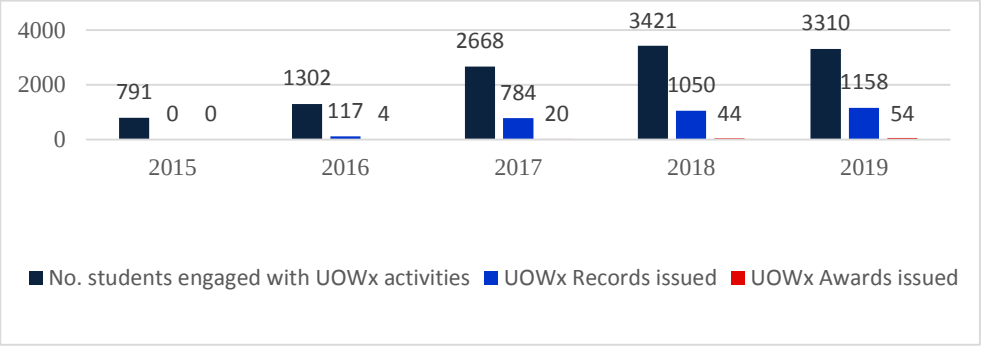

Figure 3: Student engagement in UOWx from 2015-2019

Since 2015, a total of 9981 unique students have engaged with co-curricular activities. Of this cohort, over 30% of students engage and record more than one co-curricular activity. Current participants describe the incentive to become more involved and the benefits that this offers them,

> *"I absolutely love UOWx opportunities and I am heavily appreciative of them. ...Also, once I get involved in one, it seems as though all of these other doors open and I am always asked to complete more programs..."* (UOWx Student Participant surveyed in 2017).

A particular success of the program is its ability to cater to diverse cohorts of students who typically do not engage in co-curricular activities. The significant work and family commitments experienced by students from divese backgrounds leaves less time for co-curricular activities, despite such experiences being critical for post-higher education employability (O'Shea, 2019). Ensuring that co-curricular participation is achievable for all students has been a key focus for UOWx with targeted approaches to encourage and increase the participation of these target groups implemented.

Student Group	2015	2016	2017	2018	2019
International Students	24.27%	27.66%	35.04%	31.83%	38.12%
First in Family Students	47.53%	46.96%	49.40%	48.48%	44.23%
Aboriginal and/or Torres Strait Islander Students	1.01%	1.11%	1.44%	1.72%	1.54%
Students with a Disability	9.99%	8.80%	9.35%	10.32%	10.55%

Figure 4: Equity and international student engagement in UOWx

Targeted approaches for these student groups include;

- Place-based approaches which provide contextualised face-to-face and digital opportunities for regional and metropolitan students;
- Internal partnerships with Woolyungah Indigenous Centre to embed Aboriginal knowledges into the delivery of co-curricular activities, as well as internal partnerships with accommodation services to engage with regional and international students;
- Recognition of paid as well as voluntary activities so that students can participate in ways that support their diverse situations and needs; and
- Equity scholarships that compensate students who are experiencing financial hardship to enable them to participate in unpaid co-curricular activities.

4.2. Transforming student engagement through self-reflection and self-awareness

UOWx is underpinned by a reflective framework (Stirling & Kerr, 2015) to ensure that all UOWx recognised activities significantly contribute to student learning. Wienhausen and Elias (2017) identify that students have difficulty in promoting their co-curricular involvement to employers. Reflection and self-awareness are critical to student learning and development as part of UOWx and students have the opportunity to formatively reflect on what they have learnt after each engagement through the UOWx Learning Streams and a summative reflection is captured upon completion of the UOWx Award program. Many students reflect on their transformation with UOWx, with one student describing that,

> *"Throughout more than two years of mingling amongst proactive people, the UOWx experience has had meaningful impact on my personal growth. I became more active and have discovered more about myself and more importantly, I know what I want to do in the future. I am so excited to see how far I can go and how much I can improve in the future"* (UOWx Alumni surveyed in 2017).

5. Conclusion

This practice paper describes one Australian university's approach in developing and implementing a co-curricular recognition framework. UOWx is a program designed to maximise student engagement in co-curricular learning opportunities with the specific context and student cohort of UOW in mind. UOWx is distinctive in that it provides a framework for existing co-curricular activities and cultivates new learning opportunities at UOW that promote personal and professional development, as well as active citizenship. UOWx provides students with formal recognition of these co-curricular experiences which translates the knowledge and skills gained from these opportunities to the community and

graduate employment market. Employers and community organisations have engaged strongly with UOWx, with over 100 organisations actively participating and recognizing the value of UOW's co-curricular framework.

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Transnational Higher Education and International Branch Campuses in the Gulf Cooperation Council Countries: The Case of the United Arab Emirates

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Abstract
The aim of the paper is to examine the emergence of transnational higher education (TNHE) and international branch campuses (IBCs) in the Gulf Cooperation Council (GCC) countries and the United Arab Emirates (UAE). The findings demonstrate that the emergence of TNHE and IBCs has been the result of interrelated political, economic, social, and academic factors. First, the formation of the GCC was a key moment during which member states sought to stimulate scientific progress through the development of higher education as part of a strategy to meet labor demands and economic development. Second, the commodification of education and the drive to increasing profits in educational institutions combined with decreases in government funding to Western universities during the neo-liberal era of capitalism have been an impetus for Western universities to seek 'new markets' beyond their borders. Third, the liberating of regional trade policies in services, including education, combined with the internationalization of education has enabled the cross-border movement of students, educators, and institutions. Fourth, the UAE's unique demographic group mix, which consists of a majority of international expatriates, combined with significant government funding in the education sector and international partnerships has resulted in the rapid expansion of TNHE and IBCs.

Keywords: *Transnational Higher Education; International Branch Campus; Gulf Cooperation Council; United Arab Emirates.*

1. Introduction

Transnational higher education (TNHE) has had a long history in the Middle East in general and the Arabian Gulf in particular. The American model of education was introduced in the 19th century into some countries in the Middle East; however, the more recent proliferation of Western higher education institutions has been most prominent in the Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates). The GCC countries have made significant attempts at establishing themselves as a new emerging higher education hub by promoting and designing policies to attract more international students (Wilkins et al., 2012). The United Arab Emirates (UAE) and Qatar, in particular, have become the TNHE centers of the Middle East region with more than 400 undergraduate and graduate programs from universities in the US, UK, and France (Alam et al., 2013). As of 2015, the UAE hosted 31 international branch campuses (IBCs) and was second in the world compared to China which hosted 32 IBCs. Qatar and Singapore were fourth with 11 IBCs each following Malaysia which had 12 IBCs (Mackie, 2019). The purpose of the paper is to examine the emergence of TNHE and IBCs in the GCC countries more generally and the UAE more specifically. This has occurred as a result of several interrelated political, economic, social, and academic factors. First, the formation of the GCC in 1981 was a key moment during which member states sought to stimulate scientific and technological progress through the development of programs and curricula for higher education as part of an overall strategy to meet labor market demands and economic development. Second, the commodification of education and the drive to increasing profits in educational institutions combined with significant decreases in government funding to Western universities during the neo-liberal era of capitalism have been an impetus for Western universities to seek 'new markets' beyond their borders. Third, the liberating of regional trade policies in services, including education, combined with the internationalization of education amidst an era of globalization has enabled the cross-border movement of students, educators, and institutions. Fourth, the UAE's unique demographic group mix, which consists of an overwhelming majority of international expatriates, combined with significant government funding in the education sector and international partnerships has resulted in the rapid expansion of TNHE programs and IBCs. The paper is organized in the following way. The first section defines the terms TNHE and IBCs and provides an overview of their rapid global expansion. The second section develops the context by examining the TNHE programs in the Middle East region, GCC countries, and the UAE. Several factors are discussed including colonialization and the role of education, the formation of the GCC and the development of education, and the emergence of TNHE programs in the GCC countries. In addition, issues such as the educational sector, unique demographic group mix, and the internationalization of education in the UAE are discussed. The third section is a concluding summary and discussion of the findings.

2. TNHE and IBCs

According to the Council of Europe, TNHE refers to "All types of higher education study programmes, or sets of courses of study, or educational services (including those of distance education) in which the learners are located in a country different from the one where the awarding institution is based" (Council of Europe, 2001). TNHE involves the internationalization of education in an era of globalization. According to Knight (2003, p. 2), "Internationalization at the national, sector, and institutional levels is defined as the process of integrating an international, intercultural, or global dimension into the purpose, functions or delivery of postsecondary education". This is affected by processes associated with globalization. Globalization incorporates "the flow of technology, economy, knowledge, people, values, and ideas … across borders" (Knight, 2003, p. 3). Knight (2003, p. 3) claimed, "internationalization is changing the world of education and globalization is changing the world of internationalization" (see also Knight, 2006).

TNHE incorporates a broad range of activities such as providing higher education in places that cannot meet demand, upgrading the international perspective and skills of students, and cross-cultural communication (Altbach & Knight, 2007). It employs several delivery modes: IBCs, franchising or partnership, articulation or twinning, distance or virtual education, and study abroad programs (Alam et al., 2013). IBCs refer to higher education institutions that have a physical presence in a foreign country. They provide students undergraduate and/or graduate programs solely or jointly with a foreign institution. The foreign institution grants the degree and the students are expected to follow similar programs to the ones offered at the home campus. IBCs have rooms for teaching and may have other facilities such as libraries, student accommodations, and so on (Wilkins, 2010). Since the mid-1980s, global student enrollment in TNHE programs has proliferated from an estimated 50,000 to 404,000 in 2016/2017 (Bennell, 2019). According to Bohm et al. (2002), TNHE will account for 44% of total demand for international education by 2025. In addition, as of January 2017, universities have established 249 IBCs across 33 countries with 26% growth in the last five years (Escriva-Beltran, 2019).

2.1. TNHE in the Middle East Region

The introduction of higher education from Western to non-Western regions is not new. Non-Western regions have had European university models imposed on them through colonization. Colonial education served to consolidate foreign rule through ideological subjugation. This was accomplished by diminishing the validity and legitimacy of indigenous knowledge and replacing it with that of the metropole (Kelly & Altbach, 1984). The original colonial educational model was imported from England and combined with the German research university to produce the 19th century modern American university. The American educational model has been used to establish universities in the Middle East region

including places such as Egypt, Turkey, and Lebanon (Altbach, 2004). A case in point is the American University of Beirut (AUB), which was founded in 1866 under the name Syrian Protestant College by the American missionary Dr. Daniel Bliss. AUB was established by the American Board of Commissioners for Foreign Missions as "a college of higher learning" with "an American educational character" (American University of Beirut, n. d.). Moreover, Western colonizers have had different purposes for establishing and operating branch campuses including educating and training natives for administrative and civil service jobs, providing education to natives of developing countries, and serving military and civilian personnel (Bhuian, 2016).

The formation of the GCC in Riyadh, Saudi Arabia on 4 February 1981 was in part "To effect coordination, integration and inter-connection between Member States in all fields" (International Relations and Security Network, 1981, p. 2) including economic, customs, communication, education, and culture. More specifically, among the stated objectives were "To stimulate scientific and technological progress in the fields of industry, mining, agriculture, water and animal resources; to establish scientific research; to establish joint ventures and encourage cooperation by the private sector for the good of their peoples" (International Relations and Security Network, 1981, p. 2). As part of this commitment, the GCC countries have made several efforts to develop educational plans through a number of resolutions. For example, the Economic Agreement between the GCC States adopted by the GCC Supreme Council during the 22nd Session on 31 December 2001 stated, "Member States shall cooperate to develop programs and curricula of public, higher, and technical education, to ensure high levels of scientific content" and "Member States shall adopt appropriate policies and mechanisms to ensure compatibility between the outputs of higher education and scientific and technical research on the one hand, and the needs of the labor market and economic development, on the other" (The Cooperation Council for the Arab States of the Gulf (GCC), 2001, p. 10). The response by the GCC countries to the challenge of extending higher education to all segments of society has been met by different concrete measures including establishing universities, the development of a variety of higher education programs, collaborating with higher education institutions, and the assessment of such efforts (Mukerji & Jammel, 2008).

Part of this process has been the introduction of TNHE programs. TNHE programs in the GCC countries have proliferated in volume, scope, and complexity in the past two decades. For example, the UAE and Qatar governments have established education cities for hosting IBCs that are either fully subsidized or rented to Western universities. Such efforts have been part of a variety of strategies aimed at attracting world-class intuitions to the region (Becker, 2010). Establishing TNHE programs has been due to a combination of political, economic, socio-cultural, and academic factors (Childress, 2009). Political factors, particularly after the events of September 11, have emphasized the importance of making

students more aware of world cultures, and providing students with the skills to address issues related to national security and foreign policy. Economic factors have included preparing students for careers in their respective countries or internationally, increasing income for Western universities, and contributing toward domestic economic development and international competitiveness. Socio-cultural factors have emphasized the need to develop students' inter-cultural communication skills. This addresses communication processes and problems that are the result of integrating people from different religious, social, ethical, and educational backgrounds. Students are expected to know how people from different countries and cultures behave, communicate, and perceive the world around them. Academic factors have highlighted the importance of strengthening liberal education. This includes developing a broad knowledge base and transferable skills, instilling a sense of values, ethics, and civic engagement, and developing critical thinking (Childress, 2009).

Some authors have been critical about the introduction of TNHE programs into the GCC region. For example, Knight (2002) argued that regional trade agreements such as the General Agreement on Trades in Service under the auspices of the World Trade Organization focus exclusively on removing barriers to trade in services such as education as opposed to products. This has increasingly threatened the role of government in education, diminished the importance of education as a 'public good', and reduced the quality of education. This has occurred amidst significant reduction of government subsidies to Western universities and a greater drive toward profitability in education that has become endemic during the neo-liberal era of capitalism (Girdzijauskaitė et al., 2019).

The commodification of education has been an impetus for Western universities to setup IBCs largely as profit-making enterprises. Altbach (2015, p. 2) poignantly stated that education has been "increasingly seen as a commodity to be purchased by a consumer in order to build a "skill set" to be used in the marketplace or a product to be bought and sold by multinational corporations, academic institutions that have transmogrified themselves into businesses, and other providers". Moreover, Ellili-Cherif et al. (2012) found specific procedural and socio-cultural issues problematic. The authors point to ambiguous terminology and procedures, sidelining the input of local educators, and imposing unrealistic expectations. Also, they claim that many of the educational services have been imported without taking into account local socio-cultural dynamics. Knight (2002) refers to such processes as a form of acculturation. Cross-border supplies of educational services produce a homogenized culture where diverse customs, ideas, and values are reduced into a single culture.

2.2. TNHE in the United Arab Emirates

The outcomes of TNHE programs have been uneven and evolving when comparing regions, different countries in one region, or even different institutions in one country (Knight, 2008).

The UAE provides an interesting case. Its education sector is divided into public schools, private schools, and higher education. Significant expansion of the UAE's education market is expected over the next few years from $4.4 billion in 2017 to $7.1 billion by 2023. The 2018 federal budget allocated $2.8 billion (20% of the total budget) for general, higher, and university education programs. The UAE's unique demographic group mix, which consists of approximately 89% international expatriates and 11% Emirati citizens (7.64% of the population is in the 15 to 24 years age bracket) has led to greater demand for international schools with enrollments expected to increase from approximately 56% to 66% over the next five years (U.S. Commercial Service, 2019).

Part of the effort to develop the education sector in the UAE has been a series of reforms that resulted in the growth of international partnerships and setting up private universities. The American University of Dubai was the first in 1995 followed by the University of Sharjah in 1997 which was a branch campus for the American University in Washington D. C. Other notable examples are Paris-Sorbonne University Abu Dhabi, New York University Abu Dhabi, and Michigan State Dubai. TNHE programs and IBCs have been very visible and a resource intensive aspect of the educational sector of the UAE. The rationale behind this growth has been the "belief that the recognition and achievements these institutions attained over decades in their native land would be transferable in the implementation of international branch campuses" (Franklin & Alzouebi, 2014, p. 121). Moreover, the UAE has made an effort to enter the international market in higher education and compete with countries like China, Singapore, and Saudi Arabia by investing in the establishment of top-tier research universities. Accordingly, higher education has increasingly shifted in the UAE to private universities and IBCs. Currently, 70% of the 120,000 students are in private universities. TNHE programs are accredited by the Ministry of Higher Education's Center for Academic Accreditation. Many of the institutions operate in the free zones of the country such as the Dubai International Academic City and the Knowledge Village in Dubai (Datta & Vardhan, 2017).

The development of TNHE programs in the UAE has been met with mixed reviews. Some studies focused on a variety of economic factors that condition market demand for higher educational services in the UAE. For example, commercial-based studies claim that enrolments in Dubai rose from 33,500 in 2011/2012 to 46,000 in 2015/2016 (U.S. Commercial Service, 2019) and point to investment opportunities in the educational sector. The increase in enrollment in the UAE in general and Dubai in particular may be attributed to several factors. First, is the increasing UAE population (currently 9.6 million with a projected increase to 10.4 million by 2025) (World Bank, 2019; PopulationPyramid.net, 2019) of mostly expatriates that are drawn to Western institutions in the UAE. As a result, Dubai is expected to require an estimated 68,000 student places by 2025, of which 50,000 are expected to be in the private sector. This supports Dubai's initiative to become a leading

player in the TNHE market regionally and internationally as over 33% of students come from abroad with 56% from Asian countries and 30% from the MENA region. Second, the growing attraction to Dubai as a center for international higher education and the increasing number of IBCs given the economic incentives for Western universities to locate in the UAE. Third, growing preference for TNHE programs among Emirati parents seeking higher standards of education for their children as well as Emirati professionals seeking to complete higher education while pursuing a career (Colliers International, 2018). These factors have resulted in an increase in demand for TNHE programs as indicated by the number of IBCs in the UAE.

The decision-making process to enrolling in a TNHE program in the UAE has been an important criterion for attracting students. According to Ahmad and Hussain's (2017) study on factors that determine student choice for higher education in the UAE, the decision-making process to study abroad is influenced by: (1) the learning environment (e.g., safety, security, diversity, multicultural student population, and career prospects upon graduation); (2) cost (e.g., cost of living, tuition, and travel); and (3) institutional reputation (e.g., the quality of education, the university reputation, and the recognition of the degree). The authors' findings are corroborated by other studies in a similar vein. For example, Wilkins et al., (2012) found that improved regional career prospects, cultural and lifestyle orientation, convenience, and country-specific advantages play a significant role in terms of student choice. Lane-Toomey and Lane (2011) sight several reasons that motivate students to choose the Middle East region including: (1) cultural issues such as language development, international cooperation and interaction, and religion; (2) economic issues such as the availability of scholarships; and (3) political issues such as national security following the events of September 11 and exposure to international issues.

While attracting students is of great importance for any educational institution, retaining them is perhaps even more important. Some studies in the UAE focused on student experience in TNHE programs to determine student satisfaction at IBCs. According to Wilkins and Balakrishnan (2013), achieving student satisfaction brings several benefits: (1) higher student retention; (2) higher grades; (3) positive word-of-mouth and on-line support of the institution; and (4) more likely to collaborate with the institution following graduation. The authors found that the quality of lectures, the quality and availability of resources, and the effective use of technology were the most important factors affecting student satisfaction. Other studies concerning student satisfaction in different contexts made similar findings (see, for example, DeShields and Kaynak, 2005; Alves and Raposo, 2007; Gruber et al., 2010). Data and Vardhan (2017) identify factors that play a significant role in improving the service quality for students in the management program. The authors assess service quality using five dimensions: responsiveness, assurance, tangibility, empathy, and reliability. The results of this study contrast those in the UAE with more positive outcomes. The authors found that

students in the management program of seven international universities in the UAE held a negative perception of their education as their expectations were not met. The key contributors include a low credibility of the degree provided by the institutions, the lack of placement and career opportunities, and the low quality of educational services compared to well-established Western universities. The authors claim that there needs to be an accrediting body and a national framework to regulate the quality of private institutions with measurable and transferable international standards.

While studies that examine student satisfaction are an important indicator of how effective educational institutions have been at providing core services, some authors have focused on the socio-cultural factors that undergird higher education institutions. For example, Franklin and Alzouebi (2014), question the effectiveness of TNHE programs and IBCs that have been 'imported' from abroad and simply imposed on countries such as the UAE. In particular, the authors are concerned with differences between the home country and adopting country that relate to culture, values, local and regional expectations, and strategic plans. This perspective resonates with some of the findings from Mahani and Molki (2011). The authors claim that the success of TNHE programs and IBCs in the UAE is ultimately determined by their effectiveness in addressing cultural difference including differences in laws and regulations. Clearly, such studies raise important aspects about TNHE programs and IBCs that go beyond simply the classroom setting.

3. Discussion and Conclusion

The introduction of TNHE programs and IBCS in the GCC countries more generally and the UAE more specifically has occurred as a result of several interrelated political, economic, social, and academic factors. First, the formation of the GCC in 1981 was a key moment during which member states sought to stimulate scientific and technological progress through the development of programs and curricula for higher education as part of an overall strategy to meet labor market demands and economic development. This was followed by a proliferation of TNHE programs and IBCs in the GCC countries in the past two decades. The UAE and Qatar, in particular, have become the TNHE centers of the Middle East region with 31 and 11 IBCs respectively representing more than 400 undergraduate and graduate programs from universities in the US, UK, and France (Alam et al., 2013; Mackie, 2019).

Second, the commodification of education and the drive to increasing profits in educational institutions combined with significant decreases in government funding to Western universities during the neo-liberal era of capitalism have been an impetus for Western universities to seek 'new markets' beyond their borders. TNHE programs are increasingly regarded as a top priority in many institutions, not only in terms of providing high quality educational services, but also expanding the geographical scope of such services. IBCs have

been an important but risky profit-making enterprise in this regard that position institutions internationally as well as diversify their income. Approximately 85% of the 249 IBCs globally are administered by institutions based in Western countries. Primary IBCs sending countries are the US (77 IBCs globally), UK (39 IBCs globally), France (28 IBCs globally), and Russia (21 IBCs globally) (Escriva-Beltran, 2019; Mackie, 2019).

Third, the liberating of regional trade policies in services, including education, combined with the internationalization of education amidst an era of globalization has enabled the cross-border movement of students, educators, and institutions. This has been facilitated by the 'blurring' of the "conceptual, disciplinary, and geographic borders traditionally inherent to higher education" (Knight, 2003, p. 2). The introduction on TNHE programs has opened up spaces, particularly after the events of September 11, that emphasize the importance of making students aware of world cultures, providing students with the skills to address issues related to national security and foreign policy, developing students' inter-cultural communication skills, and instilling a sense of values, ethics, and civic engagement.

Fourth, the UAE's unique demographic group mix, which consists of an overwhelming majority of international expatriates, combined with significant government funding in the education sector and international partnerships has resulted in the rapid expansion of TNHE programs and IBCs. This has not only been an academic exercise, but an economic one as the UAE has poised itself to compete in the education market with the likes of China, Singapore, and Saudi Arabia with the goal of attracting and retaining higher education seeking clients. While the strategy has been, for the most part, a success given the exponential increase in enrollments some challenges remain as the UAE continues to make adjustments that meet evolving political, economic, social, and academic factors.

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An Approach to Building Learning Objects

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Abstract

Designing for online education can be a complex endeavor and the way to approach this must be carefully considered. This article examines the case of Danish educational institution SmartLearning to map out and analyze the approach to online courses. The study find that SmartLearning approaches the online courses by setting up guidelines for educators on how to build learning objects. The approach is to use three different elements, one focused on the content and learning goals for a course, one focused on the layout of the leaning management system, and one focusing on which didactic principles to apply. These three elements must work together in the learning object in order to assure learning and motivation of learners. The study also find some structure regarding this process and based on the analysis it is recommended to bind the development of learning objects and courses together through instructional design tools. This will aid the further development of combining the three elements into quality learning objects.

Keywords: *Learning Objects; E-learning; Continued education; Online course design.*

1. Introduction

The background for this paper is the interest in mapping out how modern educational institutions can create online courses with consideration to both user friendliness, quality of education and easy to use development tools for educators in the continuous designing of online courses. Focus will partly be a new didactic guideline in SmartLearning, and partly the basic rules for designing learning objects to be easy to access.

2. Case description and methodology

SmartLearning is the case study used in this paper, an institution owed by eight Danish business academies and charged with the responsibility to handle all fully online courses in the area of continued education (further adult education) on behalf of the academies. SmartLearning offers thirteen different educations and a series of smaller micro learning courses. The educational levels are academy profession programs and diploma graduate programs, which were attended by 3.187 learners in 2019. SmartLearning is located in Copenhagen, Denmark, but since all teaching takes place on SmartLearning's Moodle platform, placement really does not mean much to the operations. Because of this SmartLearning can work with educators all over Denmark and therefore employ many part-time employees. Because of these virtual aspects of the operation challenges lies in the organization of the educators and courses, which becomes crucial to success (Danmarks Evalueringsinstitut, 2019). Strong processes and clear roles are necessary to develop and maintain this type of organizational structure (Larsen et al., 2016). Because of this, the organization decided to develop common processes and define new roles for learners. This to ensure the quality of the courses offered by SmartLearning. The methodology is observations, educational materials and feedback from learners and educators from both courses and training seminars for educators. I have analyzed the structure and design of 26 courses containing 364 learning objects. Further 2-3 learner evaluation surveys per course and for about 15 sets of course evaluation data extracted from analytical tools in Moodle. This was carried out as qualitative analysis, working with educators and digital learning consultants on structure and design of learning objects and creating general guidelines for this work. I have participated in three two-day workshops and three one day workshops with the educators on topics of developing online courses, designing learnings objects, using evaluations, using analytical tools in Moodle and applying didactic principles.

3. Approaching learning object design

At SmartLearning, the design of learning objects has several elements to it, and I have decided to divide these elements into different approaches to designing learning objects. The approaches are sliced content in an appropriate amount, the layout of the Moodle platform,

and the didactics to be used in order to secure learning and student participation. Learnings objects in this case is referred to as a lesson. I comprises both instructions, teaching materials, exercises and evaluation. A typical course consists of 14 such themed objects and a general section functioning as a frame for the entire course.

3.1. The components of an online learning object

First, there must be sliced pieces of content. Slicing the content of the course creates small chunks of learning with appropriate learning targets. Slicing is beneficial to learning, because typically, the brain is not able to handle more than 3-4 new concepts at a time, as there is limited rage in the short-term memory (Boser, 2017, p. 41). At the same time, the chunks must not be too small at to become trivial or neglectable.

Then there need to be a structure. It must be easy for a student to move from one learning object to another. It should not be a challenge for the learners to orientate themselves in a new learning object, so they should be predictable in their structure. This is achieved on the level of the organization by creating a baseline for the structure of learning objects (SmartLearning, 2019I). This baseline is built on some general design principles, in SmartLearning the principles are: fast, functional, familiar. Fast in regards to how easy, it is to navigate the learning objects, and learning platform as a whole. There should not be many layers and it must be easy to jump between objects and parts of objects. Each course is then a series of linked learning objects and what we could call a general object containing the overall course information. Functional refers to that each specific element in the learning object must be easy to use and have a singular purpose. Because of this, interdependence between parts it not used a lot, but there can be a forced succession in some tasks. Familiar refers to the learning objects are based on the same baseline for design. These three design principles ensures that further development of learning objects does stay within a common framework and adhere to common quality standards. Part of the baseline also outline what data points there should be available in the design and which dashboard element should be available to learners and educators respectively.

The third element is the didactic principles, which I will examine in the next section.

3.2. The didactic principles at SmartLearning

A learning object need to contain a number of activities, either reading text, writing text, problem solving, quizzing, the possibility to engage in peer to peer activities, watching video, making video, co-creation with fellow learners and so forth. All this need to be tied together in a way, which ensures the highest learning outcome and the highest level of participation on the part of the learners. Because of this, an adequate toolbox of didactic principles must be available to all the educators at SmartLearning. This is especially important since most teachers are working part-time at SmartLearning (and usually full time in another

organization), and are working from all over the country. These virtual aspects of the organization, where most learners only meet once or twice a year, makes the sharing of knowledge less than seamless. This calls for a higher degree of facilitations on behalf of the organization, especially in terms of the development and use of online learning objects, since this is not normally a focus point in the other (usually educational) organization where the educators are employed full time.

There are many learning principles that can be employed when designing learning objects, but the principles primarily used at SmartLearning will together address a wide variety of approaches to learning so that the educators can choose from different approaches, but approaches that still support each other. The principles are: Spaced Practice & Retrieval, Cognitive overload, Variation, Personalized learning, Online socialization, Transfer and Metacognition (SmartLearning, 2019II). By utilizing these principles in the design of online learning objects and whole courses, improvements in both retention and motivation can is monitored and measured. It is important that the course designers have a clear idea about which principles to use before beginning to design the learning object.

Measurement for retention of knowledge is handled with quizzes, surveys and polls along reports and other written exercises. Quizzes, surveys and poll are easily applied in an online environment, and yield quantitative data of successes and failures, and weather learners can recall knowledge from the course. Measurement for motivation can take the form of registering participation in discussion forums, peer-to-peer exercises, but also in general course statistics such as frequency of login, time spend in the learning environment and by using weekly surveys of learner satisfaction with the course.

3.3. Organizational setup

All responsibilities of SmartLearning's educational activities lies within what is called the 'column of education'. As mentioned, most educators are part-time at SmartLearning, but a small handful of full time educators are employed and function as coordinators. These coordinators assist the educators in updating the courses in relation to curriculum design and combining the individual courses that makes up full formal educations. There are also specific course designers employed called Digital Learning Consultants, who do not teach, but work only on assisting educators in using the guidelines and the Moodle platform in general alongside guiding educators in using the didactic principles online. This means that three functions exists in the column of education: teaching, structuring courses in Moodle (baseline) and didactic support. It is important that these three functions work closely together. Most importantly, this is aiming at ensuring that the educators can focus on their teaching and teaching methods. Put in another way, the educators can focus on ensuring the learning output and motivation of the learners. This is quite a significant change form earlier, when educators were expected to develop and design everything independently, but now

designer and educator is not necessary the same person, so a specialization is taking place within this setup at the organization.

3.4. Future developments

The development in SmartLearning towards a structured approach to ensuring quality and innovation in education has gained traction over some years now, but initiatives are not necessary seen within a cohesive framework. More in depth analysis is needed for this. However, based on this study an overarching framework can be outlined which can be used to structure the principles and guidelines mentioned in this paper. In building learning objects (and combining these into full courses), I find there must be three elements working in accord and these are content, baseline and didactic principles as shown in figure 1.

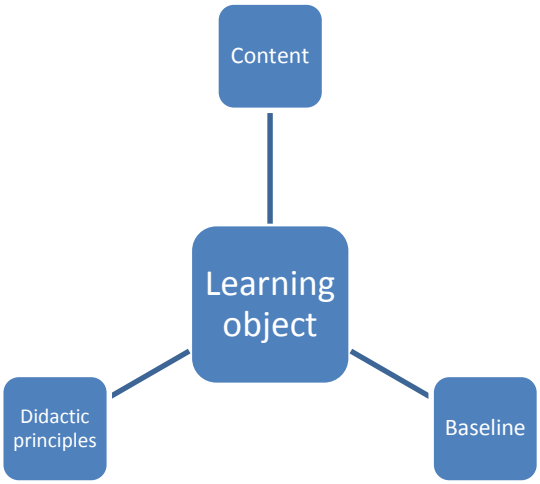

Figure 1. The three elements of building learnings objects.

These three element interacts as a process of mutual adjustment. Development of content and implementing baseline are the two processes that have progressed the furthest. Developing and securing the quality of the content is handled by the coordinators and educators together, and the baseline have been updated a couple of times since the first version. Educators and the digital learning consultants in collaboration have handled subsequent programs of implementation. The processes that led to the development of the role of the coordinator and the development of the baseline began in 2015. The process towards the guidelines for the didactic principles began in 2019 by introducing them to the educators and encouraging educators to implement and experimenting. This process is set to be formalized in the spring of 2020 with the digital learning consultants assisting the educators in the process of setting

up targets, implementing and executing the didactic principles in learning objects (SmartLearning, 2020). Evaluation processes will follow this.

The approach to creating learning objects at SmartLearning is a process in rapid development. From an organizational perspective there has to be careful planning and plan for execution with everyone in the organization knowing their role to ensure all the different components interact properly. Continued study of, reflections on, and development of these processed could yield further improvement in performance at SmartLearning.

4. Recommendations

Based on this study I find the three elements described could use a more formalized method in practice. From the information, I have collected it is my estimate, that the focus should be on measurable outcomes amongst learners, using predictable learning outcomes as target points. Based on this the design of courses and course elements can take the form of instructional design. Instructional design is useful for designing learning objects (Patel et al., 2018) and with the SAM model (Successive Approximation Model) the designer can benefit from a more dynamic approach to instructional design in online education (Jung, 2019). Because of the nature of online learning objects, and the idea of developing fundamental principles for learning throughout the organization, I can see a particular benefit to operate within the SAM framework. This because it allows the developers to design and test in sprints and therefore can change direction fast if needed, and at the same time allows for maintenance and continuous improvement of courses from semester to semester. This flexibility is important because if SmartLearning is to capitalize fully on their ability to respond fast to feedback from learners and analytics data, both during and after courses are run. Development of the learning objects can then be organized in a development cycle consisting of three steps: analyze, design, development. For the reason that cycles can be applied both during and after courses are run, online learning objects should always be considered works in process. As new data accumulates with each course run, and new developments in didactics provides new tools for learners, the learning objects can be continuous improved in regards to both content, baseline layout and didactic principles.

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The Skills of University Students in Educational Settings Assessed by Company Tutors: A Longitudinal Study in Italy

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Abstract

The paper aims at investigating what the fundamental characteristics of a trainee of the Courses of Studies in Education and Training Sciences of the University of Rome La Sapienza are, as identified by the company tutors who evaluate them during the traineeship. The aim is to understand whether trainees are trained to act in educational settings. The analysis of a particular item of the questionnaire addressed to the company tutors, has shown that the trainees in the educational field are well integrated in the institution where they do the treaineeship, thanks to the possession of "key skills" that we have deduced from the open responses of the tutors. These skills are also among those most requested ones by the world of work. We conclude that the traineeship is an important formative moment for the professions in the educational field and that it is possible to grasp the necessary link between theory and practice.

Keywords: *Traineeship; University students; Company tutor; Skills, Assessment.*

1. Introduction

The paper aims at providing a brief description of the traineeship path pursued by university students of the Degree Courses in Education and Training Sciences (Bachelor's degree) and in Pedagogy and Education and Training Sciences (Master's degree) of the University of Rome La Sapienza (Italy) and analyze some data relating to the skills that company tutors evaluate in trainees to consider them well integrated in their institution. This is the first study conducted by Sapienza which explores the skills of trainees in the educational field, assessed by company tutors, based on the mixed-methods approach (Morgan, 2007).

Curricular traineeships are reserved for students and undergraduates. The student's study plan includes 12 CFU of traineeship (CFU – Crediti Formativi Universitari – ECTS credits), corresponding to 300 hours for a Bachelor's degree and 6 (CFU) ECTS credits (150 hours) for a Master's degree. Throughout the traineeship, the student is given the opportunity to gain experience in the field, to complete and deepen his theoretical and methodological training and to understand if the educational profession that the trainee wants to undertake is in accordance with their skills and competences (Salerni et al., 2011; Salerni, 2019b). According to the Traineeship Regulations Bachelor students can start a curricular traineeship after reaching 60 ECTS credits, or starting from the second year of the three-year course of studies. The student can undertake traineeship activities in organizations or institutions that have entered into a special Agreement with the University; or the student himself can propose to stipulate an Agreement with an institution that trains and works in professional contexts similar to those to which the course of study is addressed; the Traineeships Commission will then evaluate the proposal. However, students can also request the recognition of a previous traineenship experience, which took place before or during the enrollment in the Course of study and in this case it is obvious the evaluation by the tutors is not required. In curricular traineeships, as required by the relevant legislation, a training project is drawn up for each student relating to the path that the student will have to follow in the work context. The project is formulated thanks to the contribution of the university tutor and the company tutor, or the person who, at the institution, assumes the task of guiding and following the trainee in doing the traineeship. The University covers the insurance costs.

At the end of the traineeship, in order to recognize the activity, the student must obtain a certificate from the institution certifying the duration and type of activities that they have undertaken and receive the Activity Assessment Questionnaire from the company tutor, which is enclosed to the Application for the recognition of the activity; the student then has to write a report on the traineeship activity and also fill in a questionnaire. The entire documentation will be assessed by the Traineeship Commission consisting of some of the teachers of the Degree Course.

2. The assessment of company tutors: the skills of the trainees

Students who undertake the course of studies in Education and Training Sciences (both Bachelor'd degree and Master's degree), by means of the traineeship experience in the field, get familiar with the professional figures for which they are trained as well as the different contexts in which educational graduates can operate. By means of the field experience, which must necessarily intertwine with academic training, they discover that the contexts in which they can work are the most disparate: from contexts of care services to educational and training institutions, from health services to cultural ones (Szpunar, 2019). And they learn that the people they can take care of (Mortari, 2015) will be quite diverse: different age groups and life situations: disabled people, immigrants, the elderly, people with addictions, children, prisoners, victims of violence, etc. (Szpunar, 2019). Precisely because of the complexity of the contexts in which the educators operate and the multiplicity of users with which the educators interact, the professional figures trained in the educational sphere have a series of characteristics, the "schematization" of which may seem limited and not very effective (Szpunar, 2019). However, characteristics and skills that seem necessary for those trained to work in socio-educational contexts emerge. Personal qualities such as engagement, motivation and vocation are certainly a prerequisite for these professions (Shulman, 1998). The cognitive, technical, methodological aspects of the socio-educational professions intersect with personal skills that are formed and transformed into a context of "community of practice" (Lave & Wenger, 1991), where the trainee is guided by the company tutor to insert himself in the most appropriate way possible. For this reason, the assessment of the company tutors is presented as an assessment by those who have experience in the field, in a specific professional context, who can guide those who must "be trained in the experience", as "the experience is the purpose and means of education, and education can be considered effective if it manages to generate further experiences of quality, capable of living in the future of the subjects, stimulating growth and progressive existential enrichment" (Salerni, 2019a, p. 12). For this reason, halfway through the traineeship, the university tutor gives the trainee the questionnaire for the company tutor, who can fill it in from that moment until the end of the traineeship and then return it, in a sealed envelope, to the student who will submit it to the university tutor for the final recognition of the activity. In order to collect reliable and non-complacent data, there is no obligation on the tutor to reply, for this reason the number of completed questionnaires does not correspond to the number of students who did the curricular traineeship.

The trainee evaluation questionnaire for the company tutor is composed of 13 questions with the aim of examining the traineeship path taken by the student, the evaluation of the activities, the role of the trainee and satisfaction with the traineeship experience (Salerni et al., 2007).

From 2008 to 2019, 621 questionnaires were completed by company tutors. Figure 1 shows how, over the years, grouped in calendar three-year periods, the tutors who fill in the

questionnaire have definitely increased. As we said, the tutors are not obliged to fill in the questionnaire, but the increase in participation over the years makes us note that there is greater attention in the evaluation of the trainee.

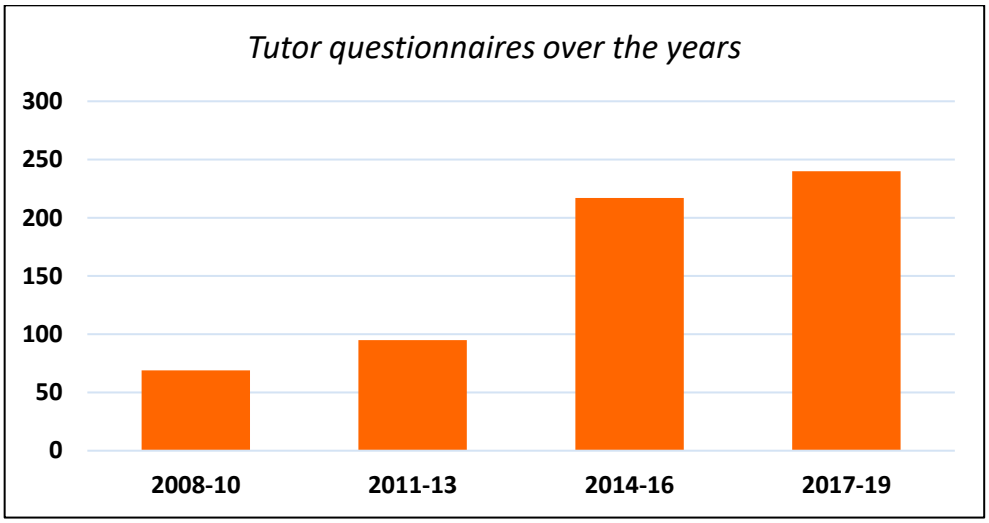

Figure 1. Tutor questionnaires over the years. Source: own elaboration

Among the hypotheses that we have formed about the increase in the number of responses to the questionnaire by tutors there is probably the fact that, over the years, the relationships between the Courses of Study and the organizations where students can do the traineeship have intensified. Consequently, the trust of the institutions in this activity increases and the traineeship is seen not only as a bureaucratic obligation to be fulfilled in order to achieve the academic title. The intensification of relations with companies also allows the development of more targeted training projects with respect to the professional profiles trained and with respect to the work outcomes of the students enrolled in the Courses of Study in the field of educational sciences. This is, moreover, the main objective of the curricular traineeship: to favor the integration between theory and practice (Dewey, 1938).

2.1. Data analysis: Why is the trainee well integrated in the organization?

In these pages we specifically examine Item 3 of the questionnaire in which the tutor is asked: Do you think that the trainee has entered the organization adequately? Why? The first part of the question is a multiple-choice one, with three possible answers: Yes, Partially and No. For 621 questionnaires, 92.6% of the tutors answered Yes; 6.3% answered Partially; the rest answered No, or did not answer. The second part of Item 3 asks the tutors the reasons for this response; or to explain why they believe that the trainee integrated well into the organization. We need to stress that not all the ones who answer the first part of the question add an

explanation. Out of the 621 tutor questionnaires collected over the years, 549 (88%) reported a "positive" reason as to why the trainee was well integrated into their company; so these are the tutors who answered Yes and Partially in the first part of the item. Out of the 549 questionnaires, 5% responded Partially but not all of them provided an explanation. These responses were also analyzed in order to understand the shortcomings highlighted by the tutors. 523 (83%) answerd Yes and provided an explanation for the answer. The latter are the main object of our research, from which some dimensions that the tutors consider to be the reason for a good insertion of the trainee in the company have emerged. Figure 2 shows which dimensions emerged from the open responses of the tutors.

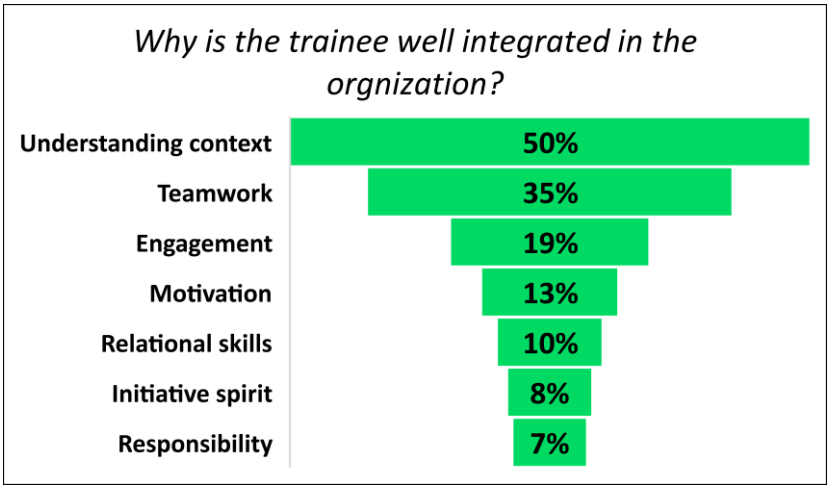

Figure 2. Why is the trainee well integrated in the organization?. Source: own elaboration

The analysis of the open responses of the tutors led to the identification of seven "key skills" which according to the tutors explain the good integration into the company. After a first reading of the open answers, we looked for macro-areas that could include a certain type of answers. Once the agreement was reached between us evaluators on the definitions of the macro-areas, we categorized the answers. Each answer can contain multiple explanations or reasons and therefore be classified into different categories. The approach used to codify the textual responses reported by the tutors is the construction of a posteriori categories through the principle of open coding derived from grounded theory (Strauss &Corbin, 1990; Trinchero & Robasto, 2019).

The seven skills that emerged by this approach were defined by us as follows:

1. *Understanding context*: ability to understand the company's mission and to share common objectives, ability to fit into the organization of the institution, adapting to experience, relating correctly to the users. (Examples of answers: *She showed an aptitude to understand*

the different needs of users and to interact accordingly; She showed adaptability and context reading skills; She shared the objectives of the company's activities).

2. *Teamwork*: ability to work in a team and establish excellent relationships with work colleagues. (Examples: *Good relationship with the staff; She collaborate effectively with workers in group activities; She managed to collaborate effectively with the team*).

3. *Engagement*: ability to engage in assigned work and tasks, undertake the proposed activities constantly and show active participation in the activities. (Examples: *She shows a spirit of participation; She actively participated in the activities in which she was engaged; She carried out all the assigned tasks carefully*).

4. *Motivation*: motivation for the work to be done, interest and curiosity developed for the activities. (Examples: *She showed interest in the activities she was involved in; She participated with enthusiasm and curiosity in the proposed activities; He was highly motivated*).

5. *Relational skills*: ability to connect with everyone also showing empathy and relational skills not specific to the context. (Examples: *Good relationships; She showed positive relationship skills; She has established a good relationship with everyone*).

6. *Spirit of initiative*: ability to take the initiative and get involved, also finding original solutions to problems. (Examples: *She participated in daily activities proactively; She showed initiative and a lot of goodwill; She quickly acquired the ability to make a personal contribution*).

7. *Responsibility*: ability to take responsibility for assigned work, also showing autonomy in work and reliability. (Examples: *She performs the assigned tasks responsibly; She has been able to work independently; The trainee was immediately responsible and practical*). In several cases, tutors identify multiple "key competences", as in the case of examples such as: *Through a very proactive open and predisposed attitude to teaching, she managed to fit both in the team context and in the group of small users* indicating not only *Spirit of initiative*, but also *Teamwork* and *Understanding context*.

Understanding context (50%) is the skill that is most often mentioned by tutors, followed by *Teamwork* (35%) and *Engagement* (19%): we consider this result in line with what can be considered the "vocation" (Shulman, 1998) of the socio-pedagogical educator, since in *Understanding context* we find items that describe the relationship between the trainee and the user as adequate, that is, the trainee was able to understand the context in which they entered, he was able to share the company's mission and has been able to relate to the users. This also enables us as researchers to reach a definition of a trainee "expert" in this profession. The other dimensions detected are also in line with the requests for skills from the labor market. Excelsior surveys (Unioncamere, 2019, p. 13), on Italy, show that relational

skills will be increasingly required, such as empathy, collaboration, the ability to find original solutions, etc. The dimensions that emerged from the tutors' questionnaires are attributable to the skills listed in the European project ModEs (European Commission, 2014) which emphasizes the need for an adaptation of the educational offer of higher education institutions to requests from the world of work, so that Universities can become engines of change and innovation. From the "voice of the tutors" it would that there is no danger of a skill mismatchs (Unioncamere, 2019), a mismatch between the skills required and those possessed (OECD, 2018).

3. Conclusion

We have seen from the analysis presented above how relevant it is, in the educational sphere, to understand the context in which we intervene and, consequently, to know how to relate adequately to a particular user. A professional in the educational field must know how to connect theoretical knowledge with practice together with the "artistic ability" or that ability to face problems by relying on common sense, one's intuition and trusting one's judgment (Salerni 2019a), without however ever abandoning the scientific method (Dewey, 1929). "The educational situations are unique, unrepeatable, and as such there are no effective and valid procedures for all circumstances as there is no definitive knowledge" (Salerni, 2019b). Faced with such a complex panorama, the task of those who train the "complexity of the experience" in the educational field is certainly to guide the "novice" along a path full of surprises. When we are surprised, something that we do not expect happens and the educator is often faced with surprises precisely because of the multiplicity of contexts and situations in which they work. In order to support and train the trainee in the educational professions, it is important that there is a dialogue between the study experience lived through university exams, also purely theoretical, and the field experience, starting with the traineeship, to help them cross that bridge that connects theory to practice. Analysis of the questionnaire item addressed to company tutors *Why is the trainee well integrated in the organization?* is read precisely from the point of view of the link between theory and practice, to understand if what students learn from theory (formal academic training) is useful and supportive to act in practice (traineeship), considering the point of view of an expert tutor which helps the student to experience in the field.

This research on the skills of the trainees in the educational field will be useful to improve the questionnaire completed by the tutors and to understand if it will be possible to identify a core of skills that characterize those who work in the educational sector and that are shared by the scientific and educational community.

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Educational System Assessment: Italy and Finland, Comparative Case Study

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Abstract

Educational system assessment allows the evaluation of some learning outcomes and permits the continuous monitoring of educational processes. The aim of this study is to explore the ways used to assess and evaluate school systems and universities and students' learning outcomes in Italy and Finland, two important educational realities as shown in PISA (Programme for International Student Assessment) results (OECD, 2019). The attention is focused on common and uncommon practices employed in each country and on perceptions that the educational system assessment creates in those who evaluate and in those evaluated. Ten stakeholders from Italy and Finland participated in focus groups or interviews one to one audio-taped, transcribed and analysed using qualitative methods. The results underline that the evaluation of school systems and universities helps build a large database and that the evaluation process have to be made with trust between stakeholders involved, with innovation and awareness. The general acceptance is increasing: stakeholders from two contexts considered highlight that, in order to improve efficiency and effectiveness, school systems and universities need a formative assessment and evaluation in which everyone is involved from central educational institutions to teachers and students.

Keywords: *educational system assessment; INVALSI; ANVUR; FINEEC-KARVI; external evaluation; standardized testing.*

1. Introduction

Evaluation in education is a systematic investigation that permits to assess the quality of schools, universities or school systems in terms of efficiency and effectiveness and in terms to capacity to meet the needs of local community. It is a practice that measures students learning outcomes, monitors educational process and provides data to local, regional and national stakeholders informing their decisions (Sanders & Davidson, 2003).

Know the practices employed in each country and the perceptions that the assessment in education creates in those who evaluate and in those evaluated is important because there are still doubts about the assessment and the evaluation in terms of accountability and educational benchmarking. School system and universities in Italy and Finland are different: when in 2001 PISA results (OECD, 2001) were published for the first time there was a surprised reaction. Finland was among the best countries in reading, mathematics and science knowledge and skills, while Italy was among the low performers countries. Today the situation is a little bit changed (OECD, 2019), but Finland remains among top performers, while Italy is under the international average. As a *good managment practice*, evaluation in education helps to: *identify needs, establish goals, clarify goals, select strategies to achieve goals, monitor progress*, *assess outcomes* (Sanders & Davidson, 2003).

Educational evaluation models vary in regard with their goals, focus and needs. Italian and finnish school systems are different in structure, process and results, but there are some differences also in the evaluation models of school and universities. However, assure to all young generations an education that is based on quality and on exchange of methods, models and criteria is an emergency now more relevant than ever in favor of which countries must cooperate. All young people, not only in Italy and Finland, but all over the world, must have same possibilities and same future perspectives. For these reasons having a mechanism that guarantee school success and well-being with fairness and equality is fundamental. National and international large scale assessment, infact, helps to better understand reasons behind learning outcomes and educational process and promotes flexibility and school autonomy. Nevertheless, the danger is concentrate attention only on a part of the school curriculum, even if the large database created and the informations provided should be considered during the decision-making process. Targeted decisions need to be made: educational evaluation can satisfy the necessity for different empirical evidences on which base decisions.

2. Comparative case study: Italy and Finland

This paper aims to provide more informations on the educational evaluation as a tool to improve school systems and decision-making process in two national contexts, Italy and Finland. A comparative case study approach is adopted to gain a detailed understanding and to obtain further in-depth information on the educational system assessment (Zanazzi,

2014; OECD, 2004). The study is realized through interviews and focus groups with ten subjects. The participants included directors of national evaluation centres, school principals and teachers. Over the course of three months (June-August 2019, compatibly with the availability of stakeholders) the interviews were conducted with open-ended questions in italian or finnish and audio-taped, transcribed and analysed using qualitative methods. The findings are analyzed in the following sections.

2.1. Italy

INVALSI (Istituto Nazionale di Valutazione del Sistema Educativo di Istruzione e Formazione, National Institute for Educational Assessment, https://www.invalsi.it/invalsi/index.php) and ANVUR (Agenzia Nazionale per la Valutazione dell'Università e della Ricerca, Italian National Agency for the Evaluation of Universities and Research Institutes, https://www.anvur.it/) are responsible for the assessment of the education system. It is divided into two levels: schools by INVALSI and universities by ANVUR. The National System for the evaluation of education (SNV – Sistema Nazionale di Valutazione) was born in 2014 and today is composed by INVALSI, INDIRE (Istituto Nazionale di Documentazione, Innovazione e Ricerca Educativa, National Institute for Documentation, Innovation and Educational Research, http://www.indire.it/) and external evaluation units: the purpose is to evaluate the education system in order to get better and instill the perception that the national evaluation is a resource useful to improve and earn more awareness (Morini & Rossi, 2016).

INVALSI manages the national system for the evaluation of education called Sistema Nazionale di Valutazione (SNV) and is a public institute that was born in 1999 under the surveillance of Ministry of education, university and research (Trinchero, 2014). Among other things, it carries out systematic and periodic evaluations on students' knowledge and competencies in order to guarantee the assessment and evaluation of the overall quality of the educational national offer. Currently the assessment of sudents' learning outcomes is carried out through standardized tests administered on the entire cohort of students in second and fifth grades of primary school (italian and mathematics), in the last class of lower secondary school (computer based test - italian, mathematics and english) and in the second and last class of upper secondary school (as part of the final exam, computer based test – italian, mathematics and english). Computer based tests are a news recently introduced. Standardized tests in the last class of upper secondary school, longitudinal analysis of data and return of results to students as possessed competencies in italian, mathematics and english are others innovation recently adopted. Thanks to Anna Maria Ajello's interview (Mattarelli, 2019), director of INVALSI, emerged that the intent of the national institute is to provide informations at different levels starting from students, schools and teachers and arriving to Ministry. Infact, in her opinion, the fright about the standardized evaluation that some italian teachers had is not founded because they are not the only elements on which the

attention is focused: the quality of education is very important, even if the current educational emergency in regions like Calabria, Campania, Sardinia and Sicily is worrying and quickly solvable (INVALSI, 2019).

ANVUR is the italian national agency for the evaluation of universities and research institutes. It *oversees the national quality evaluation system for universities and research bodies. It is responsible for the quality assessment of the activities carried out by universities and research institutes, recipients of public funding. It is also entrusted with steering the Independent Evaluation Units' activities, and with assessing the effectiveness and efficiency of public funding programmes or incentive programmes for research and innovation activities* (https://www.anvur.it/) in line with the principles of independence, impartiality and professionalism. In June 2019 ANVUR became a member of ENQA (European Association for Quality Assurance in Higher Education, https://enqa.eu/) for the next five years. Two of the ANVUR's activities (e.g. funding for basic activities related to research or rating of scientific journals) are the third mission that evaluates the impact on society and economy of universities and research institutes and AVA (Autovalutazione, Valutazione Periodica e Accreditamento). AVA stands for self-assessment, periodic evaluation and accreditation. One of the projects that are part of self and external assessment of quality assurance system is TECO (TEst sulle COmpetenze, TEst on COmpetences): it assess and evaluates university students' competencies through a standardized test with the purpose of improve the quality of the educational process (Ciolfi & Di Benedetto, 2019). It is non-compulsory and it is divided into two tests: the first one assess soft skills, while the second one hard skills. Considerations concerned by the last kind of test demonstrate that the effect of unfavorable entry characteristics does not correlate with hard skills, while this relation is not as strong as the relation between social and economical background and soft skills (Hilbig et al., 2015). Raffaella Rumiati, vice-director of ANVUR, during the interview reported (Mattarelli, 2019) that there is collaboration between the agency and Ministry and that universities' self-assessment and external assessment is unaware of ranking: the aim is not to classify universities and research institutes, but to make conscious about local or national differences and inequalities in order to fight them and promote the achievement of quality in education.

About perceptions on educational assessment in schools, two teachers, technical contacts for the assessment and evaluation, from a secondary school near Rome (Liceo Classico Ugo Foscolo, Albano Laziale) underlined how important is the dialogue and communication between similar schools also in terms of educational offer and results. In point of facts, to conciliate a global vision about educational process and outcomes with a particular situation is useful and positive deal with other contexts to have an image about what is going on. Unfortunately, in the opinion of two teachers, the problem in almost all italian schools is that there are not in-depth discussions about the results of national system assessment.

2.2. Finland

If in Italy there are two institutes how handles with educational assessment and evaluation, in Finland there is an institute, KARVI-FINEEC (Kansallinen Koulutuksen Arviointikeskus – Finnish Education Evaluation Centre, https://karvi.fi/en/fineec/), concerned with national system assessment.

FINEEC is an independent agency born in 2014 from Finnish higher education council, Finnish evaluation council and Finnish national board of education. It *operates as a separate unit within the Finnish National Agency for Education. It carries out evaluations related to education including the operations of education providers from early childhood education to higher education. The FINEEC comprises the Evaluation Council, the Higher Education Evaluation Committee and four units: the General Education and Early Childhood Education Unit, the Vocational Education Unit, the Higher Education and Liberal Adult Education Unit, and Development Services Unit* (https://karvi.fi/en/fineec/). The main purpose of FINEEC is assess and evaluate learning outcomes, but also evaluate higher education institutions, implement system and thematic evaluations and support stakeholders during decision-making process (FINEEC, 2019): *the aim of the evaluations is to develop education and to support learning while ensuring the quality of education. The evaluations also produce information for local, regional and national decision-making on education as well as development work and international comparison* (https://karvi.fi/en/fineec/). In basic education the assessment of learning outcomes is focused on mother tongue (Finnish, Swedish, Sami, finnish as second language) and mathematics, while in upper secondary education system assessment is carried out above all during the final exam: the assessment is focused on mother tongue and literature, mathematichs, science, health education, religion and ethics etc. About higher education institutions the assessment is related to evaluation and quality assurance through audits of quality systems. Thematic evaluations, like peaceful and safe learning enviroments in schools and education and training institutions or impact of national budget cuts on educational rights, are realized from early childhood education to higher education. The implementation of evaluations related to education is one of the most important issue for FINEEC, said Harri Peltoniemi, FINEEC's director, during his interview (Mattarelli, 2019). It is fundamental that there is school welfare and that decisions are made consciously starting from data collected through national and international assessments. However, in Finland the assessment of learning outcomes is not based on all students cohort: only some schools every year are envolved in the sample population, the purpose is have a truthful image of reality.

In the opinion of the school leader of Porvoo High School (Mattarelli, 2019) the final exam now is more difficult than in the past because the national tests require to link knowledges, abilities and skills to answer questions. Infact, the attention is gathered upon the ability to connect each other informations from different disciplines thanks to a critical reflection. Instead, in basic education the national evaluation is both a tool to have a feedback on learning outcomes and a tool to self-evaluate the school, in particular the ability of teachers to evaluate the students (this happen thanks to the match between learning outcomes assessed in standardized tests and in the everyday formative evaluation). In the opinion of Vesala's Comprehensive School leader (Mattarelli, 2019) educational assessment is a really important working tool because it helps to understand the direction that is taken and that the school should take to improve herself.

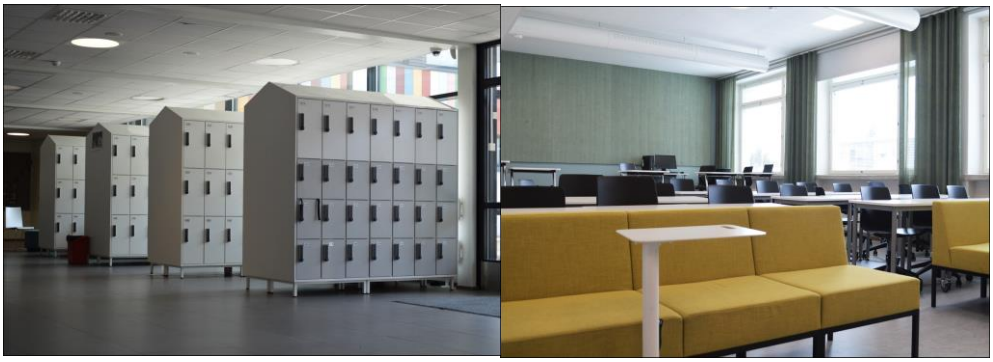

Figure I. Vesala Comprehensive School and Porvoo High School. Source: author's photo (2019)

3. Conclusions

This paper focuses upon the functions linked with educational system assessment and upon the ways used to realize it (Philips, 2018) not forgetting that assessment always creates perceptions and different opinions in how is evaluated and in how evaluates. The purpose of the current study is to determine similarities and differences and to contribute to recent debates concerning the academic understanding of educational system assessment, but more than this, the findings will be of interest to those stakeholders who are involved in educational decision-making process.

Even if educational system assessment in Italy and Finland is a consolidated practice, stakeholders have to work in terms of social acceptance of this kind of assessment and evaluation: it should encourage a in-depth reflection that lead to understand the important role of educational assessment as a tool useful to build a strong and valid education system (OECD, 2019).

An interesting fact is that in some cases there are few discrepancies between participants: they underlines how practices in two national contexts are similar, while perceptions are very

different. A possible explanation for these results may be different educational cultures that have produced not only different approaches and assessment methods, but also specific ways of teaching and learning. In Italy Rumiati from National Agency for The Evaluation of Universities and Research Institutes reports that the effect of unfavorable background variables, e.g. parents who have not a degree, is reduced on hard skills: in other words there is an extraordinary acquisition of competences over university years, in part this is true also for soft skills. At school level the endorsement about national system assessment is increasing, but instruments like standardized tests used by INVALSI are not always clear to teachers, for example, scared and stressed by external evaluation. Gap between north and south of the country, between schools, male and female students and immigrants and non-immigrants remains: problems which have to be solved through joint efforts and reflections over the results of educational assessment. On the other hand KARVI-FINEEC, in the opinion of his director, has to make the cooperation with schools even stronger and elaborate a timetable for national standardized tests that does not overload schools, as school leaders and teachers suggest. Future researches could usefully compare experiences across educational systems in other countries.

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Effects of course coordination and part-time precalculus instructor support on student academic performance

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Abstract

This study aims to measure the impact of course coordination and part-time Precalculus instructor support on students academic performance. Our results show the Precalculus passing rate (71.53%) was slightly higher in the post-coordination cohorts. However, this difference was not statistically significant from the passing rate (70.70%) of the cohorts in pre-coordination. Also, there was no significant difference between the passing rates (66.90% vs 65.25%) of calculus in the pre- and post-coordination cohorts. However, when accounting for the two versions of calculus, we observed one passing rate was statistically significantly lower in post-coordination cohorts, while the other passing rate was statistically significantly higher after Precalculus coordination. This paper discusses how our results confirm that a careful curriculum design in addition to a dedicated course coordination can have a significant positive impact on students' learning and their academic performance. We observed that the reflective teaching philosophy and opportunity to engage in critical conversations about teaching and learning promoted through course coordination influenced classroom practice and resulted in improved student outcomes. We recommend that departments should recognize the importance of course coordination and encourage faculty to work closely towards the common aim of delivering the best teaching practices.

Keywords: *Precalculus; Calculus; STEM; Course Coordination; Part-time Faculty; Retention.*

1. Motivation

Educational research studies have indicated that the level of interest towards Science, Technology, Engineering, and Mathematics (STEM) has declined both in terms of enrolment (Sjøberg and Schreiner, 2007) and student motivation to learn science (Osborne et al, 2003). This problem has been especially concerning in western countries and more prosperous Asian nations (Thomas and Watters, 2015). Despite the strong labor-market demand for STEM, these fields still attract a smaller share of students (OECD, 2019). In the United States of America, the number of students in STEM fields has remained constant while the demand for STEM majors has been increasing (Carnevale et al, 2011). In the coming years, approximately a million STEM graduates are expected to be needed to meet the economic demands of the USA workforce (President's Council, 2012). This trend points towards the need for research on attracting and retaining STEM students in higher education. Existing research shows that students' classroom and learning experiences can influence their decisions to pursue STEM degrees, especially initial experiences in introductory mathematics courses (Pampaka et al, 2012). Students often blame poor instruction as a cause for leaving science majors (Seymour and Hewitt, 1997). Therefore, improving instruction may influence their decision to stay in STEM (Ellis et al, 2014).

2. Methods

2.1. Background

This proposal presents work from a larger project focused on developing a model for promoting part-time (or adjunct) instructors' learning through various resources and support. Our project, *Adjunct Mathematics Instructor Resources and Support: Improving Undergraduate Precalculus Teaching and Learning Experience* (Project AMIRS), aims to measure the impact of course coordination and support on part-time Precalculus instructors' knowledge, instructional practices, and job satisfaction as well as students' academic success and retention in STEM majors. We use coordination of Precalculus to further the goals of implementing best practices for learning and instruction, improving content and pedagogical content knowledge of instructors, creating a professional learning community, and improving student academic achievement. In this paper, we present our findings regarding *how course coordination and adjunct instructor support impact student academic performance.*

2.2. Context

In Fall 2016, our department adopted a research-based curriculum, *Precalculus: Pathways to Calculus* (Carlson et al, 2010), and began to provide a variety of supports such as course coordination (common syllabus, pacing, and assessments in addition to access to a designated course coordinator (second author)), as well as workshops and professional learning

opportunities to help our instructors implement the curriculum.

In our department, there are two different 4-credit first-courses in Calculus. All science majors are required to take "Calculus I," with the exception of Biology and Information Technology (IT). Biology and IT students take "Calculus A," which is an equivalent course that is specifically designed for life science majors. The primary learning goal of Calculus A is to acquire the ability to understand the importance of the mathematical concepts in calculus and apply them to solve problems in life sciences. This course is particularly important and challenging since students are not required to take any additional mathematics courses. Unlike Calculus I but similar to Precalculus, Calculus A is mainly taught by part-time instructors. Moreover, Calculus A is a coordinated course with a common syllabus, pacing, project, and final exam, in addition to access to a designated course coordinator (first author).

2.3. Participants

The participants in our study were students who took Precalculus in our department during either Fall or Spring semester between Fall 2015 and Spring 2018 (6 cohorts). A student enters a cohort when they take the Precalculus course for the first time. A sub-cohort is comprised of students who pass the couse the same semester they enter the cohort and take the subsequent Calculus course over the immediate following semester (Fall or Spring).

2.4. Data Collection

In this study, we report on I) academic achievement and II) retention, described below. All data were provided by our university's Office of Institutional Research which is housed within the Office of Information Technology.

I) Academic achievement was measured by students' Precalculus and corresponding subsequent Calculus grades over 6 semesters from Fall 2015 to Spring 2018. The grades were classified in one of the following three categories: 1) Pass, *P* (> 70%); 2) Fail, *F* (< 70%); or 3) Withdrawn, *W*. We refer to these as the P/F/W categories. **II) Retention** refers to retaining students in STEM education during their academic careers, for instance from the freshman to sophomore year.

2.5. Data Analysis

For the purposes of this study, pre-coordination refers to the two cohorts (Fall 2015 and Spring 2016) before the adoption of *Pathways Precalculus*, where instructors did not receive any formal training or support for course coordination. Correspondingly, post-coordination refers to the four cohorts (Fall 2016 to Spring 2018) after the adoption of *Pathways*, where instructors received formal training and support for course coordination through the department. We compared the Precalculus and Calculus passing rates as well as retention rates between the pre- and post-coordination cohorts using the chi-square test. All the

statistical analyses were conducted in statistical software R (Team, R. C., 2017).

3. Results

3.1. Precalculus achievement

The analysis result of students' achievement in Precalculus using the P/F/W categories by comparing student pass rates along with the corresponding standard errors (SE) before and after the start of Project AMIRS is given in Table 1. Two cohorts (N = 587) were included in the pre-coordination and four cohorts (N = 1131) were included in the post-coordination. The passing rate (71.53%) was slightly higher in the post-coordination cohorts. However, this difference was not statistically significant from the passing rate (70.70%) of the cohorts in pre-coordination with p-value 0.7605.

Table 1. Precalculus and Calculus passing rate along with the corresponding standard error (SE) comparison between pre- and post-coordination.

Final Grade	Precalculus		Calculus	
	Pre-coordination Count (%, SE)	**Post-coordination Count (%, SE)**	**Pre-coordination Count (%, SE)**	**Post-coordination Count (%, SE)**
P	415 (70.70%, 1.88%)	809 (71.53%, 1.34%)	192 (66.90%, 2.78%)	346 (65.25%, 2.07%)
F	124 (21.12%, 1.68%)	230 (20.34%, 1.20%)	72 (25.09%, 2.56%)	148 (28.08%, 1.96%)
W	48 (8.18%, 1.13%)	92 (8.13%, 0.81%)	23 (8.01%, 1.60%)	33 (6.26%, 1.06%)
Total	587 (100%)	1131 (100%)	287 (100%)	527 (100%)

3.2. Precalculus to Calculus achievement

Next, we compared the passing rate of all calculus sections (Calculus I + Calculus A) between the pre- and post-coordination cohorts: 287 out of 415 students who passed Precalculus took calculus during the immediate following semester in the pre-coordination cohorts; 527 out of 809 students who passed Precalculus took calculus during the immediate following semester. These students were included in the comparison of calculus passing rate. Table 1 shows there was no significant difference between the passing rates (66.90% vs 65.25%, p-value 0.7789) of calculus sections combined (I & A) in the pre- and post-coordination cohorts.

3.3. Calculus I vs. Calculus A

Since students who take Calculus I and Calculus A come from different populations and the two courses are run differently, we analyzed students' performance separately in Calculus I and Calculus A by looking at their pass rates (> 70%) both pre- and post-coordination. By analyzing the aggregate data from 2 cohorts who took Calculus I during the immediate following semester passing Precalculus before coordination (N = 148) and 4 cohorts after coordination (N = 253), we observed the Calculus I passing rate was statistically significantly lower (p-value = 0.0137) in post-coordination cohorts, and the failing rate was significantly higher in post-coordination cohorts. On the other hand, Calculus A passing rate was statistically significantly higher (p-value = 0.045) after Precalculus coordination (Table 2).

Table 2. Calculus I and A passing rate along with the corresponding standard error (SE) comparison between pre- and post-coordination cohorts.

	Calculus I			**Calculus A**		
Final Grade	**Pre-coordination Count (%, SE)**	**Post-coordination Count (%, SE)**	**Chi-square test (p-value)**	**Pre-coordination Count (%, SE)**	**Post-coordination Count (%, SE)**	**Chi-square test (p-value)**
P	91 (61.49%, 4.00%)	122 (48.22%, 3.14%)	**0.0137**	101 (72.66%, 3.78%)	224 (81.75%, 2.33%)	**0.045**
F	42 (28.38%, 3.71%)	103 (40.71%, 3.08%)	**0.0177**	30 (21.58%, 3.49%)	45 (16.42%, 2.24%)	0.2501
W	15 (10.14%, 2.48%)	28 (11.07%, 1.97%)	0.9014	8 (5.76%, 1.98%)	5 (1.82%, 0.81%)	0.0624
Total	148 (100%)	253 (100%)		139 (100%)	274 (100%)	

We also compared the passing rate between Calculus I and Calculus A in the pre- and post-coordination cohorts. In the pre-coordination cohorts, Calculus I passing rate (61.49%) and Calculus A passing rate (72.66%) were near statistical significance at 5% (p-value 0.059). Calculus I and Calculus A had significantly different passing rates (48.22% vs 81.75%) in post-coordination cohorts with p-value of 0.

3.4. Student Retention

Retention rate was defined as the ratio of number of students whose initial major was STEM and remained in STEM through the end of the Spring 2018 semester or when they graduated

to the number of students whose initial major was STEM. Using a chi-square test to compare the two retention rates, 359 out of 466 (77.04%) in the pre-coordination cohorts and 410 out of 505 (81.19%) in the post-coordination cohorts, we found they were not significantly different at the level of 5%.

4. Discussion

4.1. Course Coordination

These results are quite interesting given the fact that similar to our Precalculus curriculum, Calculus A is also a coordinated course with a focus on active learning and conceptual understanding. Students in Calculus A are consistently provided opportunities to connect the subject matter to their interests in real world applications. By doing so, the underlying relationship between apparently disparate areas of science can be illuminated, which offers students a glimpse of a bigger picture. On the other hand, Calculus I sections are typically taught in a lecture format and the level of course coordination is significantly lower.

We conjecture that the course coordination played an important role in Calculus A, especially since the coordinator was also involved with the AMIRS project and the Precalculus course coordination effort. Similar to Precalculus, the coordination of Calculus A included common syllabus and pacing, and common assessments amounting to 50% of the final grade. The part-time faculty who taught Calculus A also had access to a designated coordinator who met with them regularly to discuss course objectives, pacing, suggested in-class engaging activities, and other effective pedagogical approaches.

4.2. Course Design

Beyond course coordination, we hypothesize that a focus on course design impacted student achievement. The two coordinators of Precalculus and Calculus A courses participated in a Research Academy for University Learning program through which they defined goals, objectives, assessments, and curriculum mapping for the course sequence Algebra-Precalculus-Calculus, described as follows:

Goals: The overarching goals for the sequence of courses were defined as follows: (1) be able to use modeling and problem solving techniques to solve mathematical problems; and (2) understand connections between multiple representations of functions (e.g., tables, graphs, equations).

Objectives: To define our Specific Learning Objectives (SLOs), we used each course specific objective and put an emphasis on the student, used observable action verbs, and created concrete learning statements. For example, the goal to understand connections between multiple representations of functions became the SLO: Students can interpret the

rate of change for a function from a graph, table, or equation. The SLOs also helped us plan for common assessments.

Assessment: While goal setting enhances the course, assessing whether those goals are reached is crucial. Thus, assessment should be integrated seamlessly into the entire course. In particular, formative assessments can assure that substantive learning happens at every step of the process. Formative assessments were incorporated as they foster understanding and keep both the instructor and the students in the loop with what is happening in class.

Curriculum mapping: Next, we created the curriculum mapping (outlined in Table 3) by aligning the SLOs with each course and indicating where each would be introduced (I), reinforced/practiced (R), mastered (M), and summatively assessed (A). This map helped us improve communication with course instructors. We also anticipated that the curriculum mapping could encourage reflective practice as instructors planned for their lessons.

Table 3. Curriculum Mapping for Algebra-Precalculus-Calculus Course Sequence.

Course	SLO1: Algebraic Processes	SLO2: Relations & Functions	SLO3: Rate of Change	SLO4: Antiderivatives & Areas Under a Curve
Algebra	I R A	I R A		
Precalculus	R M A	R M A	I R A	
Calculus	M	M A	R M A	I R A

5. Conclusion

Our results suggests that a careful curriculum design in addition to a dedicated course coordination can have a significant positive impact on students' learning and their academic performance. In particular, we observed that the reflective teaching philosophy and opportunity to engage in critical conversations about teaching and learning influenced classroom practice and resulted in improved student outcomes.

Due to a number of issues including the ever-growing pressure on full-time faculty to intensify their research, it is becoming more challenging for them to be engaged in sustained and deep conversations around teaching and learning or to actively participate in course design and coordination. Our recommendation is that departments, with cooperation from the administration, should recognize the importance of course coordination and encourage both full-time and part-time faculty to work closely with each other towards the common aim of delivering the best student-centered teaching practices. Our recommendation is aligned with what other research has suggested for best teaching practices (e.g. Wieman and Gilbert, 2014;

Wright 2011).

We plan to continue analyzing our student data, including other assessment reports, in order to verify our presented findings. Subsequently, we would like to encourage departments to utilize the curriculum mapping (Table 3) in Calculus I classes across the sections and promote active learning among the full-time faculty.

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MOCCA College: An Assessment of Inferential Narrative and Expository Comprehension

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Abstract

MOCCA-C is an assessment of adult reading ability designed for early diagnosis of reading problems, for formative assessment in reading intervention planning, for assessment of reading improvement over time, and for assessment of reading intervention outcomes. It uses both narrative and expository reading passages and it currently has four forms. Two goals of this research were to compare narrative and expository passages on (a) their difficulty and (b) their ability to discriminate between good and poor readers. An additional goal was to assess whether narrative and expository passages measure the same or different comprehension dimensions. A final goal was to assess the reliability of forms. We randomly assigned students to forms with between 274 – 279 college students per form. Across the several forms, results suggest that narrative passages are easier and better discriminate between good and poor readers. However, both narrative and expository passages measure a single dimension of ability. MOCCA-C scores are reliable. Implications for research and practice are discussed.

Keywords: *Reading comprehension; reading assessment; adults; college students; formative assessment; diagnosis of reading problems.*

1. Introduction

In the U.S., there has been increasing concern about the reading readiness of college students. The concern stems, in part, from the low percentage students meeting the ACT benchmark for college readiness (ACT, 2014). In 2013-2014, only 44% of high school graduates who took the ACT met the ACT benchmark for reading readiness (ACT, 2014). Moreover, approximately half of community college students could be considered struggling comprehenders—they have basic reading skills, but have difficulty generating appropriate inferences (Hoachlander et al., 2003). This has led us to pursue development of an inferential reading test for college students (a) to identify students in need of a reading intervention, (b) as a formative assessment for planning such an intervention, (c) to measure improvement during an intervention longitudinally over time, and (d) as an outcome measure.

MOCCA-C is based on earlier work to develop a reading assessment for students in grades 3 – 5 (Biancarosa et al., 2019; Davison et al., 2018; Liu et al., 2019). Unlike the earlier test that contained only narrative passages, the adult MOCCA contains both expository and narrative passages to reflect the expository nature of most college texts. It has multiple forms and therefore could be administered multiple times during an intervention to monitor student progress without the student having to take the same form twice. By administering forms before and during an intervention, the instructor may be better able to plan and adjust instruction as the intervention proceeds.

MOCCA-C is designed to be diagnostic of student errors. Each item consists of a paragraph with a sentence missing. From three alternatives, the student must select the sentence that best completes the story when inserted for the missing sentence. Figure 1 shows a sample item. Whereas most multiple-choice tests have two types of responses, each MOCCA-C has three types of responses, one correct response and two types of incorrect responses. The correct response is the causal coherent (CCI) response. The causal coherent response involves an inference that best completes the story line when inserted as the missing sentence.

The incorrect responses are drawn from observations of common error types in think-aloud research (e.g., Coté, Goldman, & Saul, 1998; McMaster et al., 2012.). The first type of incorrect response is a *paraphrase* (PAR), a sentence that simply repeats prior information from the text. Paraphrases do not involve an inference, do not move the story along by adding new information, nor do they complete the story line (narrative) or line of thought (expository). The second type of incorrect response is an *elaboration* (ELA). An elaboration involves an elaboration of, association with, or evaluation of information in the story. It can involve an inference and it goes beyond the explicit information in the story, but it does not complete the story line (narratives) or line of thought (expository). The answer types lead to three scores: a number correct score, a number of paraphrase response score, and a number

of elaboration response score. Since there are 50 items in each form, these three scores add to 50 if the student has answered every item.

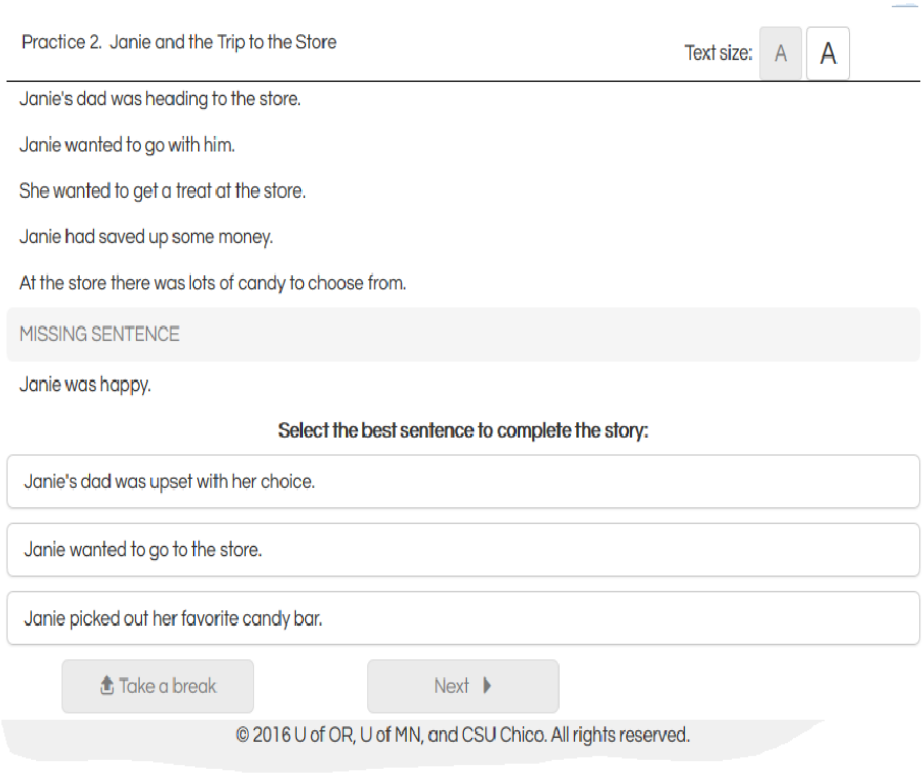

Figure 1. Sample item.

MOCCA also yields a comprehension rate score, minutes per correct response. According to automaticity theory (LaBerge & Samuels, 1974) as comprehension improves, the comprehension becomes more automatic and faster. Automaticity may improve learning from reading material, because once comprehension becomes automatic, the reading process demands little conscious attention and does not interfere with a focus on the content to be learned from reading. There is a fifth score, number of items not reached that can be inferred from the CCI, PAR, and ELA scores given that the test has 50 items. The goal of this research was to examine the reliability, difficulty, and discrimination of the items.

2. Methods

The sample, test, and administration procedures are described only briefly here.

2.1. Sample

Since there are four forms there were four samples composed of 274, 279, 279, and 278 college students. The students constituted convenience samples from several states and several higher education institutions.

2.2. Instrument

Each form of the test contained 50 items with approximately equal numbers of expository and narrative items. Forms were matched on factors such as average number of sentences per item, sentence length, and Flesch-Kincaid readability.

2.3. Procedures

Participants were recruited through emails, social media, and courses in which instructors shared recruitment information. They participated for course credits or gift cards. Participants were randomly assigned to one of the four forms. All students took the test on a laptop or tablet. The computer administration included extensive instructions and showed two sample items. Students can go to the next item only after having answered the current item. If a student answers in less than 10 seconds, the answer is not accepted and they are told to read the item carefully before answering. There was no time limit on the test, although when the test was given in a class setting, the length of the class period may have set a limit. In other class settings, the instructor may have set a limit.

3. Results

Results are divided into four sections: descriptive statistics, reliability, difficulties and discriminations of narrative and expository items, and dimensionality of narrative and expository items.

3.1. Descriptive Statistics

Table 1 shows the descriptive statistics for the number correct (CCI), number of paraphrase (PAR), number of elaboration (ELA), and not reached (NR) items by form. While results varied by form, students generally answered about 80% of items correctly. When students failed to get credit for an item, it was somewhat more often because they did not reach the item. These trends are consistent across forms.

Table 1. Descriptive statistics for correct, paraphrase, elaboration scores, and not reached scores.

	Correct		Paraphrase		Elaboration		Not Reached	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Form 1	40.85	9.37	4.94	5.50	5.01	4.24	6.42	12.06
Form 2	39.14	8.73	6.06	5.50	4.80	4.10	6.76	12.74
Form 3	39.77	10.44	5.41	5.49	4.87	5.47	6.00	12.21
Form 4	41.64	8.28	3.90	4.83	4.46	3.97	6.74	12.63

3.2. Reliability

Table 2 shows the reliability for each of the scores. The reliability of the number correct scores are excellent, all above .90. Those for the Paraphrase and Elaboration scores are good to excellent, all but one above .80. The reliabilities for the Not Reached responses are high, but undoubtedly inflated by the non-independence between not-reached items at the end of a test.

Table 2. Reliability.

	Correct	Paraphrase	Elaboration	Not Reached
Form 1	.936	.875	.807	.981
Form 2	.917	.855	.771	.984
Form 3	.948	.863	.876	.974
Form 4	.932	.870	.809	.983

3.3. Difficulty and Discrimination of Narrative and Expository Items

Figure 2 shows the mean item difficulty (proportion correct) by form for narrative and expository items. For every form, the average item proportion correct is higher for the narrative items than for the expository items. To test this difference for significance, we performed a two-way ANOVA with item as the unit of analysis, with the factors of form and narrative vs. expository, and with item proportion correct as the dependent variable. The test statistic ($F_{1,192)} = 266.165$, p = .001) would lead to rejection of the null hypothesis that the average item difficulty was equal for both narrative and expository items. We employed a

Type III sums of squares, thereby controlling for both the Form and Form x Narrative interaction in the hypothesis test.

Figure 3 shows the mean item-total correlation (a standard measure of item discrimination) for narrative and expository items by form. The average discrimination index is higher for the Narrative items across all forms. Again we performed a two-way ANOVA (Form by Narrative vs. Expository) with item as the unit of analysis and item discrimination as the dependent variable to test the hypothesis that the average item discrimination is equal for narrative and expository items. The obtained $F_{(1,192)} = 19.781$, $p = .021$ would lead to rejection of the overall null hypothesis. The error bars in Figure 3 suggest that the difference is significant for all but Form 2.

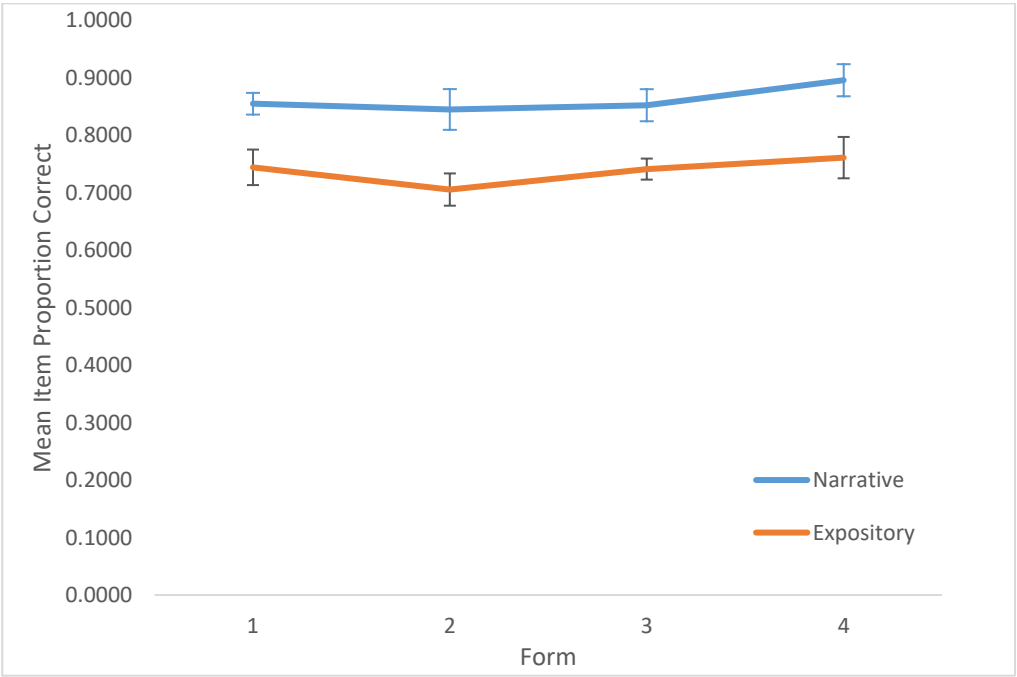

Figure 2. Mean proportion correct for narrative and expository items by form with 95% confidence intervals for the means.

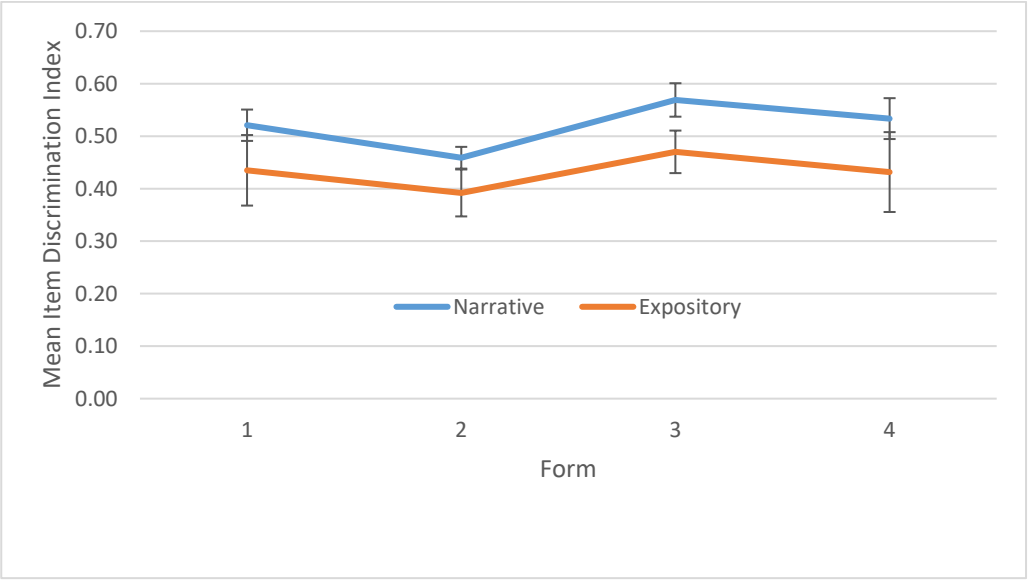

Figure 3. Mean item discrimination for narrative and expository items by form with 95% confidence intervals.

3.4. Dimensionality

Lastly, we used item response theory to address the question of whether the reading comprehension dimension underlying the narrative responses was the same as the dimension underlying the expository responses. To do so, we first fit a unidimensional, three-parameter logistic (3PL) model with all guessing parameters constrained equal for all 50 items. Then we fit a two-dimensional 3PL model with all guessing parameters constrained equal with narrative items discriminating only on the first dimension and expository items discriminating only on the second dimension. Table 3 show the statistics used to compare the models.

Table 3. Statistics comparing one- and two-dimensional models for the narrative and expository items.

	Correlation	**AIC 1 Dimension**	**AIC 2 Dimension**	**BIC 1 Dimension**	**BIC 2 Dimension**	**Likelihood Ratio Test**
Form 1	1.00	8757.64	8758.90	9122.57	9127.44	0.74
Form 2	1.00	9857.84	9859.87	10224.59	10230.25	0.01
Form 3	0.97	9236.64	9234.09	9603.39	9604.48	4.55*
Form 3	0.99	7536.29	7537.25	7902.67	7907.27	1.04

*p < .05

The IRT estimates of the correlations between the Narrative Dimension 1 and the Expository Dimension 2 are all at or above .97, suggesting that the two dimensions are virtually identical. The likelihood ratio statistic (LRT) provides a test of the null hypothesis that the two models fit equally well. It is not significant ($p > .05$) for all but Form 3. We can only reject the null hypothesis of equal fit for one of the forms, Form 3. The AIC is better (lower) for the unidimensional model for all but Form 3. The BIC is better (lower) for the unidimensional model on every form. With the exception of the Form 3 AIC and likelihood ratio test, results suggest that a single dimension underlies both the narrative and expository responses.

4. Discussion and Conclusions

Results lead to four major conclusions. Scores on the test have high reliability. The narrative items are easier, and they are somewhat more discriminating than are the expository items. Even though most college reading assignments involve expository text, narrative passages are just as useful as expository passages in measuring the comprehension ability required of college students.

In prior research (Graesser, McNamara, Cai, Conley, Li, & Pennebaker, 2014), authors have also found that expository text tends to be more difficult to comprehend. In part, this is because expository text contains technical vocabulary and relies more heavily on prior knowledge. In MOCCA-C, however, we have avoided technical vocabulary and the need for prior knowledge. Therefore, technical language and prior knowledge cannot explain the greater difficulty of expository items. Based on our experience writing items, it is our conjecture that the causal structure in expository text tends to be more subtle than that in most narrative passages, thereby making the expository texts more difficult.

Research on individualizing reading instruction based on MOCCA-C is at an early stage. McMaster et al. (2012) and Rapp et al. (2007) conclude that those who predominantly paraphrase and those who predominantly elaborate may benefit from different questioning strategies. In these studies, paraphrasers benefitted more from a questioning strategy emphasizing general connection making (e.g., “Make a connection to what you previously read.”), whereas elaborators benefitted more from a questioning strategy more narrowly focused on causal connections (e.g., “Why was Janie happy?”). However, a later study (McMaster, Espin, & van den Broek, 2014) using small group instruction did not replicate these earlier results, perhaps because small group instruction provides more optimal, individualized feedback about students’ comprehension or lack of comprehension.

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Functional and conservation value of fruits - a lab approach

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Abstract

Fruits are a relevant source of phenols and ascorbate, biomolecules which scavenge reactive oxygen species. For this reason, they are considered as healthy for the human being. Fruits quality depends on their levels of antioxidants and enzyme activities that ensure their conservation. The aim of this work was to plan and execute a laboratory class of Enzymology, a discipline of Biochemistry degree of University of Évora, Portugal, for determining the functional and conservation value of three different fruits types, sold in the market of Évora, Portugal. The development of this activity allowed that students of a pilot class participate in a laboratory activity which intended to compare the content of phenols, ascorbate, and polyphenol oxidase enzyme activity present in apple, peach and blueberries pulp. At Lab activity, the students successfully determined markers of functional and conservation value of selected fruits. The skills acquired by the students, in terms of obtaining fruit pulp and their composition in antioxidants, stimulated their commitment degree on the application of biochemistry in the everyday, acquiring thereby significant learning, with a high degree of satisfaction.

Keywords: Malus domestica, Prunus persica, Vaccinium myrtillus, antioxidants, conservation, enzymology class.

1. Introduction

Natural antioxidants present in foods have attracted special attention due to their nutritional effects, prophylactic and therapeutic action in various human pathologies (Ratnam *et al.*, 2006). Among the main antioxidants of plant origin are phenolic compounds and L-ascorbate. These can block lipid peroxidation by scavenging free radicals, decomposing peroxides or acting as metal ion chelators (Çam and Durmaz, 2009). L-ascorbate is a metabolic derivative of glucose or galactose that has ubiquitous distribution among plants and animals, with some exceptions including humans, some primates and teleosts (Mann, 2002). The ability to participate in oxidation-reduction reactions is one of the well-known functions for this vitamin which is often used as a food preservative. Humans get this vitamin from their diet, using natural or preserved foods where they are in abundance, so it is imperative to provide consumers with vitamin C-rich products (Pénicaud *et al.*, 2010).

Polyphenoloxidase enzyme (PPO) plays a relevant role in modulating the quality of food products as its presence has been correlated with the loss of fruit or vegetable quality during processing causing browning, loss of taste and nutritional qualities (Liu *et al.*, 2010). From a structural and functional point of view PPO is a metalloenzyme that catalyzes two distinct reactions involving phenolic compounds and dioxigen: (*i*) monophenol monooxygenase (EC 1.14.18.1) and (*ii*) diphenol oxygen oxidoreductase (EC 1.10.3.1) (Mayer, 2006). In the plant cell occurs a physical separation between PPO enzymes that express themselves in the plastides and their phenolic substrates stored in vacuoles which prevents the oxidation of phenols and consequent darkening of tissues. Physical aggression or senescence disrupt this barrier facilitating the contact of the enzyme with phenolic substrates, occurring the hydroxylation of phenols to o-quinones and respective darkening of the fruit (Toivonen and Brummmell, 2008).

This class took place in two three-hour laboratory sessions, using apples, peaches and blueberries, sold at points of sale in the city of Évora, as biological models. The lesson plan, as well as the assessment of the experimental protocols were elaborated in the scope of the discipline Enzymology of 2nd year of the Biochemistry degree of the University of Évora (Gomez *et al.*, 2007). In this experimental activity, it was intended, in a first phase, to compare the content in water-soluble proteins, antioxidants and polyphenol oxidase activity of three different fruit type, applying the teaching of biochemistry, using centrifugation and UV/Vis spectrophotometry, in the determination of the functional and conservation value of wilde-type fruits, a target that deserved particular importance given the progressive importance attached to these food properties by the juice industry.

2. Aims

Estimate the functional and conservation value of *Malus domestica*, *Prunus persica* and *Vaccinium myrtillus*, using centrifugation and UV/Vis spectrophotometry.

3. Skills to be acquired/assessed

Develop the ability to *i*) planning the experimental activity: "Functional and conservation value of fruits - a lab approach"; *ii*) apply centrifugation for fruit juice clarification; *iii*) apply UV/Vis spectrophotometry for antioxidant quantification and enzyme detection; *iv*) outline and construct calibration curves; *v*) outline and construct reaction curves; *vi*) compare functional and conservation value of fruits (Gomez *et al.*, 2007).

4. Strategy

The theme, addressed in the scope of the discipline Enzymology highlights the relevance of analytical biochemistry in determining the functional and conservation value of fruits. It took place in two moments: *i*) short theoretical exposition and planning of experimental procedure; *ii*) lab activity for obtaining juices fruit, for determining its antioxidant properties and a conservation marker.

The students, supported by the teachers, selected information available in on-line databases that allowed them to design the experience, write the protocol and obtain useful results to discuss fruit quality.

The activity occurred in the Laboratory of Analytical Biochemistry, Department of Chemistry, School of Science and Technology, University of Évora, Évora, Portugal, using as biological models the species *Malus domestica*, *Prunus persica* and *Vaccinium myrtillus*. Assays included **a**) obtaining peach, apple and blueberries pulp homogenates, **b**) determining content in water-soluble protein, phenols and ascorbate as well as **c**) determining PPO enzyme activity present in fruit pulp, using techniques such as centrifugation and UV/Vis spectrophotometry.

The universe covered a 15-member pilot class, enrolled in the discipline of Enzymology of the Biochemistry degree of the University of Évora in the academic year of 2017/2018, with an age distribution of 19 (28%), 20 (60%) and over 20 (12%) years old, where 44% were male and 56% female, attending for the first time in that discipline. The action lasted two 3-hour sessions. The activity assessment focused on skills acquired during and after the action, using the same set of problem questions asked before and after the completion of the three phases of the experimental activity (**a**, **b** and **c**).

5. Methods

Approximately 5 g of pulp of *Malus domestica*, *Prunus persica* and *Vaccinium myrtillus* fruits were homogenized in water (2:1, w/v). Homogenates were clarified by centrifugation at 18000 *g*, 40 min, 4 °C in a Hermle Z 323K centrifuge. Water-soluble protein content (720 nm) (Lowry *et al.*, 1951), ascorbate (534 nm) (Cai and Tang, 1999), total phenols (760 nm) (Singleton and Rossi, 1965) and PPO enzymatic activity (420 nm) were determined at 37 °C (Valero *et al.*, 1991), using a Genesys 10S spectrophotometer.

Students assessment skills survey realised before and after the lab approach had a score from 0 to 100. Significant differences between the two moments were detected by the t-student test for independent samples and the analysis of the highest scores in the phases **a**, **b** and **c** by ANOVA II, post-hoc test HSD of Tuckey, by Software SPSS 24, licensed to the University of Évora. The degree of students' personal satisfaction regarding the lab activity was detected by an opinion survey, and analyzed by the percentage value of the answers obtained in each item (Sokal and Rohlf, 1997, Gomez *et al.*, 2007).

6. Results

6.1. Obtaining fruit pulp homogenates and their clarification by centrifugation

In this sub-theme, students successfully prepare homogenates (5 replicates) of apple, peach and blueberry pulp, having the possibility to acquire laboratory skills in the execution of homogenization and centrifugation techniques. The students obtained a higher volume of peach pulp homogenate and a smaller volume of blueberry pulp homogenates (Figure 1).

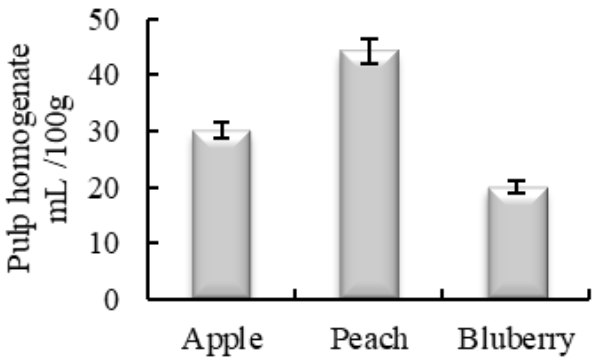

Figure1. Pulp homogenate volume of Malus domestica, Prunus persica and Vaccinium myrtillus (mL/100g fruit). Each bar represents the mean of five replicates, and the error bars represent ±1 SE..

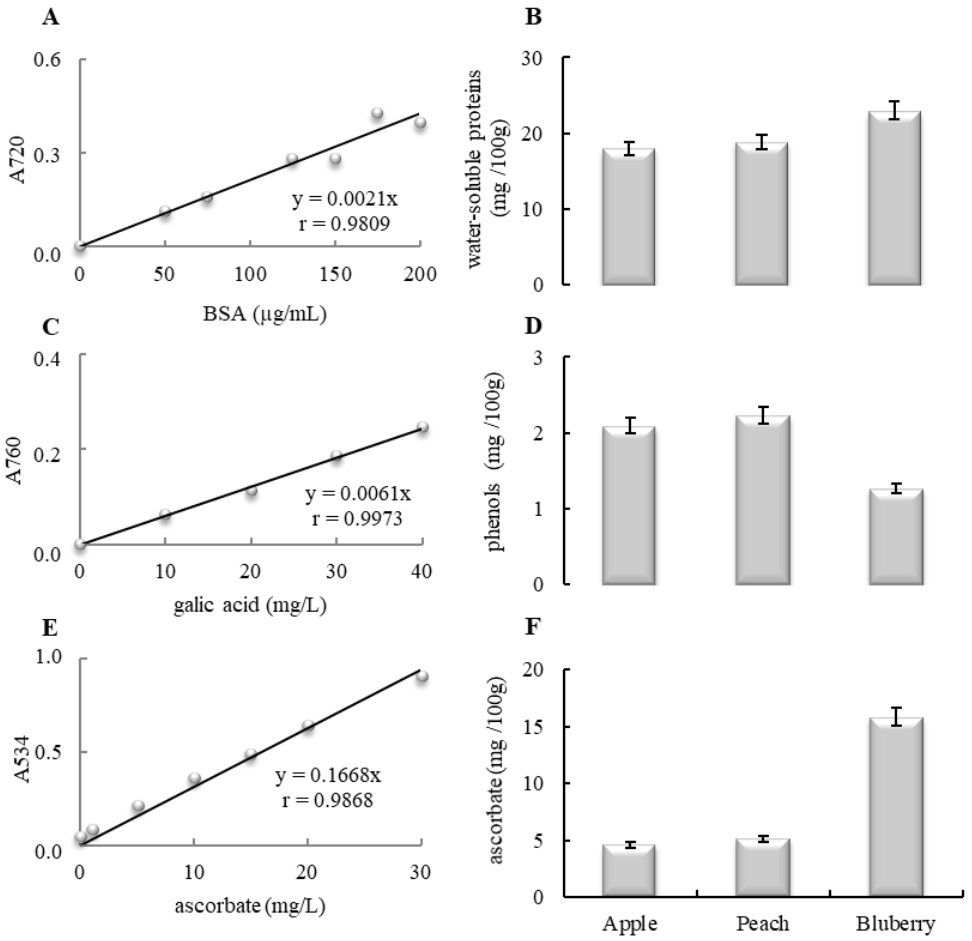

Figure 2. Calibration curves of proteins (A), phenols (C) and ascorbate (E). Content of water-soluble proteins (B), phenols (D) and ascorbate (F) from samples of Malus domestica, Prunus persica and Vaccinium myrtillus. Each bar represents the mean of five replicates, and the error bars represent ±1 SE.

6.2. Determination of the composition in water-soluble proteins, ascorbate and phenols by spectrophotometry.

In this sub-theme students had the opportunity to use UV/Vis spectrophotometry for prepare calibration curves for quantification of protein, ascorbate and phenol using BSA, gallic acid and ascorbate as standard. The critical analysis of the results allowed them to evaluate the quality of the obtained curves in terms of slope (positive), origin (0.0) and correlation coefficient (0.976 <r <0.997), confirming its agreement with Beer's law (Figure 2A, 2C and 2E). The students were also able to determine the content of water-soluble proteins, ascorbate and phenols, by graphically interpolation the readings of the samples in the obtained curves,

managing, for example, to identify the fruits richest in water-soluble proteins (blueberries), ascorbate (blueberries) and phenols (peaches and apples) (Figure 2B, 2D and 2F).

6.3. Determination of PPO enzyme activity by UV/Vis spectrophotometry

Regarding this sub-theme, the students were able to assess the linearity of the reaction catalyzed by PPO enzyme, using reaction curves such as the one illustrated in Figure 3A, which exhibited correlation coefficients that varied between 0.9887 and 0.9734. Subsequently, they also had the opportunity to determine the enzyme activity from the slope of reaction curves as well as to calculate the specific activity using the protein content estimated for each sample in the sub-theme **a**. Thus enabling students to acquire skills in determining enzymatic activities by UV/vis spectrophotometry. Figure 3B show that peach and apple pulp exhibited PPO values higher than those detected in the blueberry pulp, a marker of the greater tendency of these fruits to darken by mechanical action. The discussion of these results highlighted the contribution of this methodology in the definition of fruit preservation strategies.

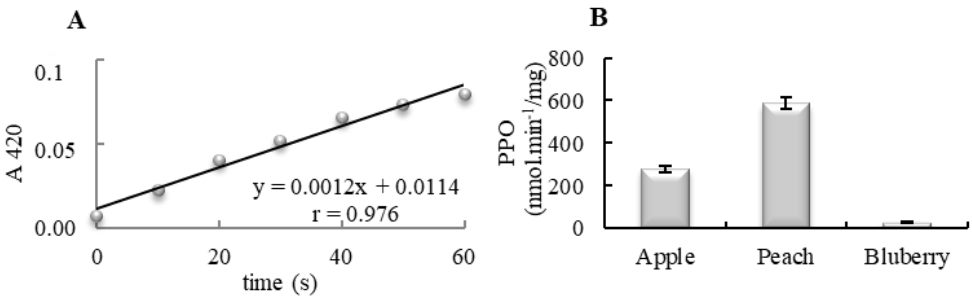

Figure 3. PPO (A) enzymatic reaction curve and PPO specific activity of samples from M. domestica, P. persica and V. myrtillus (B). Each bar represents the mean of five replicates, and the error bars represent ±1 SE).

6.4. Students evaluation

The average score obtained before and after the experimental activity 28.65% and 49.72%, respectively, revealed a positive overall evolution of the students' skills in terms of manipulation of centrifuges and spectrophotometers to obtain fruit extracts and to quantify its antioxidants level and conservation marker (Figure 4A). The t-student test revealed that occurred an increase of 21.08 percentage points, in the average score obtained after the development of the lab activity ($p < 0.05$) (Figures 4A and 4B). Students also demonstrated an increase in the skils to discuss the validity of results, formulating and discussing hypotheses for comparison of the functional and conservation value of the fruits. Figure 4B shows in detail a positive ($p < 0.05$) increment in the experimental development phases: (**a**) obtaining fruit pulp homogenates and clarifying them by centrifugation; (**b**) determining the

composition of water-soluble proteins; ascorbate and phenols by UV/Vis spectrophotometry; (**c**) determination of PPO activity by spectrophotometry on the score previously obtained.

The results of the opinion survey on the teaching activity, where students evaluated the performance of teachers in theoretical and experimental sessions and the impact of biochemistry on the characterization of the functional value of fruits, revealed that most respondents considered the size of the lab activity to be good (87.5%) and suitable the degree of difficulty (93%) as well as the means of work (90%).). Regarding the degree of overall satisfaction, 75% of students were very pleased to be able to apply centrifugation and spectrophotometric techniques to detect biological properties of fruits, relevant to human health and with consequent socioeconomic importance (69%). Among the aspects they liked least, they mentioned only waiting times (10%). Most students (75%) considered that they learned in a very pleasant way. Most students (82%) suggest that this activity be made available to students of the 2nd year of the degree in Biochemistry in order to provide more direct contact between the research environment and its application to everyday problems, such as food quality evaluation, since this activity well-illustrated some aspects taught in the theoretical plenary sessions of Enzymology discipline (98%).

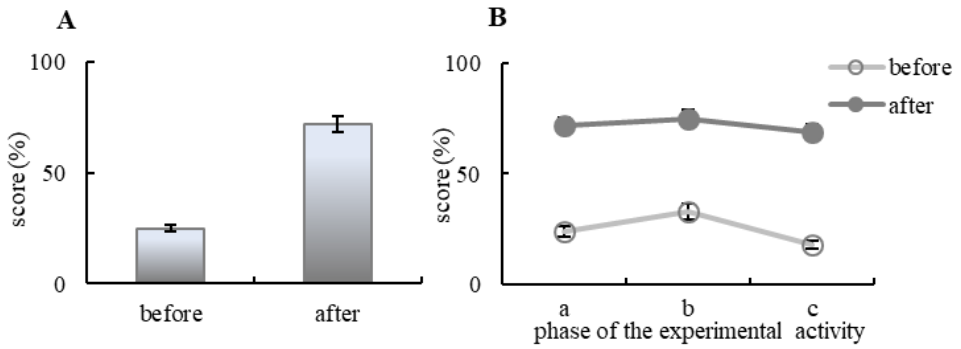

Figure 4 - Overall average score (A) obtained by students, before and after the development of the action and in each phase of the experimental activity (B). The values are presented as the mean of five replicates ± SE and the differences observed between the means of the two groups are statistically significant (p <0.05).

7. Conclusions

Students in the Enzymology Pilot Class, from the 2nd year of the Biochemistry degree, successfully participated in the planning of the activity: "Functional and conservation value of fruits - a lab approach". The preparation of the lab activity allowed them to extend valences such as: *i*) preparing and clarifying fruit pulp homogenates by centrifugation; *ii*) quantifying, water-soluble proteins, ascorbate, phenols and the PPO enzyme activity by UV/Vis spectrophotometry. The obtained results, such as calibration curves for proteins, phenols and ascorbate as well as reaction curves for PPO activity, stimulated in students a great desire

and curiosity to evaluate the antioxidant composition of the analyzed samples, expanding their knowledge regarding the functional value of fruits and their implication in its commercial value. The evaluation of skills developed by the students, confronted with the same set of problem questions posed before and after the different phases of the experimental activity, revealed that they improved their level of achievement, thus acquiring significant learning.

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Blended support of undergraduate interdisciplinary research

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Abstract

This paper discusses blended support for undergraduate students to perform interdisciplinary research in teams. Interdisciplinary research is a complex process that consists of multiple steps and requires collaboration with people from different backgrounds. This paper presents research done at Liberal Arts and Sciences, Utrecht University (LAS), where students learn to do interdisciplinary research as part of the core curriculum. Considering the complexity of doing interdisciplinary research, it is important that students are guided in this process. Blended support that combines technology-mediated guidance and face-to-face meetings would be of use to help students become more independent interdisciplinary researchers. This paper explores preferences in blended support, based on a survey and interviews with second and third year students and with undergraduate research supervisors at LAS, UU. Results indicated that there are different activities during the interdisciplinary research process where technology-mediated support would be of value. However, students and supervisors especially value meeting face-to-face when doing interdisciplinary integration. This should be taken into account when designing a blended framework for support of undergraduate interdisciplinary research.

Keywords: *Interdisciplinary education; undergraduate research; blended learning; educational technology.*

1. Introduction

Nowadays, technology provides the means to create online or blended educational environments, with different benefits for student learning such as facilitating a student's self-regulation (Shea & Bidjerano, 2010) and supporting a student's deep learning (Garrison & Kanuka, 2004). This paper discusses the value of using blended learning for support of students doing undergraduate interdisciplinary research. What is typical of undergraduate research is that students do not have much experience with doing research and support often focuses on providing structure. (Todd et.al., 2004). However, at the same time, Todd et.al. (2004) emphasize the importance of fostering autonomy when teaching the undergraduate student to do research, especially when doing the final undergraduate project.

Interdisciplinary research provides additional challenges in that it often involves a collaboration between people with different disciplinary specializations and that the interdisciplinary research question is complex in nature. The interdisciplinary research process, as taught at LAS, UU consists of a number of steps, based on the book on interdisciplinary research by Repko and Szostak (2016). Three to four undergraduate students with different disciplinary specializations work together on an interdisciplinary research problem. The research process consists of three different phases. The first phase is to define an interdisciplinary research question. In the second phase all students write their own disciplinary research part where they answer the interdisciplinary research question from a disciplinary perspective. Finally, during the third phase students reflect on the different disciplinary insights and provide an integrated answer to the interdisciplinary research question. As undergraduates have fewer experience with research, they especially can have difficulties with this final phase (Newell, 2006)

Alhough there is many research on blended education, there is not much research on blended support of undergraduate research. There are some examples of research on technological-mediated supervision (Heinze & Heinze, 2009; Jaldemark & Lindberg, 2012), but here the focus is more on communication throughout the process instead of providing support during different research phases. In addition, the interdisciplinary research process provides additional challenges to disciplinary undergraduate research. The current paper presents a study of students at the bachelor of LAS, UU, where students learn the interdisciplinary research process in their second year and write an interdisciplinary capstone in their third (final) year of their undergraduate. The study shows results from students on their preferred and current interaction with each other and their supervisor, both online and face-to-face. The paper ends with a discussion, addressing issues that are important when considering the design of a blended framework to support students doing interdisciplinary research.

2. Methodology

This study consisted of two parts. In the first (quantitative) part, a survey was taken of second year students of LAS, who had just completed their first course on interdisciplinary research (Interdisciplinary research I). In addition, the same survey was taken of third year students who had just finished their final interdisciplinary research project (interdisciplinary capstone). In the second (qualitative) part, interviews were held with students who had recently finished their interdisciplinary capstone. In addition, their interdisciplinary supervisors were interviewed.

2.1. Participants

All participants were students at the bachelor LAS, UU. For the first part, 22 students of the Interdisciplinary Research I course and 15 students of the Interdisciplinary Capstone took part in the survey. All students were asked to fill in the online questionnaire on the day of their final presentations of their interdisciplinary research projects. The former group had just finished their first interdisciplinary research report. In the latter group, students were doing interdisciplinary research for the second time as all students had finished the Interdisciplinary Research I course at an earlier point in time. Eight students of this group were in their third year of the program and eight students were in their fourth year.

From the students of the capstone that took the survey, two students participated in an interview. These students both had a different interdisciplinary supervisor, who also participated in a separate interview. The supervisors were both junior teachers at the Liberal Arts and Sciences program. Table 1 shows an overview of the students and supervisors who took part in the interviews.

Table 1. Participants in the interviews (anonymized)

Student	Supervisor
Student Sarah	Supervisor Dave
Student Eve	Supervisor Fiona

2.2. Survey and interview questions

Both survey and interview questions were based on literature on dissertation supervision and on elements of the interdisciplinary research process. As the goal of both the survey as well as the interview was also to investigate general supervisor preferences, not all questions were relevant to online or blended supervision. Two questions in the survey were particularly relevant to the topic of blended supervision. One of them was: “how did you work when doing the interdisciplinary integration?” (an important part of doing

interdisciplinary research). Here, online was an optional answer (amongst other answers such as 'talking to each other', 'on paper' or 'with post-its'). The other question that was asked is "To what extent would you like to use an online tool for…:". Here, six different elements important for the interdisciplinary research process were presented to students (see table 2) and they had to rate on a likert scale (from 1 to 5: totally disagree to totally agree) whether they would like to use an online tool for that element.

Regarding the interview questions, two semi-structured interview schedules were set up to guide the interviews, one for the student interviews and one for the supervisor interviews. The student interview schedule included questions on doing research, on facilitating the interdisciplinary research process and on the preference regarding a specific tool for facilitation of interdisciplinary research. Especially in the second and the third part, questions were relevant for investigating blended supervision, such as: "would you have like to have had more help and if so, during what steps of the interdisciplinary research process?" and "would you like to use and online tool to guide you through the interdisciplinary research process?". For the interview schedule for supervisors, the relevant questions that were included regarding use of an online tool were: "Do you think there could be a different way of supervising?" (indirect), "what part of supervising is done online and what part is done offline?" and "do you see value in an online tool to support students during the interdisciplinary research process"?

Table 2. Possible elements to include in online support of interdisciplinary research

Progress interdisciplinary process	As the interdisciplinary research process involves different steps, it is of use for students to track of where they are in the process.
Information different steps	For each step of the interdisciplinary research process, extra information could be of relevance to students (such as theory or examples).
Communicate between group	A tool could be used to facilitate communication between different interdisciplinary research groups.
Communicate within group	When doing an interdisciplinary research project, communication between group members is important.
To guide the integration	Integration is an important part of the interdisciplinary research process and it is not always clear to students what they should do exactly.
To visualize the integration	Visualization of the integration is an important way to show newly created insights

3. Results

3.1. Part I: survey on interdisciplinary research supervision

In this section, results of the survey on interdisciplinary research supervision are presented, including comparisons between the students who had less experience with interdisciplinary research (second year students) and the students who had more experience with interdisciplinary research (capstone students).

Differences were found between the less experienced and the more experienced group on to what extent they would like to use a tool for the different elements involved in doing interdisciplinary research (table 2). The average score of both groups was highest for the element 'information during different steps' and lowest for the element of communication (between and within groups). Figure 1 shows the average scores per elements and the difference between groups. Interestingly, for almost all elements, the less experienced group has a significantly stronger preference towards using a tool as compared to the more experienced group. The exception is communicating between groups, which is relatively low in both groups.

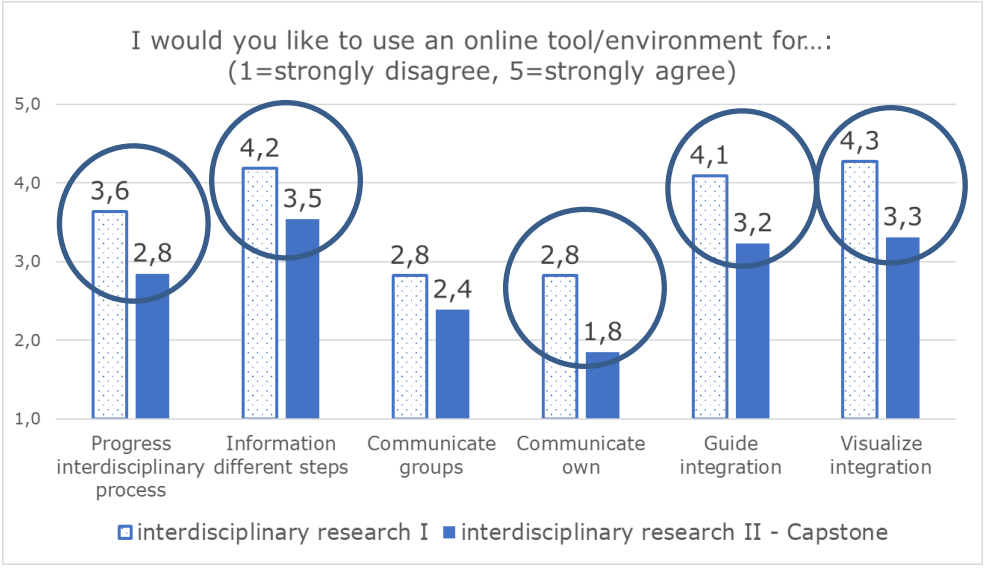

Figure 1. Average scores on tool preference for the less and more experienced group on different elements involved in doing interdisciplinary research. A circle indicates a significant difference ($p<0.05$).

When looking at how students worked during the integration of disciplinary insights (multiple answers possible), in both groups the number of students who indicated that they worked on their integration online was lowest (28 percent from the less experienced group indicated and 13 percent of the more experienced group). In addition, the highest

percentage in both groups was working on the integration by engaging in a conversation with each other (77 percent for the less experienced goup and 86 percent for the more experienced group). This emphasizes the value of meeting face-to-face, but still shows the difference in approach between the less experienced and the more experienced students.

3.2. Part II: qualitative research

In this part, results of the qualitative research are presented, consisting of in-depth interviews of two students and their supervisors. As the number of interviews per group (students/supervisors) is limited, results are mainly indicative.

In general, both students and supervisors did have a slight negative attitude towards a new tool to support interdisciplinary learning. Two different topics could be found in the interviews that lay the ground for this negative attitude: the *importance of face-to-face interaction* and the *preference of own tools as opposed to new tools*.

3.2.1. Face-to-face versus digital support

The importance of face-to-face interaction was stressed several times by the students: Eve mentioned the value of face-to-face interaction nine times and Sarah six times. Especially during the integration phase (phase C), to physically meet and discuss together was found to be essential. On this, Sarah said:

Especially with the integration it is impossible to do that without talking to each other. To share specific disciplinary insights with each other.(…) It is very useful to sit with each other and write down all the insights (Student, Sarah).

In addition, Eve talked about the value of discussing with the supervisor during this phase:

In the feedbacksession with the supervisor, we wrote and drew many of our insights and Fiona gave us suggetions on how to approach that. That was more like collaboaration, like we wrote the dissertation with the four of us, that was really cool. (Student, Eve)

What is apparent is that both supervisors indeed present the integration phase as something they do together with the students. Fiona talks about her experience:

I said: lets put everything we have aside. Then I made a model with them on the whiteboard with the concepts and the relations we were using. (Supervisor, Fiona)

These results could be explained by the creative and meta-cognitive thinking competencies required during the integration phase (Newell, 2006). It involves discussing each other's disciplinary insights and benefits from multiple moments of interaction. However, also other benefits of meeting face-to-face where pointed out, such as meeting other groups to learn about their progress and ask for advice.

3.2.2. Use of extisting personal tools

At multiple occasions in the interview, the students talked about using different online tools, including their personal social media tools, for different purposes. This showed the variety of tools that student are already using on their own account. Eve mentioned using Facebook, Google Docs, email and Whatsapp. Sarah mentioned using Whatsapp, Blackboard and email.

Both students contacted their potential group members online before commencement of the capstone. Eve did this through Facebook and Sarah indicated that she looked at Blackboard for the list of participants and contacted her classmate through Whatsapp. Besides using their personal tools prior to the course, they also indicated using their tools while writing the capstone, mainly for communication and documentation when they were not able to meet each other face-to-face. For example, Eve said:

We were a bit unlucky in that we could not meet with the three of us as often as we would have liked. But in the end it went well, and it was nice that we could make use of Google Docs for that purpose. We hade made a relatively organized drive and Fiona was part of the drive as well. (Student, Eve)

Fiona in this case did not mention the communication through google docs and mentioned mainly communicating through email. Regarding email, both supervisor Fiona and Dave stated that they found communicating through email useful and that they were not particularly enthousiastic to use a new tool. Dave was quite clear that email was the best way to reach him:

Yes, communicating is working well through email. I cannot think of a tool that would be more useful. (Supervisor, Dave).

Also, Fiona specifically mentions the downside of adapting to a new tool when asked about whether giving feedback through an online tool would be useful:

I think not, because you have to learn to work with that as a teacher, and you will learn, but also as a student it is a new environment to deal with. If you do not adapt it in every course (…), then I do not see the benefit over a word-document (Supervisor, Fiona).

4. Discussion and Conclusion

Results of this study emphasize the value of providing blended support to students doing undergraduate interdisciplinary research. Especially when students have few experience with interdisciplinary research, they feel an online tool would be useful to get information on during different phases of the process. In addition, they see value in a tool that would support them during the integration phase. This is less so in more experienced students

when writing their interdisciplinary capstone. However, although students who are writing their interdisciplinary capstone state that they would not be interested in using a new tool for support of their interdisciplinary research, they do mention making use of existing online tools. These tools are often social media tools (Web 2.0 tools) they would use in their social life as well (Whatsapp, Google docs, Facebook). This has benefits as well, considering that Web 2.0 tools have the benefit of encouraging self-regulation (Dabbagh & Kitsantas, 2012). The value of Web 2.0 tools for technological support is important to keep in mind when designing a blended framework.

This study also emphasizes the importance of face-to-face interaction when supervising interdisciplinary research. This resonates with findings from the literature, where the value of blended learning is that it provides a combination of online and offline support (Ginns & Ellis, 2007; Heinze & Heinze, 2009). As the interdisciplinary research process involves collaboration between students with a different disciplinary specializations, meeting face-to-face is even more important. Indeed, students work in different ways to integrate disciplinary insights, such as drawing concepts on the whiteboard and engaging in a discussion with each other and their supervisor. It is therefore important that technology-mediated support should complement this experience instead of replacing it, for example by making use of tools that can digitalize visualizations (Davidovitch & Yavich, 2017).

It should be noted that results from this study are mainly indicative, as the number of students involved is relatively low. In addition, the students interviewed for this study both indicated that they worked relatively well within their group. It is likely that students from groups who have more difficulties have different preferences concerning support of interdisciplinary research. Future work should therefore elaborate on this study to include more students. However, these findings do provide a base to design a blended framework for support of students doing interdisciplinary research. The inclusion of both students and supervisors in the design of such a framework would be essential to create relevant blended support that would help students become independent interdisciplinary researchers.

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Transdisciplinary Teaching and Learning: an Experiment

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Abstract

In our smart new world, characterized by continuous technological evolution, knowledge is subject to rapid obsolescence and change is the only constant. In this context, teachers are called upon to overcome the automatic habits of traditional knowledge transmission by developing a new perspective less tied to individual disciplines and more open to the many facets of reality. Only with a questioning and curious attitude aimed at innovation and pedagogical experimentation can teachers make their message meaningful again and help new generations to develop the habit of flexible and complex thinking in order to orient themselves in a fluid, globally connected and hypertechnological society. Following a course on multidisciplinarity, a group of secondary school teachers embarked on a journey of reading and experimenting in the classroom, realizing that through the transdisciplinary approach theorized by the quantum physicist Nicolescu, one can educate for the future. This powerful new approach suggests that teachers identify and tackle conceptual issues to work on and then they overcome the narrow limits of individual disciplines in order to understand complex events: this is the direction in which teachers and students of today's school should move, so that they will face tomorrow with greater awareness and effectiveness.

Keywords: transdisciplinarity, complex thinking, pedagogical innovation, action research, teaching.

1. Introduction

What do a quantum physicist, a Lacanian psychoanalyst, a philosopher, a specialist in education and a musicologist have in common? In this article, which deals with transdisciplinarity and ideas for a powerful new approach to teaching, we will try to answer this question and to identify possible implications for teaching. Actually, teachers are mostly motivated by good intentions, but they run the risk of being ineffective in helping their students develop an overall vision for making informed decisions (Harari 2018, p. 381).

To proceed in order, we will start from the background of this reflection. Following the suggestions of a refresher course on multidisciplinarity aimed at secondary school teachers (Borgogni 2018), we – a group of four English teachers, two Italian teachers and two Art History teachers – set out to create an innovative teaching module involving different disciplines to help our high school students face the new Italian state exam. According to Law 107/2015 (MIUR 2015), the new exam's aim is to verify that senior students are able to connect, critically and personally, the materials prepared by the exam commission with the knowledge they have acquired in the final year.

At the beginning of our action research experience, we undertook a series of readings aimed at understanding what is meant by multidisciplinarity, what new possibilities it opens up for teaching and how it responds to the needs of the fluid and hyper-technological society in which digital natives grow and learn. We started from a known terrain, namely the War Poets and the Futurist movement in Italian literature and in Art History, but we soon found ourselves facing the topic from points of view related to different disciplines, which in our experience is a still unusual and unconventional approach.

This paper is limited to our experience and it is not based on empirical data; nevertheless, it aims at turning the spotlight on a groundbreaking approach which could prove to be a very effective teaching tool. We hope our experience will inspire other teachers to go beyond the boundary of their disciplines to meet their students' needs.

The first part deals with this new approach from a terminological point of view and embraces transdisciplinarity as the key to effective teaching and learning. The second describes our teaching module inspired by the concept of transdisciplinarity, which is new as a tool for meaningful and relevant teaching. Finally, the third part concludes the article by reporting teachers' considerations and students' feedback on the strengths and weaknesses of an experience whose main outcome is our new perspective to working in education.

2. Terminological clarifications

When we talk about teaching, we come across terms such as multidisciplinary, interdisciplinary and crossdisciplinary derived from the word *discipline(s)*, considered by

Gardner (2013) as arenas for understanding, able to structure children's intuitive knowledge into an increasingly complex thought with the aim of achieving understanding (p. 7). To clarify this abundance of terms, we began a series of readings and soon realized that the literature on the subject is extensive and multidisciplinary itself: experts from various sectors have written on transdisciplinarity, confirming the existence of an interest that crosses the boundaries between disciplines and different geographical areas and is considered essential to understanding the complexity of reality.

According to Stember's classification (1991, p. 4), the approach in which one discipline is considered from the perspective of another is defined as crossdisciplinary; the multidisciplinary methodology, on the other hand, sees experts from different disciplines working together starting from their disciplinary skills, while the interdisciplinary methodology integrates the knowledge and methods of different disciplines using a synthesis of approaches.

Nicolescu (2002, p.1) takes this classification and emphasizes the disciplinary quality of the former approaches; the novelty of his thought consists in the rediscovery of the concept of transdisciplinarity introduced by Piaget, in which the boundaries between disciplines are almost non-existent, as can be seen in the following representation by Jensenius (2012).

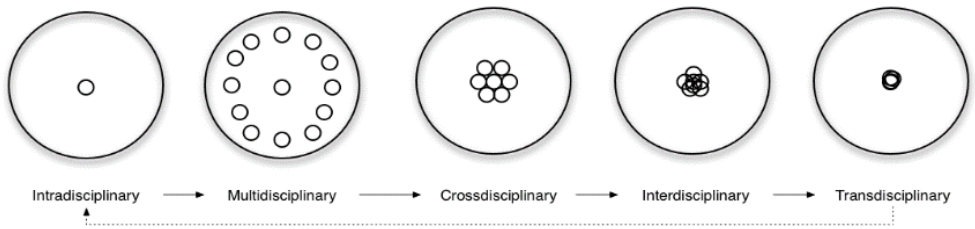

Figure 1 The different disciplinarities from Jensenius (2012)

Starting from the new idea of multiple levels of reality derived from quantum physics, Nicolescu identifies transdisciplinarity as the best suited methodological and pedagogical strategy "to meet the unprecedented challenges of our troubled world" which is deeply affected by the miraculous growth of knowledge enhanced by technological breakthroughs (Nicolescu 2002, p. 1). Although we have no skills in quantum physics, we became fascinated by this globally open way of relating to the complexity of reality, which does not provide reassuring unambiguous explanations or certainties. Actually, this approach shows us a new way of thinking and experiencing society through the unity of knowledge, which is no longer divided into single disciplines. The transdisciplinary approach, in fact, problematizes the information that circulates between disciplines and beyond them (Dinca, 2011, pp. 5-6); it is realized through a unity of structures and intellectual models overcoming disciplinary boundaries in a holistic and integrated perspective by overlapping the sectors and erasing

their borders. Quoting Piaget, Nicolescu (1997, p. 2) argues that fluctuations between disciplinary borders can generate new and more meaningful knowledge. It is precisely the power of this message that, as maintained by Recalcati (2014), can involve students and make them fall in love with the teacher's contribution, which can become significant again and bring the school back to the centre of society (p. 4).

Furthermore, transdisciplinarity as a tool for the integration of knowledge is a topic closely related to the global citizenship education proposed by UNESCO in 2015 (Ruano, Galeffi, Ponczek, 2014), which recalls the cosmodernity paradigm. This label is used by Nicolescu for a new consciousness based on the interaction between science, culture, spirituality, religion and society aiming at a more democratic and sustainable world (p. 22). This ability to think in a way that dissolves the hermetic boundaries between different disciplines can help students develop "a well-made head", as the philosopher Morin (2000) calls it in his famous essay; moreover, the transdisciplinary approach encourages flexible thinking that, as the historian Harari hopes (2018, p. 377), is able to interpret reality in its complexity by becoming a real *forma mentis* towards understanding; incidentally, this is also what the Italian state exam aims to assess (MIUR 2019).

Inspired by the similarities between the ministerial objectives for the state exam and the theories described above, we felt an imperative to set up an "arena" where students could experience the mutability of disciplinary boundaries while connecting information to reach a more global, holistic understanding of a complex phenomenon like the Great War. Unfortunately, we could not rely on previous transdisciplinary experiences or consolidated models of application of this approach to teaching in other secondary schools, as transdisciplinarity is not a mainstream teachers' attitude.

It was in this spirit of discovery and experimentation that we focused on the design of the module shown in the diagram below.

Table 1 Teaching Unit

The First World War: a transdisciplinary approach between literature, art and music	
Teachers	Four English teachers, two Italian teachers, two Art History teachers
Classes	6 classes of 23 students each, in an Italian secondary school; students were aged 18, in the final year of high school
Prerequisites	Students should already know how to analyse a poem in terms of independently identifying connections with the historical period; Students have already done group work
Content	The War Poets, Futurists, Modernism

Goals	Overcome boundaries between disciplines Understand the period between the First World War and Modernism from multiple points of view Grasp the complexity of the war event and its repercussions on society as a whole
Schedule	Step I: September 2018-October 2018 Course on multidisciplinarity, transdisciplinarity and interdisciplinarity for secondary school teachers held by Prof. Borgogni from the University of Turin
	Step II: October 2018 Lesson planning: The team of teachers planned the teaching unit, establishing times and means of implementation.
	Stage III: November 2018 Students attend a performance of Waltz in Wartime, on life in the trenches and historical events between 1914 and 1920. Step IV: 21-24 January 2019 Remembrance week dedicated to the Great War, with 2 lessons devoted to transdisciplinary activities in three main themes: class 1: War Propaganda in Pictures and Pamphlets class 2: War propaganda in Poetry and Art (R. Brooke, The Soldier, Futurism in poetry and art) class 3: Trench poems (S. Sassoon, Suicide in the Trenches, Survivors) class 4: Trench poems (I. Rosenberg, Break of Day in the Trenches, J. McCrae, In Flanders Field) class 5: Effects on society: shell shock (excerpts from V. Woolf, Mrs Dalloway, focus on Septimus Warren Smith) class 6: Effects on society: women at war and suffragettes (excerpts from V. Brittain, Testament of Youth)
	Step V: 25 January 2019 Study day: The Great War in Literature, Art & Music Transdisciplinary Lecture on Modernism held by Prof. D. Borgogni from the University of Turin Concert lesson on Piano Concerto for the Left Hand, written by Ravel for the Austrian pianist Wittgenstein, held by an Italian teacher with training in musicology Presentation by the students of the work carried out in the individual classes on the assigned themes (choral presentations of poems, dramatizations of texts written by the students based on poems, exhibitions and commentary on figurative works of the period)
	Step VI: February 2019 Reflection in class on the experience and collection of feedback
	Step VII: 6 March 2019 Follow-up plenary meeting with Prof. Borgogni to compare the different teachers' experiences and to plan the drafting of a reflection paper on the activity

3. Transdisciplinarity: challenges and opportunities

This section is not based on empirical data, but it rests on the comments provided by the students and on the reflections shared by the teachers involved in the project "The First World

War in literature, art and music". In hindsight, a question arises: despite good intentions, is it really possible to fully adopt a transdisciplinary teaching approach?

3.1. Transdisciplinarity as teamwork and networking

Teachers and students agreed that the initiative was stimulating and provided a new way to see the bigger picture with new eyes; however, at the same time, both groups believed that it was introduced too late, just to meet the needs of the state exam, and it only involved some subjects, not all.

It is common practice, especially in the humanities, to use musical passages or pictures to introduce topics, but in light of the terminological clarifications we are considering here (see par. 2), this practice appears multidisciplinary with interdisciplinary points and often turns out to be impromptu. To increase students' involvement and to make learning more relevant, teachers should merge methods and disciplines from the very beginning and throughout the course of study in order to help learners develop the mental habit of complex thinking that will enable them to face the world outside the classroom more consciously.

It is therefore necessary that the school board identify the conceptual issues and topics to be dealt with, promote transdisciplinary paths and highlight contact points in the daily teaching activities in order to facilitate a holistic and integrated perspective that crosses disciplinary boundaries. Furthermore, we believe that while safeguarding the freedom of teaching, the transdisciplinary approach is most effective if it is considered a mission of the whole institution, which adjusts teacher training and class scheduling accordingly.

Finally, the opportunity for dialogue and interaction should inspire the creation of networks of teachers and school managers who share this pedagogical principle (Jeder 2014, p. 129). Despite being aware of the challenges of organising a dialogue between different schools, we believe that new technologies such as digital platforms and discussion forums facilitate the sharing of good practices in the direction of education for complex thinking and the uniformity of evaluation between different institutions.

In our view, the transdisciplinary approach not only puts the student at the centre of the learning process, but it reactivates the teacher as the engine of pedagogical action, so we hope it will become the teachers' mainstream attitude. Being aware of the key role played by the individual teacher, in the following section we will reflect on a decisive aspect for the success of teaching in general and of transdisciplinary teaching in particular: the training of teachers.

3.2. Transdisciplinarity as a categorical imperative for training

Even if transdisciplinarity is a student-activating approach, it is the teacher who first must act by reflecting on and changing his/her own way of teaching. Approaching reality from a transdisciplinary perspective, showing initiative and working in teams and networks on

issues from different points of view are the first actions to be taken for a school that is up to the task of preparing our students for the future. From personal experience, we can affirm that it is not an easy path and requires specific training: only in this way can we first understand the need for an integrated curriculum that considers the student a person eager to develop complex knowledge in response to the challenges of a complex world. Again, thanks to specific training, in our opinion, teachers can develop their transdisciplinary skills and enrich their teaching by sharing projects and modules aimed at developing the transdisciplinary perspective in students.

Scholars from different fields have showed that, through the search for knowledge and understanding outside the boundaries of the individual disciplines, teaching can once again play the key role in preparing new generations to meet the challenges of a technologically-interconnected world. However, the transdisciplinary approach needs further attention and research: empirical data, analyses and case studies are necessary in order to create a transdisciplinary pedagogy that can help teachers to adopt this approach in their classes.

4. Conclusions

The problem of a school lacking authority and efficacy is highlighted by Lacanian psychoanalyst Massimo Recalcati, who identifies the "illnesses" from which many teachers suffer: automatic pedagogical habits and repetition (Recalcati 2014, p. 6).

However, by adopting a transdisciplinary approach we firmly believe teachers can revitalise the learning environment in schools, stimulating curiosity and complex thinking skills and making school and the teacher's role more relevant than ever. As far as the ambition of this article is concerned, we hope that we have turned the spotlight on a very powerful teaching approach that could meet the urgent need to make teaching relevant to today's students, who are asking not to be left alone to face a fascinating but frightening world, in front of which sometimes even adults feel unprepared.

Nevertheless, we recognize that a single module was not enough to deeply affect our teaching or to have a long-lasting impact on our students; in order to develop a habit to complex thinking students should be helped to experience transdisciplinary activities from the beginning of their study career. Furthermore, research, scientific literature and consolidated models are needed to help develop a transdisciplinary pedagogy.

Paraphrasing a poem by the American poet Robert Frost, we can say we have taken the path less travelled by and we hope we have made a difference (Frost 1916, 9). There is still a lot to do, but nevertheless we believe that this is the direction teaching and pedagogic research should take.

Acknowledgements

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Design for Cultural Heritage at the University of Ferrara

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Abstract

Alongside Teaching and Research, Italian universities are also committed to Public Engagement activities featuring teaching and cultural initiatives for a non-academic audience. At the University of Ferrara, this commitment was translated into an exhibition in April 2019, originating from a virtuous union of cultural heritage and teaching activities. The creation of the "Natura Naturata" exhibition involved the synthesis of taught courses and research by the University of Ferrara's Industrial Product Design students together with their teachers, in collaboration with librarians. In the Product Design 2 Workshop, students develop exhibition projects, starting from the curatorial concept, through the construction, up to the graphic-communicative aspects and the creation of information and teaching tools. The exhibition was created based on the study of rules used to properly protect library assets so that students could gain specific skills for the preparation of bibliographic exhibitions. It took shape in the Chemistry and Life Sciences Library Santa Maria delle Grazie to emphasize the importance of the University's tangible and intangible cultural heritage with the intention of conveying the 'world' of library collections – and also the University's historical and architectural heritage - to students, scholars, and citizens.

Keywords: *Cultural heritage, rare books, exhibition design, virtual exhibitions, virtual labs, education outside the classroom.*

1. Rare books heritage at the University of Ferrara

The city of Ferrara, with its historical Renaissance centre, is recognized by UNESCO as a world heritage site. A key part of its history is a university of ancient origin founded by a dispensation from Pope Boniface IX in 1391 to the Marquis Alberto V d'Este enabling him to establish the first courses in Arts, Theology and Jurisprudence. Today the Ferrara University is home to numerous courses of study attended by over twenty thousand students who make the city's streets vibrant and lively. The interconnection between the academic community and the city can be seen on the one hand both in the historical buildings and modern architecture of which the city's geometry consists and in which its places of study and research are hosted; on the other hand, the vitality and tradition of scholarship and knowledge for which the academic community and the University Ferrara are known, have built up scientific and cultural deposits such as the collections of rare books in the libraries which include about 10,000 books published from the mid-fifteenth century until 1830 including incunabula (books printed before 1501), sixteenth-century and seventeenth-century books, and volumes from the eighteenth and nineteenth centuries until 1830 (Università degli Studi di Ferrara, 2019).

2. Teaching from curating to exhibition design

These exquisite, inestimable treasures are the focal point and stimulus that serve both as research tools and teaching support in the belief that they are not merely documentary records to be conserved but also to be made accessible and introduced to a wider audience. Over the course of ten years, mapping and safeguarding these cultural deposits has been done by disinfesting, restoring and digitizing them, not to mention meticulously cataloguing every item and their characteristics as artefacts; and from 2016 onwards, teachers at the Department of Architecture have been working together with the Sistema Bibliotecario di Ateneo (University Library System) in establishing activities to promote and spread the message about the University of Ferrara's rare book collections and archival materials, having in mind not only the University's institutional users but also the interests of the wider community. Promotion was meant to increase awareness of cultural heritage and ensure the wider community through participation to round table and study days; scientific posters at national and international conferences; educational workshops and work experience projects for school students from Ferrara, with whose input we also designed a permanent touristic-cultural itinerary using the historical rare collections of the University, the Libraries, the Museum System and the historical, architectural heritage of the University of Ferrara (Università degli Studi di Ferrara, 2019). Public information on all of the scientific and educational activities is complemented by video-documentaries produced with the help of the University's Center for Communication Technologies and University Innovation (se@unife). In 2017, teachers and students from the Industrial Product Design course of the

University and the University Library System began a valuable, stimulating collaboration, which has led to the creation of innovative educational experience and cultural promotion. This experience was made possible because cultural heritage design is one of the key thematic profiles featured in the University of Ferrara's Industrial Product Design course since the course was established. This field of application has been the subject of design and project management exercises programmed into various phases of the training activities, from the workshops in the first year of study to the degree thesis. Since 2016, cultural heritage design has been taught using a very rigorous, systematic approach in the Product Design Workshop 2 where students run temporary exhibition projects, starting from the curatorial concept, through construction and fit-out, to the graphic communication aspects and the creation of analogue or digital information and teaching tools. In 2018, the Workshop operated in an exclusive collaboration with the University Library System. The students played a leading role in the research on the University's rare book collections, which involved the planning of an exhibition itinerary in the headquarters of the Chemistry and Life Sciences Library Santa Maria delle Grazie of the University of Ferrara, thus, by this choice, reaffirming the central importance of tangible and intangible heritage of the University. The result was an initiative included in the specific program of heritage communication of Ferrara's University and which is notable for its originality also at national level (Cassella, Madonna 2019).

Figure 1. Natura Naturata exhibition of rare books at the University of Ferrara (2019).

3. The University's mission from teaching to public engagement

Students and teachers of the Product Design Workshop 2 had been working for about one year together with the University of Ferrara's librarians in order to develop the research and teaching activities aimed at this rare book exhibition. The implemented methodology consisted of several consequent steps, such as planning, studying and carrying out activities, checking and communicating results. Therefore, the starting point was a detailed planning of the initiative, firstly stating its objectives, that were in compliance with the Italian law on cultural heritage (Ministero per i Beni e le Attività Culturali 2004) and the University's strategic goals related to its three Missions (Research, Teaching and Third Mission, the latter especially intended as Public Engagement), to which both the academic staff and the librarians must contribute. The whole project was then designed in accordance with the University of Ferrara's *Rectoral Mandate Plan 2015-2021* - as regards the promotion of public goods of a social, teaching and cultural nature - and pursuing its specific *Strategic Objectives 2019-2021*, especially the "C.4 Consolidation and development of the Public Engagement activities" and the "H.1 Improvement of the quality and services of our libraries". Secondly, all the activities were carried out thanks to the cooperation between librarians, academics experts in several disciplines, and students with their creativity: this mix realized a co-designed project, which benefited from highly-skilled co-designers, working in the same institution and sharing identity values - as a specific asset of initiatives developed within universities. Furthermore, the partnerships with private companies, created by means of the University's existing relationships and networks, fostered the activities. Thirdly, the checking step tried to understand how and how much the initiative helped the outreach of the academic audiences (university staff and students), as well as the non-academic ones (especially Ferrara citizens and tourists), in the perspective of Public Engagement. This assessment focused on the initiative's impact as described in ISO 16439:2014 (ISO16439 2014), *i.e.* the "difference or change in an individual or group resulting from the contact with library services": in this case, the "difference or change" regards the initiative's beneficial effects on the cultural and professional development of the involved audiences. A report of the initiative is going to be published online open access, and it is also supposed to be used by academics and librarians currently in charge of future planning. The project will be also submitted to the national assessment led by the Italian National Agency for the Evaluation of the University and Research System (ANVUR). In fact Italian universities' Teaching and Research activities have been assessed for over a decade by ANVUR, with reference to the quality of the processes and their results. In addition to this, in 2011 the assessment of Third Mission initiatives was introduced, as they are expression of each University's commitment to the social, cultural and economic progress of society, especially related to its local area and community (Sabba 2019; Bernabè, Tinti 2020).

4. Educational workshop for the exhibition

4.1. Actual exhibition

Compared to the design exercises conducted by the students of the Product Design Workshop 2 in previous years, the notable innovative dimension of the course in the 2018-2019 academic year was the opportunity given to the students of the course not merely to create a virtual or theoretical exhibition narrative but to actually engage in translating it into the reality of a physical location and having to try their hand at displaying complex objects such as scientific rare books conserved in the libraries of the University of Ferrara. The first innovative dimension was the students' and their teachers' encounter with the outstanding books belonging to the collections. The encounter was mediated by the librarians who accompanied them on this voyage of discovery of the existing heritage, the aesthetic characteristics of each artefact, and its cultural and identitarian value within the academic institution. In the workshop inside the library, the students received a special tutorial on the characteristics and history of rare books and early publishing which helped them to fully appreciate and raise a greater awareness of the very special nature and beauty of the books. The professors and students focussed their attention on four collections: Botany and Human Anatomy, Earth Sciences, and Biology conserved at the Chemistry and Life Sciences library, which was also identified as a virtual space for the workshop exhibition practical exercise. The books were selected both on the basis of the aesthetic value but also by asking for them to be assessed on their scientific value and historical relevance. Identification of the disciplines to which the chosen books belong was based on the scientific interests which have characterized the history of the University of Ferrara. These have been evocatively woven together in the curation project recalling the Spinozan meaning of Natura Naturata (Nature Natured) understood as "substance expressed" in different modes and attributes of the earth and of the forms of life that populate it (Dal Buono, Trincherini, Turrini, 2019). The rare possibility of constructing an actual exhibition in the same venue as the workshop practical exercises triggered a process of executive synthesis and translation of the students' proposals, centered on the main concept of Nature as a dynamic generative entity. This is why the exhibition itinerary guided the visitor through the antiquarian books to explore the sky and the earth, and plants, animals and humankind. The second innovative dimension of the workshop approach was the choice of the place to house the exhibition: the former church of Santa Maria Delle Grazie - a convent until the beginning of the nineteenth century and then converted into the University library. The internal arrangement of the historical building of the ex-church created a wide diversity of spaces which facilitated the layout of the various sections of the exhibition and provided a valuable opportunity to extend research into, understanding of, and experimentation in the potentialities of design in promoting artistic and cultural heritage (Lupo, 2008). Another dimension of the workshop's practical exercises relates to deciding on the elements governing the exhibition's graphic design. Alongside the

design and creation of the narrative elements of the exhibition (banners, section panels, display cases, catalogue of the rare books and of the students' projects), posters and postcards were created to promote the event As well as the work of coming up with concepts for the design of the exhibition this was also an opportunity for students to get out of the classroom and become involved personally in the construction of the exhibition with its technical aspects and logistic organization.

Figure 2. Teachers and students working to the exhibition Natura Naturata at the University of Ferrara (2019).

4.2. Virtual exhibition

Although *Natura Naturata* was open for only a short period the exhibition nevertheless enjoyed a considerable number of visitors who confirmed that they appreciated the choice of location, the exhibition itinerary, the graphic design supporting the narrative, and the exquisite books displayed. The positive response from the public would suggest that the exhibition should be continued, albeit virtually, so that those who did not get the chance to visit it can still enjoy the exhibition concepts and masterpieces of bookmaking. Our idea that we should continue along the path of a virtual - as well as a physical - exhibition was guided by the belief that it would be as an appropriate way of promoting the cultural heritage conserved by the University and would enable users to enjoy otherwise inaccessible works and documents without jeopardizing the work of protecting this heritage. Virtual exhibitions of this kind thus serve as an online archive of information relating to the physical exhibition,

with the added advantage of being accessible from mobile devices (Irace, 2013). We chose the open-source MOVIO Content Management System as the means of creating our virtual exhibition. We can consider MOVIO as a toolkit because not only it is open-source software, but also a set of tools and services such as CMS MOVIO for iPhone, Android and tablet smartphones, including an app for the most popular mobile platforms, online tutorials, and one-to-one training on how to use the kit. The virtual exhibition is nearing its end and presents a special opportunity to give a breakdown of teaching methodology at the University of Ferrara as it was conceived and created in collaboration between the teachers of the Industrial Product Design Course and graduates who are recipients of collaboration contracts for research projects and post-graduate training internships. This will be accompanied by interactive content such as the stages in the construction and fitting-out of the exhibition, the museum space and the exhibition itinerary, together with the digitized images of the rare books and photos of the inauguration and visitors. Informational and graphical contents of the panels and captions in the display cases will also be made available, together with the press coverage of the event and the analysis done using a variety of tools to assess how well received the exhibition has been.

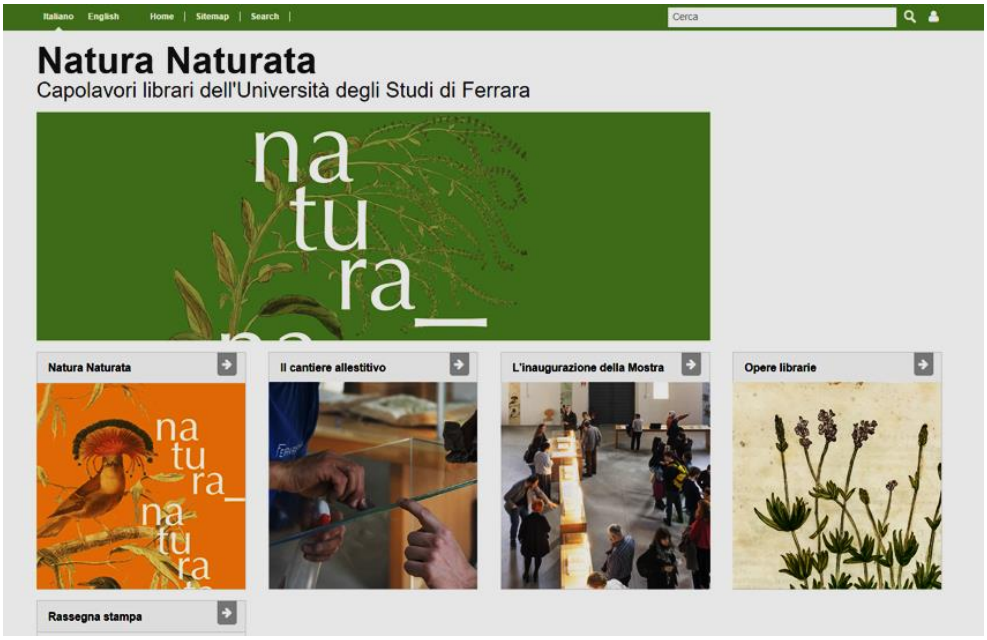

Figure 3. Natura Naturata virtual exhibition of the University of Ferrara on MOVIO (2019).

5. Impact and assessment of teaching and public engagement mission

The attempt to determine impact was based on quantitative and qualitative data collected through headcount of visitors, a paper visitors' book located at the entrance of the exhibit, an online survey and observation. The assessment tools aimed to identify the reached audiences and verify the fulfillment of the project's goals (raising of awareness on the University of Ferrara libraries' heritage; exhibition's effectiveness in communicating educational contents; audience satisfaction). The results of headcount were satisfactory, since this was the first exhibit of its kind ever held by the University of Ferrara libraries, which had no established reputation for its bibliographic heritage. The visitors' book was signed by 33.5% of visitors and some of them also wrote comments, generally positive and marking the project's originality, as well as the students' and teachers' commitment and hard work. The venue itself and the displayed books also received strong approbation. The survey was divided into two sections: the first one regarded exhibition contents, event marketing, and customer satisfaction; the second one tried to identify the reached audiences. 31.6% of visitors completed the survey: they belonged to different audiences, ranging from those who had little (33%) to those who had a considerable (4%) knowledge of rare books. Most respondents thought the displays created by the students with their teachers were effective (43%) or very effective (57%), thanks to the exhibition's linearity and the clear explanatory panels and book tags, also appreciated for their graphic design. Several comments underlined the professional enrichment the students gained from the experience in a real-life context. 77.4% of respondents lived in the Ferrara area, so we can assume that the initiative was beneficial for the cultural development of the local community in which the University is located. To assess the impact on the participating students, the librarians also considered the observed evidence, as suggested by ISO 16439. No doubt that the students enjoyed the workshops in the libraries, where they could interact with their outstanding bibliographic heritage, realizing its great value. Moreover, feedback collected through student's spontaneous comments was largely positive. We are particularly proud of this learning experience, of the knowledge acquired by the students "rediscovering" an aesthetic and cultural treasure. They became witnesses of a shared (and so consolidated) institutional identity, and this way they created an exhibition itinerary for different audiences, thereby acquiring the specialist skills of bibliographic exhibition designers. At the same time citizens could find out more about the University's cultural heritage and teaching activity - and no doubt this was a great Third Mission result[1].

[1] The paper is the result of a joint research and reflection by the authors. Paragraphs 1 and 3 are written by M. Contarini, 4.1 by D. Turrini, 4.2 by M. Manfra, 5 by A. Bernabè, paragraph 2 is the result of a joint writing by the authors.

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Improving vocational interest assessments: data complexity levels are important for social and enterprising areas

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Abstract

*Vocational interest assessments are open to imporvements to achieve higher predictive validities. One recent approach in developing interests assessments has been to incorporate more complex vocational activities in items (Toker & Ackerman, 2012). In this study we developed the Vertical Social Interests Scale (VSIS)-Data Complexity Levels to be used together with the VSIS-People Complexity Levels (Açıkgöz & Toker, 2019) to assess interests in increasingly complex activities related to the social and enterprising vocational areas. Data complexity levels in the Dictionary of Occupational Titles which are present in the work activities of social/enterprising occupations identified in the O*NET were incorporated in developing scale items. The new measure was evaluated on a sample of 238 college students., yielding a 3-factor structure reflecting high-, moderate-, and low-complexity work activities. The moderate-and-high complexity factor composites had expected associations with other interest and self-efficacy measures together with several vocational criteria, adding support to the developing literature on the importance of measuring interests for increasingly complex activities.*

Keywords: *Vocational interests; assessment; occupational complexity; social interests; enterprising interests.*

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1. Introduction

An important part of transitioning from high school to a college major and a career is making sound decisions as to one's vocational area. Counselling provided based on vocational interest assessments take most of the credit in such decisions. Nevertheless, such assessments have been criticized to lack validity in predicting vocational outcomes (e.g., Nauta, 2010). Incorporating occupations' increasingly complex activities into vocational interest assessments have proven more useful than traditional interest assessments in predicting vocational criteria at the college and work-life levels (Açıkgöz & Toker, 2019; Toker, 2018; Toker & Ackerman, 2012; Toker & Gültaş, 2019). One of these assessments focused on targeting more complex activities in the occupations under Holland's (1997) Realistic and Investigative work environments (Toker & Ackerman, 2012) whereas the other assessment developed so far focused on Social and Enterprising work environments. The latter only measures interests towards interacting with people (Açıkgöz & Toker, 2019). Nevertheless Social and Enterprising occupations also vary in their complexity levels in terms of dealing with "data". The focus of the present study was developing an interest assessment for these areas that incorporated increasingly complex activities to do with interacting with data.

The Dictionary of Occupational Titles (DOT; U.S. Department of Labor, 1991) was consulted to locate the occupations that differed based on the 4th digit code that reflects varying levels of complexity with interacting with data from the lowest level of "comparing" to the highest level of "synthesizing/generating". A total of 125 occupations (56 high-complexity, 60 moderate-complexity, 9 low-complexity occupations) were selected and analyzed based on their work activities and tasks as described in O*NET. Interviews were conducted with 39 employees, including lawyers, executives, business people, academicians (high-complexity occupations), nurses, sales representatives, executive assistants, police officers (moderate-complexity occupations), and chefs, baristas, and cashiers (low-complexity occupations), asking them for the most frequent tasks involving dealing with data. Information gathered from O*NET and the interviews were used in item generation.

A 33-item measure, named the Vertical Social Interests Scale – Data Complexity Levels (VSIS_DCL), was developed to reflect varying levels of complexity in social and enterprising areas. A validation study was conducted on a college student sample. As items were generated to reflect three complexity levels, the first hypothesis was:

Hypothesis 1. The VSIS_DCL will have a 3-factor structure, reflecting low-, moderate-, and high DOT data complexity levels.

The VSIS_DCL was developed for the social and enterprising areas, thus:

Hypothesis 2. The VSIS_DCL factors will have moderate associations with social, enterprising, and investigative interests and self-efficacies.

The most important criteria used in the validation of interest assessments have been area satisfaction and persistence, albeit with small effect sizes (e.g., Nauta, 2010; Nye et al., 2012; Spokane et al., 2000; Tracey and Robbins, 2006; Van Iddekinge et al., 2011). Assessing interests towards more complex tasks have added incremental variance to these traditional assessments (e.g. Ackerman & Toker, 2012), thus:

Hypothesis 3: The VSIS_DCL high- and moderate-complexity factors will add incremental variance over the traditional assessments in predicting relevant vocational criteria such as satisfaction and persistence.

2. Method

2.1. Participants and Procedure

Undergraduate college students from a technical university in Ankara, Turkey participated in the current study. Majority of the students participated in return for course credit upon receiving IRB approval. The sample consisted of 238 (74.5% women) students. One person was 42 and the remaining participants' ages ranged from 18 to 28 (with 36.1% at the age of 21). Of the participants 68.9% were enrolled in Administrative, Economical, and Social Sciences (AESS) (45.4% psychology, 9.2% education sciences, 7.1% sociology/philosophy, 1.7% economics and 5.5% political sciences, public administration and business administration) and 30.6% were enrolled in STEM majors (21.8% engineering, 8% biology, molecular biology, physics and chemistry and 0.8% statistics) and there was one participant from the faculty of law. Grade distribution was 6.3% freshmen, 31.9% junior, 34.5% sophomore, 17.2% senior, and 6.3% in their fifth, sixth or seventh years.

2.2. Measures

2.2.1. Vertical Social Interests Scale_Data Complexity Levels (VSIS_DCL)

The 33-item measure was rated on a 6-point scale from "not enjoyable at all" to "very enjoyable". According to DOT levels, there were 2 comparing, 4 copying (6 low-complexity), 5 compiling, 5 analyzing (10 moderate-complexity), 4 planning/coordinating, 8 synthesizing, and 5 generating (17 high-complexity) items. Two example items were "Analyzing various ideas, propositions, methods, and perspectives related to the AESS areas, with their pros/cons and strong/weak sides" (analyzing) and "Going over verbal information, combining them in various ways, and proposing ideas with a new perspective (For instance, an attorney interpreting the legislations in a way that would vindicate the client; or a teacher preparing an attractive class activity)" (generating item).

2.2.2. Vertical Social Interests Scale_People Complexity Levels (VSIS_PCL)

The 36-item scale (Açıkgöz & Toker, 2019) was rated on a 6-point scale ranging from "not enjoyable at all" to "very enjoyable". The scale has four factors of serving (low-complexity, 10 items), supervision (moderate-complexity, 7 items), leading (high-complexity, 11 items), and communication (moderate- and high-complexity, 8 items) with internal consistencies varying from .81 to .92 in college samples.

2.2.3. Self-Directed Search

Holland's (1997) RIASEC theme interests and self-efficacies were measured with a total of 120 items, adapted to Turkish by Balkış (2004) with internal consistency reliabilities from .74 to .88. Items were rated on a 6-point scale.

2.2.4. Major Satisfaction

Students' satisfaction with their major and their experiences (e.g. courses enrolled, intellectual stimulation) were assessed with 7-items rated on a 6-point scale ranging from "does not describe me at all" to "describes me very well" (Lent et al., 2005), adapted to Turkish by Toker and Gültaş (2019) with an internal consistency of .93.

2.2.5. Intentions to further Pursue the Academic Area

The 10-item scale (Toker, 2010) was used to assess participants' intentions to graduate from and further pursue the area they are enrolled in with a graduate degree and a career. Internal consistency was .91 (Toker & Gültaş, 2019).

2.2.6. Interest towards Research Assistant (RA) Activities

A 9-item measure was developed for this study to assess interests towards increasingly complex RA tasks on a 6-point scale. An example item is Analyzing how a scientific article's results would contribute to the topic.

2.2.7. Social activities

Participants were asked to indicate the social/organizing-related activities they took part in during their college life. Amongst these activities were participating in debates, being a member of university clubs, being the president of a club/society in college, active participation in organizing an event, being the spokesperson of a group, writing blogs, periodically writing in non-academic journals. A total social activity score was computed based on the number of activities participants selected.

3. Results

A pilot analyses with 156 students yielded a 3-factor solution based on Principal Axis Factoring with oblique rotation. A total of 45.7% of variance was explained before rotation, with 34.8%, 6.4%, and 4.5% of variance explained by the high-, low-, and moderate-complexity factors, respectively. Items mostly loaded on the complexity levels they were designed to represent, supporting Hypothesis 1. Three items with cross-loadings, ambiguous content or low-loading were removed, leaving 30 items. Data on these 30 items were gathered from the remaining participants. Internal consistencies in the entire dataset were .93 (17 items), .91 (8 items), and .73 (5 items) for the high-, moderate-, and low-complexity factors, respectively.

VSIS_DCL factor means were statistically significantly higher in the AESS sample ($N = 161$) than in the sample of students enrolled in other majors ($N = 77$). Specifically, interests of AESS students towards activities with verbal data were higher for high-complexity activities ($M_{AESS} = 4.68$, $M_{Other} = 3.87$, $p < .001$, Hedges'$g = 1.02$), moderate-complexity activities ($M_{AESS} = 4.78$, $M_{Other} = 3.73$, $p < .001$, Hedges'$g = 1.15$), and low-complexity activities ($M_{AESS} = 3.31$, $M_{Other} = 2.85$, $p = .003$, Hedges'$g = .48$). Factors of the VSIS_PCL did not differ across the samples. Holland social interests ($M_{AESS} = 4.90$, $M_{Other} = 3.93$, $p < .001$, Hedges'$g = 1.20$) and social self-efficacy ($M_{AESS} = 4.62$, $M_{Other} = 4.03$, $p < .001$, Hedges'$g = 0.67$) were higher in the AESS sample, whereas enterprising interests and self-efficacy did not differ.

Theoretically, construct validity evidence based on associations between vocational interests and self-efficacies needs to be analyzed within the entire sample of participants. Accordingly, VSIS_DCL high- and moderate-complexity scales were correlated strongly with each other ($r = .82$), but had smaller correlations with the low-complexity scale ($r = .34$, $r = .37$). The people high-complexity leading and communication factors were also correlated strongly ($r = .54$). All three factors of the VSIS_DCL correlated with social self-efficacy from .24 to .44 and with social interests from .39 to .51. The high-complexity factor had significant moderate correlations with enterprising self-efficacy and interests ($r = .32$, $r = .26$), and the moderate-complexity factor had a small significant correlation with enterprising self-efficacy ($r = .19$). The low-complexity factor did not correlate with enterprising self-efficacy or interests. Realistic and conventional themes were discriminated from the VSIS_DCL high- and moderate-complexity interests with small associations ($|r|$ .00 to .22). The low-complexity factor, though, was associated with conventional self-efficacy ($r = .19$) and interests ($r = .37$). Artistic interests and self-efficacy were found to have small-to-moderate associations with all three complexity levels of VSIS_DCL (*r's* .16 to .33).

Associations across the investigative theme and VSIS_DCL factors were analyzed within the AESS sample as investigative interests can be discipline-specific. AESS students with higher

investigative interests/self-efficacy also reported higher interests on high- and moderate-complexity VSIS_DCL (*r's* .25 to .48). All-in-all, Hypothesis 2 found support.

Hierarchical regression analyses were conducted to investigate the incremental variance VSIS_DCL scores have over the traditional Holland assessments. Satisfaction with academic major, a combined score of intentions to pursue an undergraduate degree, a graduate degree and a career, interests towards RA activities, and participation in social activities were predicted from a composite of social interests and self-efficacy, a composite of enterprising interests and self-efficacy, and a composite of investigative interests and self-efficacy in the first step, and a composite of the VSIS_PCL leading, supervising, and communication factors, and a composite of the VSIS_DCL high- and moderate-complexity factors in the second step.

Results (see Table 1) indicated that intention to pursue an AESS area was predicted by social interests/efficacy ($\beta = .28$, $p < .001$) and VSIS_DCL ($\beta = .47$, $p < .001$). Satisfaction with academic major was predicted by social interests/efficacy ($\beta = .29$, $p < .001$) and VSIS_DCL ($\beta = .36$, $p < .001$). Interests towards RA activities were predicted by VSIS_PCL ($\beta = .31$, $p = .003$) and VSIS_DCL ($\beta = .34$, $p < .001$), and inversely by enterprising interests/efficacy ($\beta = -.27$, $p = .011$). Thus, Hypothesis 3 found support. Social activity participation was predicted only by enterprising ($\beta = .24$, $p = .006$) and investigative interests/efficacy ($\beta = .22$, $p = .007$) in the first step.

4. Discussion

This study has provided initial evidence for the factorial structure, construct, and concurrent criterion-related validity of the VSIS_DCL. Items written to reflect the DOT complexity levels factored together within their complexity levels. Only three items were dropped from the measure. The high- and moderate-complexity factors were more highly correlated with each other than their associations with the low-complexity factor; a finding consistent with the VSIS_PCL (Açıkgöz & Toker, 2019) and the STEM Complexity Measure (Toker & Ackerman, 2012; Toker & Gültaş, 2019).

AESS majors indicated higher interests on the VSIS_DCL factors and on social interests as compared to the small sample of other majors. Consistent with the findings of Açıkgöz and Toker (2019) enterprising interests and self-efficacy were no different across the samples. Major differences were not observed for the VSIS_PCL factors either, rendering the VSIS_DCL potentially more useful.

Table 1. regression analyses

	Intentions to Pursue AESS	Satisfaction with AESS major	Interests for RA activities	Social participation
Block 1				
Social interest & SE	.40***	.37***	.18*	.03
Enterprising interest & SE	-.12	-.05	-.09	.24**
Investigative interest & SE	.07	.05	.20*	.22**
F(df)	8.87(3,157)***	8.03(3,157)***	4.35(3,157)	8.36(3,140)***
R^2	14.5%	13.3%	7.7%	15.2%
Block 2				
Social interest & SE	.28***	.29***	.09	.00
Enterprising interest & SE	-.20	-.03	-.27*	.14
Investigative interest & SE	-.15	-.10	.04	.17
VSIS_PCL H & M comp	.16	.01	.31**	.17
VSIS_DCL H & M comp	.47***	.36***	.34***	.10
F(df)change	20.36(2,155)***	9.61(2,155)***	13.09(2,155)***	2.01(2,138)
R^2 change	17.8%	9.6%	13.3%	2.4%

Notes. SE: self-efficacy, VSIS: Vertical Social Interests Scale, DCL: Data Complexity Levels; PCL: People Complexity Levels; H: High-complexity, M: Moderate-complexity. Values in cells are Beta coefficients, unless otherwise indicated. *p < .05, ** p < .01, *** p < .001.

Support for the construct validity of the VSIS_DCL came from Holland's social interests and self-efficacy correlating with all factors, enterprising interests and efficacy correlating with the high-complexity factor and also the investigative theme correlating with the high- and moderate-complexity factor in the AESS sample. Significant correlations were also observed

with VSIS_DCL factors and artistic interests and self-efficacy. This finding could be attributed to the artistic scales including items related to reading and writing literature.

VSIS_DCL appears to be a useful measure for AESS areas as indicated by the different means on factors and different correlations between factors scores and vocational criteria across the AESS and other majors. Regression analyses results showed that VSIS_DCL high- and moderate-complexity factors were more predictive of intentions to further pursue an AESS area and satisfaction with being in an AESS area as compared to the VSIS_PCL or the Holland measures. Interests towards the activities that RAs engage in frequently were predicted by both complexity measures indicating that having an interest towards both complex data processing and handling people are important in the more complex work domains such the one of RAs. Finally, participating in social and organizing activities was predicted by enterprising interests in the absence of the complexity measures. Another important finding is that enterprising interests and self-efficacy do not predict more data driven pursuits such as intending to study further, being satisfied with the academic studies, or RA tasks. Actually enterprising measures' composite was an inverse predictor of interests towards RA tasks.

All-in-all, this study provided initial support for the construct and predictive validity of VSIS_DCL. Another data collection phase is underway for studying the measure's validity in graduate student and employed samples.

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Exploring student teachers' reflection skills: Evidence from journal tasks

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Abstract

The article addresses the issue of developing reflection skills of Polish foreign language student teachers in the context of university training. Although the importance of fostering reflection in student teachers has been widely acknowledged, the complexity of the construct and difficulties to operationalize reflection in research calls for new studies, to which the present paper aims to contribute. The paper discusses the study in progress whose main aims were to explore the potential of journal tasks as techniques stimulating trainees' reflection and to investigate the nature of reflection demonstrated in students' journals. The results of the analysis of students' texts revealed different ways that the students adopted to approach the journal task. Three perspectives from which the students developed their narration were identified: teacher-focused, learner-focused and the one that focusses on external factors. Additionally, the analysis led to the identification of three types of writing, named in the study as Theorising, Describing and Discussing. The findings point to the effectiveness of journal tasks in stimulating students' thinking about their practicum experiences. They also stress the significance of fostering novice teachers' reflection skills as a way of socializing students into new roles they will play in their future professional communities.

Keywords: *teacher education; research skills; reflection skills; practicum; journal tasks.*

1. Introduction

This part of the paper provides theoretical background related to the issue of fostering reflection skills in foreign language (FL) teacher education. Teacher education is presented as a way of preparing students to enter new professional communities. It is argued that reflection skills are a prerequisite for developing research skills. The advantages of the written form of reflection are emphasisied.

1.1. Teacher education as a way of socializing students into new roles

One of the aims of teacher education is to facilitate students' efforts to enter a community of practitioners, by some scientists called a discourse community. Swales (2011) claims that: "A discourse community has mechanisms of intercommunication among its members" (p. 25). It "uses its participatory mechanisms primarily to provide information and feedback" (Swales, 2011, p. 26). As a result, community specific genres (types of texts) are developed, which can enable every member of the group to contact other members. For example, in the group of applied linguists the most common genres are research papers, conference abstracts, research proposals, oral presentations as well as theses and dissertations. Another characteristic of professional discourse is that: "A discourse community has a threshold level of members with a suitable degree of relevant content and discoursal expertise" (Swales, 2011, p. 27), which implies that a discourse community consists of both novices and experts. Individuals who enter the community develop their knowledge by participating in the life of the community.

The FL teaching program organized by the university prepares students to enter two types of communities: a community of FL teachers and a community of academics (applied linguists). It is important to realize that in the two groups, students are novices. The teaching program provides student teachers with opportunities that will help them to develop new competences and at the same time enjoy the freedom to construct new roles in academia and future professional contexts. An important place in socializing students into these new roles should be taken by the activities that are conducive to facilitating students' research skills.

1.2. Research skills in FL teacher education

Unfortunately, there is not much literature that would define research skills in relation to the FL teaching profession, although advice about how to conduct research within specific disciplines at post-graduate and doctoral levels can be commonly found. For example, Nunan (1992) defines research as a systematic process of investigation consisting of three components: 1/ a question, problem or hypothesis, 2/ data and 3/ analysis and interpretation of data. However, he does not offer a clear explanation of research skills, i.e. competences that a person that conducts research should develop. In a similar publication devoted to conducting studies in FL education, Wilczyńska and Michońska-Stadnik (2010) enumerate

three components of the competence that should researchers should demonstrate: 1/ discipline knowledge, i.e. being familiar with the specificity of what can be researched within a given discipline, 2/ research knowledge, i.e. the one concerning methods and techniques that can be applied in research and 3/ awareness of ethical issues that need to be considered by researchers when embarking on a study.

In reference to the FL teaching profession, a number of scholars, e.g. Zawadzka (2004), Targońska (2009), Bogucka and Grabowska (2018), discuss research-related skills, which they view as a component of innovative-creative competences (Pol. *kompetencje innowacyjno-kreatywne*). In the process of developing innovative-creative competences, teachers practice the following skills: reflection upon and critical approach to one's teaching practices as well as readiness to apply innovative solutions in educational settings. A necessity to develop skills of a reflective practitioner is also underlined in the guidelines suggested by European Commission (2012) in the document *Supporting the Teaching Professions for Better Learning Outcomes.* In the list of competences required for effective teaching in the 21st century, "reflective, metacognitive, interpersonal skills for learning individually and in professional communities" (European Commission, 2012, pp. 25, 26) are underlined.

1.3. Reflection skills

What are reflection skills in teaching? For Little and Perclová (2000), who discuss reflection in reference to learners and the process of learning a FL, reflection means "thinking about something in a conscious and focussed way" (Little & Perclová, 2000, p. 45). But as the scholars (2000) explain: "This deceptively simple definition covers a complex range of mental behaviour" (p. 45). Also in relation to teachers and teaching, reflective capacity appears to be a multifaceted notion. Schön (1983) distinguishes "reflection-on-action" and "reflection-in-action". The first type happens some time after the action reflected on took place; the latter one occurred while the action was happening. Hatton and Smith (1995) observed the relationship between the type of writing and the type of reflection student teachers demonstrated in their texts. They identified three types of reflection: descriptive reflection, dialogic reflection and critical reflection. Descriptive reflection involves analyzing situations from the teacher's personal perspective and contains some sort of reflection. In dialogic reflection, one explores possible reasons and solutions that may be applied in a given situation. Critical reflection incorporates taking various factors into consideration and drawing reasonable conclusions. The scholars distinguished one more type of writing – descriptive writing – in which no reflection is involved but only description of a given situation. It is important to emphasise that the concept of reflection is "extremely difficult to render operational in questionnaires and other research instruments" (Hatton & Smith, 1995, p. 38). Therefore, it seems challenging for researchers to design studies in such a way that the data present the evidence of reflection.

1.4. The importance of the written form of reflection

A number of educators, e.g. Little and Perclová (2000), Czajka (2014) and Stańczyk (2010), emphasise the advantages of reflection written down. Little and Perclová (2000, p. 46) explain: "Writing things down is … essential, partly because it provides a focus for discussion, and partly because it helps to clarify what we think and provides a stimulus for further reflection." Clark (1997, cited in Little & Perclová, 2000, p. 46) adds that although "[t]here is a natural tendency to suppose that we first have thoughts and then write them down ... some kinds of thinking become possible only when we write." The importance of the written form of reflection is also stressed by Czajka (2014), who claims that involving trainees in writing down their reflections prepares them for further discussions in class. An interesting conclusion drawn on the basis of an action research study was presented by Stańczyk (2010), who believes that "writing reconstructs awareness". In her study, student teachers were engaged in writing on-line blogs about their teaching practice and responding to other students' comments. In the author's opinion, the opportunity to express reflections in writing and exchange opinions with other trainees resulted in the enhancement of the students' metacognition skills.

2. The study: Exploring student teachers' reflection skills

In this section, the analysis of journals written by post-graduate students during their teaching practice is presented. The following will be discussed: the context of the study, a specificity of the journal task, the analysis of the texts produced by the trainees, the results and the interpretation of the findings in reference to the students' reflection skills. It is important to explain that this analysis is part of a more extensive project of an exploratory nature, whose aims are to explore techniques that lend themselves to enhancing student teachers' research skills and to find effective ways to evaluate student teachers' research skills.

2.1. The context of the study and the methodology applied

Twenty three trainees, the post-graduate students of English Philology at the Jagiellonian University in Poland, participated in this study. They had completed obligatory teacher training classes and were taking part in a continuous practicum organized in secondary schools. The students were asked to keep the teaching journal over a period of two months. One of the tasks (the one analysed in the present paper) asked the trainers to reflect on their students and identify the most serious problem that their learners experienced in their learning. Additionally, the trainees were required to design and conduct a remedial programme, and finally to evaluate its effectiveness at three different points in time. The students were also instructed to make references to professional literature that they found relevant to the topic of their journal.

Two research questions informed the study: 1/ Can a journal task stimulate students' reflection skills?; 2/ If so, what types of reflection skills can be identified in the texts produced by the students?

For the purpose of the study, reflection was defined as "deliberate thinking about action with a view to its improvement" (Hatton & Smith, 1995, p. 40). In the context of the study, reflection or reflection skills (the terms are used in the present study interchangeably) were viewed as thinking about one's teaching situations within one's practicum stimulated by the journal task. The term "narration'' is used to refer to the way the students developed their arguments in the journal.

The analysis of the students' texts involved reading and rereading the texts against a set of criteria, which were formed as the following questions:

A. What problems did the trainees write about? How did they write about these problems?;
B. Did the students refer to the professional literature? If so, what role did this literature play in their narration?;

C. Did the trainees report on the remedial program at three different points in their teaching? What role did this report play in their narration?

2.2. The results

All the students completed the journal task. The average length of the text was 800 words; however, there were texts that were quite long (2000 words) and texts that were rather short (500 words). The analysis conducted to answer question A led to the identification of three types of narration: Teacher-focussed, Learner-focussed (the names were coined by the author of the present paper) and one that focusses on external factors (see Figure 1).

It was very surprising to find that 14 trainees (the authors of Teacher-focussed texts) discussed the factors that made their teaching difficult, instead of focussing directly on their students' problems. The most common issues that this group of trainees wrote about were problems connected with keeping discipline and teaching speaking. Only 5 trainees (the authors of Learner-focussed texts) identified their students' problems, discussed them and only then did they relate them to their teaching. The following issues were discussed by this group: being too shy to participate in the lesson, lack of motivation and concentration in class, stress and anxiety that discourage students from speaking English. It is important to note that in this analysis the learner's problem and the teacher's problem could refer to the same issue, e.g. learners not willing to speak English in class. The difference between the narration of Teacher-focussed texts and that of Learner-focussed texts lay in the perspective from which a given issue was discussed – the first group wrote from the perspective of the teacher ("I find this aspect of teaching difficult") and the second group from the perspective of the

learner ("I think or I know it from some data that my learners find this aspect of learning difficult").

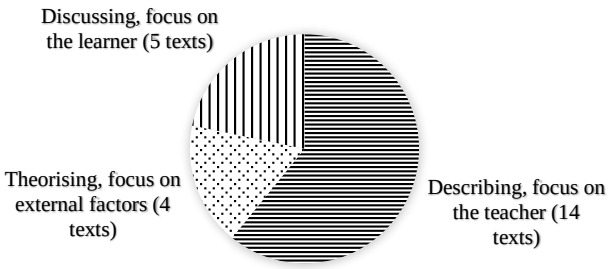

Figure 1. Different ways of writing identified in the trainees' journals. Source: own study.

There was one more group of trainees – 4 students – who decided to write about the manner in which their teaching practice was organised. The trainees complained about too numerous classes, poor equipment at school and no possibility to prepare teaching materials.

The further stages of the analysis conducted to answer questions B and C revealed some other characterictics of the texts. Three different ways the trainees adopted to complete the journal tasks were identified, named by the author of the study as Theorizing, Describing and Reflecting (see Figure 1). In "Theorizing", the trainees identified problems in their teaching and found solutions. However, in their texts they very rarely referred to their teaching. Most of the report involved discussing the literature the students found useful in reference to their problems. There was no report of the progress in developing ways of dealing with the problems. In "Describing", the trainees identified problems in their teaching and found solutions. They referred to their lessons and described them in detail. There was no report of the progress in developing ways of dealing with the problems. Not all the student teachers in this group referred to professional literature. Those who did drew on literature in order to describe the materials or techniques they applied in their teaching. In "Discussing", the trainees identified problems in their students' learning and related them to their teaching; they also found solutions to the problems. There was a clear report of identifying problems, finding and applying solutions, as well as reflecting on the effectiveness of the remedies at different points in the teaching practice. The trainees referred to professional literature when writing about the remedial program they had introduced in their teaching. "Theorizing" was found in 4 (18%) texts produced by the students who in their journals focussed on external factors, such as classroom equipment (as specified at the earlier stage of the analysis). "Describing" was identified in 14 (60%) texts written by the students who adopted a teacher-focussed perspective; "Discussing" was found in 5 (22%) texts produced by the students

who in the previous analysis were named "learner-focussed". See Figure 1 for the summary of all the results.

2.3. Conclusions

In reference to research question no 1, which concerns the potential of the journal task to stimulate students' reflection skills, the results indicate that the task was an effective technique in encouraging trainees to think about their teaching situations. The data elicited from the students during their practicum are rich and demonstrate evidence of the students' reflection skills (in the study defined as deliberate thinking about one's teaching).

As regards research question no 2, which concerns types of reflection skills elicited by the task, the data obtained imply that the journal proved to be a sensitive elicitation instrument which allowed to discriminate between the students. The findings indicate that the group was not homogenous in terms of their approach to the requirements of the task and their skills to reflect on their lessons. What could be the main reason of the students completing the task in this way? It is possible that the trainees, who belonged to the same group and attended the same teacher training courses, could have been at different stages of reflection skills development. According to Woods (1996), in their professional development teachers go through a series of stages. At the stage of technical rationality, teachers tend to pay more attention to teaching techniques (thereby to their role as a teacher in the classroom) than to their learners. It is at the stage of critical reflection when teachers start to develop their own personal theory, which involves developing "deeper" reflection and self-evaluation. These abilities enable teachers to pay attention to the role of the learner and to look at their own style of teaching in a more critical way. The results of the present study seem to indicate that most of the trainees (60%) who participated in the research were at the stage of technical rationality, where, as Woods (1996) explains, teachers are more concerned with mastering basic teaching techniques than thinking about their students' learning.

The author of the study believes that these results should not be treated as something negative. All the types of reflection identified in the present study are necessary components in one's development as a teacher trainee. Drawing on professional literature and discussing it (theorizing) can be a valuable task as it enables a novice teacher to learn from the masters of the discipline by relating their theories to his/her own teaching situation. Describing one's teaching is also important as it helps the trainee to concentrate on his/her job, i.e. what he/she does in the classroom. A natural step further is a more elaborate reflection of the trainee on him/herself and also his/her learners; at this stage, the student realizes that he/she is not alone in the classroom – there are other participants who he/she should take into consideration. All the types of reflection seem important in socializing novice teachers into new roles they will play in their future professional communities.

The paper presents the findings of the study that is still in progress. The next stage of the analysis will have a closer look at how the trainees drew on professional literature and what role these sources played in their narration. This will allow the author of the study to gain more insight into the nature of reflection demonstrated in the student teachers' journal tasks.

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A decade of TeachMeet: an Interpretive Phenomenological Analysis of participants' tales of impact

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Abstract

TeachMeet is an emerging informal professional development event organised by teachers for teachers, commonly described as an unconference. It is a volunteer-led global phenomenon without any established hierarchy. To celebrate the first ten years of TeachMeet, the founders announced an open call for participants to submit, online, their stories of impact.

The resulting submissions were subjected to an Interpretive Phenomenological Analysis (IPA), capitalizing on the 'double hermeneutic' lens of the experience of researchers whose positionality is that of informed insiders.

Findings revealed the categories in which the lived experiences reported by participants reflected the impacts of TeachMeet: ranging from appreciative description of the event they attended to reflective confessions of life-enhancing transformation in their personal and professional lives, their classrooms and the wider teaching community.

These finding are examined in the light of how they align with several models of evaluation of teacher learning (Guskey 1998, Kennedy 2005, Kirkpatrick 2006, Desimone 2011, Wenger, Trayner and de Laat 2011), and what they indicate about where evolving TeachMeet communities and networks may be situated in an informal learning landscape.

Keywords: *TeachMeet, IPA, impact, teacher learning, community, network.*

1. Introduction

TeachMeet, founded in 2006, is an unconference form of professional learning event, characterised from the start as "for teachers to share good practice, practical innovations and personal insights in teaching" (Wikipedia, nd); it has been aptly dubbed "guerrilla CPD" (Bennett, 2012). Events adopt the focused informality of Open Space Technology (Owen, 1993). Co-founder McIntosh (2009) speaks of the importance of it being free on two fronts – free speech, and free of cost. Social media tools are harnessed for organisational and promotional purposes, and utilised during the events to connect with those who cannot attend in person. Teachers' online discourse, as collated by Amond et al. (2018, p. 241-242), reports significant numbers who consider TeachMeet to be a community of practice (CoP), a personal learning network (PLN), and a part of their continuing professional development (CPD).

In 2016, in order to celebrate reaching the tenth year of TeachMeet, participants were invited to partake in an open online survey in response to the single question "How has TeachMeet made an impact in your life?". This paper reports on an IPA analysis of these responses and provides commentary on the significance of the findings.

2. Method

2.1. What is Interpretive Phenomenological Analysis (IPA)?

IPA is a qualitative sensemaking research method which seeks to interpret the lived experience of individuals. It is built on three pillars: phenomenology, hermeneutics, and idiography. IPA aims at "identifying the essential components of a phenomenon" (Pietkiewicz et al., 2012, p. 361), in an interpretive analysis which "retains the voice of the participants" (p. 369). According to Noon (2018, p. 75), "the two complementary commitments of IPA are 'giving voice' and 'making sense'". Smith et al. characterise the process as the "unfurling of perspectives and meanings" (2012, p. 21).

2.2. Why IPA was chosen for this analysis

A researcher's positionality as an insider is acknowledged as important in IPA. Oxley (2016, p. 56) states that the "pre-existing knowledge and preconceptions of the researcher are always brought to the encounter with the phenomenon". This feeds into a double hermeneutic cycle, the value of which according to Smith et al. (2012, p. 21), is that "the phenomenon is hidden within the participants' accounts until interpreted by the researcher's own experience". In this case, the research team is experienced in the world of TeachMeet. Noon (2018, p. 80) suggests IPA to be "a particularly useful methodology for researching those whose voices may otherwise go unheard"; TeachMeet is a good fit for this, being an informal event which

has to date been rarely subject to academic scrutiny. The choice of IPA for analysis of these short stories is suggested in Biggerstaff et al., (2008, p. 9) who advise that "data need not be confined to interviews … other useful sources are … personal accounts … documenting their thoughts and experiences … returns from questionnaires".

2.3. How this IPA was carried out

Survey respondents were asked one open question: "How did TeachMeet make an impact in your world?". This open question aligns with the emphasis within IPA on seeking the lived experience of the individual. The survey was open to any TeachMeet participant who could access it online. A purposive cross-section was not sought, but when we examined the random sample that replied by mapping details onto both Rogers' Theory of Diffusion of Innovations (1962) and the Wenger Trayner de Laat Levels of Participation Theory (2011), a fair cross-section in respect of length and breadth of TeachMeet experience was evident from the responses. The replies (n. = 60) were anonymised and subjected to an IPA cycle which involved iterative reading of individual descriptions, taking note of content, language and concepts, then clustering and reflecting on emerging themes in order to write a commentary.

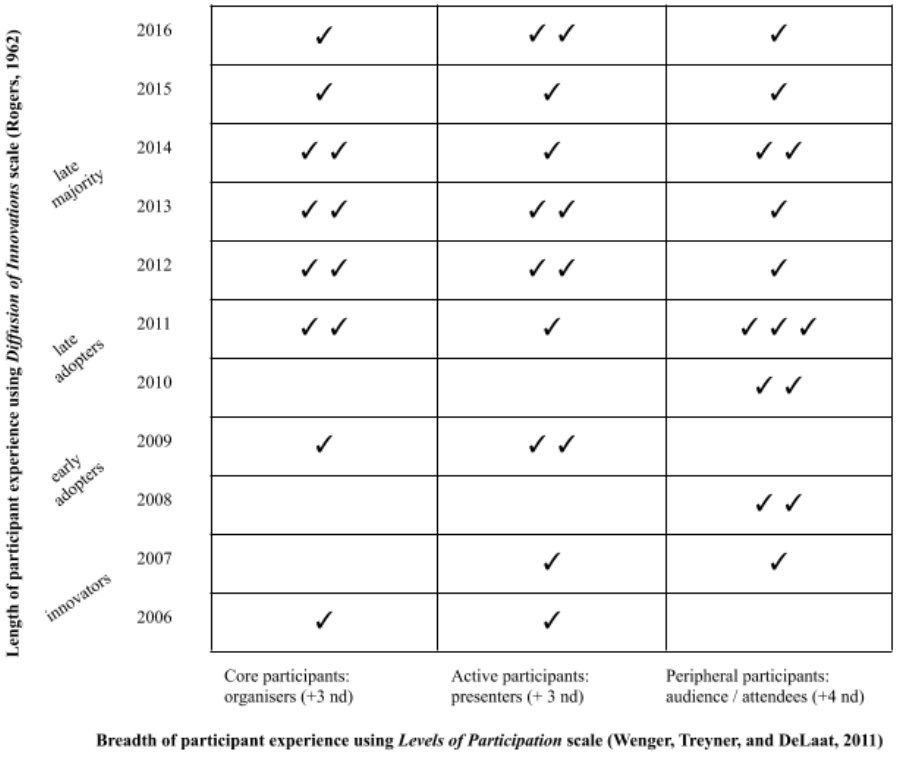

Figure 1. Temporal and experiential profile of survey respondents.

3. Findings

3.1. Overview of the superordinate themes in the collective narrative

All of the respondents were educators, with most being currently practicing teachers. Most replies were a paragraph in length, a few were a single sentence, some told longer stories. The question posed asked about "impact in your world". The responses suggested there are ever-widening layers in the worlds of the respondents – their personal world, their classroom world, their professional world and the world of their teaching community.

During analysis, four superordinate categories of comments emerged:

descriptive comments about the event itself;
descriptive comments about the others encountered there;
reflective and narrative comments about the respondent themselves;
reflective and narrative comments about the classroom and the teaching community.

Each superordinate category forks further into subordinate categories; typical quotes for each category are summarised in Table 1.

3.2. Observations about the TeachMeet event

These fell into three sub-categories – descriptions of the *atmosphere* in the venue, the actions of *others* that were witnessed, and comments on the event *organisation*. The description of atmosphere was typically of a convivial, open, welcoming space, with repeated instances of 'fun' and 'joy', 'laughter' and 'camaraderie'. The action was that of a packed space, full of conversation, short sharp presentations (2 mins, 7 mins); lots of mention of Twitter being used; some mentioned being engaged in debate, others mentioned 'lurking'; the overall feel was one of peers sharing their expertise; it was 'teachers talking about teaching'. Remarks about organisation referenced the house rules common to many TeachMeets (a soft toy thrown as a 'time's up' signal, a 'random name picker', 'drinks and nibbles'); many commented on the relaxed and non-hierarchical or 'DIY' nature of the organisation, the fact that is was 'democratic' and the 'opposite to conference guru talks'.

Table 1. "How did TeachMeet make an impact in your world?" Categories emergent from an IPA of n=60 responses.

Superordinate categories	the **event:** comments on the TeachMeet event itself	the **others:** comments on the presenters and audience	the **self:** comments on personal reactions	the **community:** comments on what happened afterwards
Subordinate categories	about **atmosphere, actions, organisation**	about **sharing ideas inspiration & motivation, participants**	about impacts that were **relational, emotional, practical, transformational**	about transformation of **personal life, classroom, career, community / network**
Typical comments	on atmosphere *"fun… joy… open laughter, sharing"* on action *"connecting in real life… short (7min, 2 min)...everyone equal… twitter… debate… eclectic… the 'in-between' conversations"* on organisation *"opposite of conference… democratic… without hierarchy… relaxed atmosphere… drinks & nibbles"*	on sharing *"real teachers sharing real experiences… window into the classroom of actively practicing teachers"* on inspiration and motivation *"teachers lighting up when they talk about what they do… inspiring… enthusiasm"* on participants *"passionate… infectious passion… authentic… expressing beliefs… positive"*	relational *"chance to network… meet friends… exchanging ideas… (newcomers) felt welcomed"* emotional *"inspiration… enthused… revitalised… excited to get back to classroom next day"* practical *"most effective and cheapest CPD… testing ideas in the in-between debates"* transformational *"showed me the power of grassroots… the chance to share is so powerful"*	on personal life *"gave confidence to be daring… organised more teachmeets… went to more teachmeets… life-changing… left feeling different"* on classroom *"left excited to share with my students… shaped my teaching… impacted practice"* on career *"made me research a masters… did PhD... changed my professional life"* on community *"connections… new network… building a community… doing it ourselves … on our own"*

3.3. Observations about others encountered at TeachMeet

When describing the others encountered and the effect they had on the respondents, three sub-categories of comments emerged – the *sharing of practical ideas, inspiration and motivation,* and *descriptors of the presenters*. The sharing of practical ideas was mentioned frequently – practical ideas from other people's classrooms, 'real experiences', 'innovative ideas' modelled by others, and a peek through 'a window into their classroom' were appreciated. The infectious nature of inspiring and motivating presenters was reported many times, their enthusiasm and the unselfish nature of 'teachers lighting up from inside when they talk about what they do'. A remarkable number of responses included the names of the teachers whose presentations made an impact. The stand-out descriptors of others repeated many times in the reports of TeachMeet presenters were that of 'generous', 'passionate', 'positive', 'authentic', 'honest' and 'truly excellent educator[s]'.

3.4. Observations about the self on attending TeachMeet

Reports about the effect of attending the TeachMeet address four effects on the self - *relational, emotional, practical,* and *transformational.* In relational terms, respondents expressed appreciation for meeting others, feeling welcomed, and making friends. On an emotional level, there was much talk of being 'totally inspired', enthused, re-vitalised, excited, 'having a wonderful experience' and 'walking away full of the joys of what we do'. The practical effects listed were about seeing new resources, and having the chance to try them out, 'testing half-baked ideas in the in-between debate'. One comment echoes that often seen posted online after a TeachMeet, calling it 'the most effective and cheapest CPD I have experienced'. Some of the reports were of effects of a potentially transformational nature, of renewal of passion, happiness, and about feelings of empowerment: 'the chance to share what you know is so powerful', 'the power of grassroots'.

3.5. Observations about wider impact on the teaching community

Many of those reporting impacts and outcomes after experiencing TeachMeet detailed some lasting transformational effects in one or more of four areas of their lives – their *personal life*, their *classroom life*, their teaching *career*, and their teaching *community*. Writing of transformational impacts on themselves as a teacher and as a person after encountering TeachMeet, many spoke in terms of being reinvigorated as a teacher, 'changed my view on education', 'a big effect on my learning and my life', 'left the TeachMeet feeling like a different person'. The words 'life changing' appeared several times. The friendships developed were mentioned by many. The most striking change was the number of participants who reported that they went on to attend, present at, and organise TeachMeets. Transformational impacts in the classroom were noted by participants who said they were returning to their classroom with new ideas and a new passion, 'a new zest for teaching', some feeling they had a 'license to try new things', 'explore, be inventive and joyful', 'to

develop the ideas of others'. All of these developments were reported with reflective honesty … 'it impacted my practice', 'I may be a better person and more importantly a better educator'. Transformational impact on the career, although not as widely reported as impact on the self, was in some cases quite dramatic – many described a personal and professional growth that lead them to further study, 'I signed up for a Masters', 'it made me research', 'I co-wrote a paper', 'I now lecture at initial teacher training'. Two ensuing PhD enrolments were mentioned. Some saw it as an 'opportunity to lead', for another it 'helped me at an interview', 'a night that changed my professional life'. Transformational impacts on the wider teaching community is inferred in the many reports of highly appreciated and ongoing new 'connections' 'collaborations', 'networks', 'PLN', 'increased trust and respect', 'building a community'. There was repeated thanking of named and unnamed others. One comment resonates with something that is often posted online by those who attend an unconference for the first time: 'it transformed my attitude to what CPD could be in the hands of teachers'.

4. Discussion of findings

Table 1 represents an interpretive reduction and summary of the reports of impact of TeachMeet in the previous years as experienced by 60 respondents from across the globe. Themes ranged from descriptive commentaries on the event and the people involved to reflective, and in many cases, confessional tales of transformation in the personal and professional spheres of their lives.

This progression reflects the stepped layers of success present in many of the classic models and theories of evaluative CPD such as Desimone's *Path Model* (2011), Guskey's *Five Levels* model (1998), the Kirkpatrick *Four Levels* model (2006), the Wenger, Trayner and de Laat *Value Creation* model (2001). In all of these models modest success is represented by a positive reaction to the event itself, but the highest level of success is represented by a change across the system. Examined in the light of Kennedy's Five Tool framework (2005, p. 247), many of the listed characteristics of success can be detected - "development of the collective as well as the individual, increase in professional autonomy, facilitation of transformation" - rather than mere transmission. Although the sample reflects only educators involved in the TeachMeet community, it suggests that TeachMeet can be benchmarked as a format for informal professional learning.

The articulated appreciation of the networks and communities formed as a result of TeachMeet suggest a cohort seeking the connectivity of a *personal learning network* as espoused by Siemens (2006) or a *community of practice* in which they can move from "legitimate peripheral participation" (Lave and Wenger, 1991, p. 27)) to developing capacity and agency by what one respondent called 'doing it for ourselves'.

5. Conclusion

The interpretive phenomenological analysis of the responses from TeachMeet participants to a call to detail it's impact on 'their world' identified four categories of impact: relating to the event itself; the others encountered there; the person themselves; and the wider classroom and teaching community. Furthermore, this analysis presents evidence, albeit mainly localized and on an individual basis, of the potential and actual value of TeachMeet as an informal peer-organised professional learning activity. We suggest that, as TeachMeet evolves and matures, further data should be generated from a wider and more purposeful sample, using more probing research questions and seeking deeper insights from experienced participants. This would benefit both the TeachMeet community, and the broader professional learning world.

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Internal branding at university: Do tenure and job security matter?

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Abstract

Universities, as educational service providers, must pay attention to their employees who are pivotal in delivering and communicating brand promise and service quality to the stakeholders. While branding initiatives most frequently focus on external stakeholders, internal branding efforts establish systems/processes and consequent employees' behaviour that are consistent with external branding efforts. With a sample of 753 faculty members and researchers from a Spanish public University, the study aims to establish if employee tenure and job security have a significant relationship with employees' brand commitment and employees' brand supporting behaviour. An analysis of variance was carried out for testing the hypothesis. Differences were found according to tenure in employees' brand commitment while job security did not impact significantly on employees' brand commitment. In addition, a positive and significant relationship were found between employees' brand supporting behaviour and tenure, but not for job security. For business practitioners, this research state that it is essential for service companies, such as universities, to use differing approaches to employees according to their organisational tenure as an important managerial implication.

Keywords: *Internal Branding; Job security; Employee tenure; Employee-brand supporting behaviour; brand commitment.*

1. Introduction

Universities now operate in an environment characterized by high competition, the lack of financing and declining demand for students (Assad *et al*., 2013; Yu *et al*., 2018). As a result, many institutions of higher education (HEIs) are gradually adopting market-oriented strategies to differentiate themselves from competing universities. In this context, the brand strategy is a fundamental tool to gain competitive position and differentiate (Hemsley-Brown & Lowrie, 2010).

Heretofore, previous studies have been more focused on the external aspects of the brand and the perspective of students (Stephenson & Yerger, 2014), ignoring the importance of managing the brand internally. While branding initiatives most frequently focus on external stakeholders, internal marketing, employee branding and/or internal branding efforts establish systems/processes and consequent employees' behaviour that are consistent with external branding efforts (Aurand *et al*., 2005).

Employees who are in consensus with an organisation's brand are more likely to act consistently in ways supporting how the organisation hopes that external constituencies perceive it and its products/services (Aurand *et al.*, 2005). While employees are pivotal in delivering and communicating brand promise and service quality to external stakeholders, the relevance for HEIs to engage their employees in the brand building process is acknowledged (Judson *et al*., 2009).

Nevertheless, organisations should pay attention to the differences between different demographic and psychographic groups of employees (Allen & Meyer, 1990; Yu *et al.*, 2018). Tsui *et al*. (1992) found that employees' psychological commitment and behaviours might vary because of demographic heterogeneity. Moreover, other studies have identified those variables that might influence organisational and brand identification and commitment (Yu *et al*., 2018). These studies have evaluated personal variables (e.g. age and gender) and situational variables (e.g. tenure and function).

However, to date, there have been few analyses of the relationship between these situational variables (tenure and function) and different dimensions of internal branding like brand commitment and employee brand supporting behaviour. This study aims to examine differences in brand commitment and employee brand supportive behaviour, according to tenure and job security.

2. Theoretical background

2.1. Brand commitment

The concept of employee commitment is central at an organisational strategy. Typically, is defined as the relative strength of an individual's identification with the involvement in a particular organisation, characterised by strong acceptance of and a belief in an organisation and a strong desire to maintain membership of the organisation (Mowday *et al*., 1982).

The conceptualization of brand commitment employed in this research derives from Allen and Meyer's (1990) definition of organisational commitment and is described as a psychological state that exemplifies an employee's relationship with the brand. Although Allen and Meyer (1990) acknowledge three distinct types of commitment (i.e., affective, normative, and continuance), we focus only on affective commitment, which is defined as employees' emotional attachment to the brand. Previous studies have already demonstrated the importance of the commitment in internal branding process (Xiong & King, 2015).

According to Van Nguyen *et al*. (2019), employees, the longer their organisational tenure, the more familiar they will become with their role and organisational culture. Therefore, accumulating years of tenure could affect their ability to seek out and absorb the brand awareness provided by the organization's internal brand campaigns.

In this study, the organisational tenure concept refers to the number of years an individual has spent working for a respective organisation (Oshagbemi, 2000). Strong identification is developed over the long term, when individuals have passed an extended period working in an organisation and have embedded the organisation's objectives, and key attributes into their self-concepts (Hammed *et al*., 2013). Riketta (2005) found using a meta-analysis study that tenure is significantly related to organisational identification.

Another variable considered at this study is job security. Probst (2003) defined this concept as the perceived stability and continuance of one's job as one knows it'. It represents an employee's perceptions of whether he or she can continue to maintain employment and whether the desired characteristics of his or her job are stable.

Employees who experience job insecurity may find it difficult to predict what will happen in the future and to decide on the appropriate reaction within the organisation. In other words, they are confronted with the uncertainty of how to behave and what to expect in their work environment, and have a strong motivation to regain the social order originally expected in the organisation (Loi *et al*., 2014). Therefore, the following hypotheses are proposed:

H1. Tenure has a positive impact on employees' brand commitment.

H2. Job security has a positive impact on employees' brand commitment.

2.2. Employees' brand supporting behaviour

Morhart *et a*l. (2009) define employee-brand building behaviour as employees' contribution (both on and off the job) to an organisation's customer-oriented branding efforts. According to Judson *et al*. (2006), employee brand support can be defined as the actions of employees that deliver the brand's values to stakeholders. From a marketing and communication approach, employees tend to support their organisation's brand by means of understanding the brand an incorporating the brand values in their day-to-day operation.

Managers can enhance internal branding mechanisms by taking into consideration tenure and job security, as factors influencing in the internal branding (Dechawatanapaisal, 2019). Therefore, institutions need to plan those activities based on the organisation's brand values in order to foster brand-supportive behaviour among employees (Aurand *et al*., 2005).

In accordance with the literature on the theory of social identity, Picolli *et al*. (2017) stated that job insecurity is related to reduced levels of identification with the organisation and, consequently, to low tasks performance. By creating a sense of belonging and providing a positive basis for the social identity of employees, managers can increase involvement and attachment to the organisation. Therefore, the following hypotheses are proposed:

H3. Tenure has a positive impact on employees' brand supporting behaviour.

H4. Job security has a positive impact on employees' brand supporting behaviour.

3. Method and results

3.1. Data collection and instrument

The situation of Spanish public universities from 2012 onwards began a decline in the relative participation of permanent teaching staff, which lost 8,288 staff in the period 2008 to 2017, representing 16.2% of the total initial staff (CRUE, 2019). In this study, a sample of 753 faculty members and researchers from a Spanish public University participated in this study. An email was sent to all university staff (i.e., 2,431 according to the institutional statistics) inviting them to participate in an online survey, obtaining a response rate of 31%. Most respondents were aged between 35 and 54 years (65.6%). The tenure was ranged between 1 and 36 years, with an average of 14.93 years (SD = 8.86). The permanent academic staff comprised 55.2% of the sample.

In addition to the classification data (i.e., gender, age, tenure and staff position), the questionnaire also included: (1) four items to assess the employees' brand commitment, adapted from Yu *et al.* (2018); and (2) five items related to employees' brand supporting behaviour (Aurand *et al.*, 2005). All items were rated on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5).

3.2. Results

Statistical analyses were carried out using IBM SPSS Statistics 19.0 and R version 3.6.0. Before testing the hypotheses, the reliability of the scales was evaluated using ordinal alpha (Oα), which is a measurement of the internal consistency of the items in the instrument. The Oα was 0.91 for employees' brand commitment scale and 0.84 for the employees' brand supporting behaviour scale. The scores for these two constructs were, therefore, calculated as the average of these four and five items, respectively, for the subsequent analyses.

With regard to the hypotheses testing, the differences in employees' brand commitment (H1 and H2) and brand supporting behaviour (H3 and H4) according to tenure and job security were studied by: (1) the one-way analysis of variance (ANOVA) procedure when the homogeneous variance assumption was correct; or (2) Welch robust test of equality of means when the variances were heterogeneous.

Regarding the employees' brand commitment (Table 1), differences were found according to tenure. Specifically, those employees who had been working at this university between 16 and 20 years had a higher brand commitment than those who had between 6 and 10 years of experience. The Spearman correlation coefficient (r_s) between brand commitment and tenure was 0.073 (p = 0.044). Therefore, H1 was supported. H2 was rejected because job security did not impact significantly on employees' brand commitment.

Table 1. Differences in employees' brand commitment according to tenure and job security.

(Hypothesis) Factor	**N**	**M**	**SD**	**Levene test**		**ANOVA/Welch test**		**Games Howell Test (p < 0.05)**
				F	***p***	***F***	***p***	
(H1) Tenure				2.482	0.030	2.481a	0.032	16-20 > 6-10
1-5 years	130	4.38	0.67					
6-10 years	144	4.29	0.72					
11-15 years	119	4.33	0.75					
16-20 years	166	4.51	0.56					
21-25 years	85	4.43	0.71					
> 25 years	109	4.47	0.63					
(H2) Job security				0.106	0.744	1.737	0.188	
Permanent	337	4.37	0.65					
Non-permanent	416	4.43	0.69					

Note: a Asymptotically F distributed.

The results obtained in relation to H3 showed a positive and significant relationship between employees' brand supporting behaviour and tenure (r_s = 0.081, p = 0.027). This provided support for H3, although the ANOVA (performed with tenure in five-year intervals) did not reveal statistically significant differences in employees' brand supporting behaviours (Table 2). H4 was, however, rejected.

Table 2. Differences in employees' brand supporting behaviour according to tenure and job security.

(Hypothesis) Factor	N	M	SD	Levene test		ANOVA/Welch test		Games Howell Test (p < 0.05)
				F	p	F	p	
(H3) Tenure				0.715	0.612	1.666	0.141	
1-5 years	130	3,47	0,65					
6-10 years	144	3,40	0,73					
11-15 years	119	3,46	0,71					
16-20 years	166	3,62	0,71					
21-25 years	85	3,47	0,82					
> 25 years	109	3,53	0,75					
(H4) Job security				3.516	0.061	0.672	0.413	
Permanent	337	3.47	0.67					
Non-permanent	416	3.52	0.77					

Finally, two regression analyses, in which sex and age were also included as explanatory variables, were conducted to test the results' robustness. In the case of employees' brand commitment, only a significant and negative effect was obtained for the tenure interval of 6 to 10 years (β = -0.238, t = -2.093, p = 0.037). In the case of employees' brand supporting behaviour, none of the parameters associated with tenure and job security was significant.

4. Conclusions

The study of internal branding in universities and its effects from a marketing perspective in combination with its relevant mechanisms is crucial in order to fully understanding the way in which a brand can resonate among all its stakeholders (Sujchaphong *et al.*, 2015).

The aim of this study is to examine the relationship between employee tenure, job security and internal brand consequences such as brand commitment and brand supportive behaviour. Findings of the study indicate that tenure has a positive influence on brand

commitment and brand supportive behaviour. On the other hand, this research could not support the hypothesized positive effect of job security on brand commitment and brand supporting behaviour.

As an important managerial implication for business practitioners, our research state that it is essential for service companies, such as universities, to use differing approaches to employees according to their organisational tenure. That is in line with Van Nguyen *et al.* (2019) who stated that the effectiveness of internal branding campaigns and brand leadership might be affected by the employee tenure.

Future studies may enrich existing knowledge of employee internal branding via a cross-faculty and/or cross-discipline research. Moreover, further studies could investigate how such faculty brands co-exist and interact with the broader university brand.

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"Because, as a teacher, giving feedback and assessment is actually really difficult": using self- and peer-assessment to develop Higher Education teachers' skills in assessment and feedback

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Abstract

This paper explores the use of self- and peer-assessment to develop skills in assessment and feedback in a postgraduate programme in teaching and learning, targeted at Higher Education practitioners. It explores the rationale underpinning a focus on the development of self- and peer-assessment skills, particularly in the context of the challenges experienced by early career teachers in making evaluative judgments and providing feedback to support student learning. Examples from practice are included to illustrate the activities used to develop practitioners' ability to evaluate their own learning and that of their peers against given criteria, based on a model for incremental skill development proposed by the authors. In particular, the importance of scaffolding and support, in the form of guidance, templates and rubrics, is explored, in order to build confidence and competence in assessment and both giving and receiving feedback. Focus group feedback confirms that such an incremental approach is welcomed and valued, along with a programmatic approach to the development of these skills, whereby all modules across the programme provide opportunities for the enhancement of the skills associated with assessment and feedback for academic practice.

Keywords: *Higher Education; academic practice; assessment; feedback; self assessment; peer assessment.*

1. Introduction

This study focuses on perceptions and the experience of using peer- and self-assessment to develop skills and competencies in assessment and giving and receiving feedback in a postgraduate programme for Higher Education teachers. As part of the development of a range of skills and competences needed for effective academic practice, the programme team designed a range of formative self- and peer-assessment and feedback activities which were interwoven through the programme teaching and learning strategy. 'Assessment', for the purposes of this paper, is broadly defined to encompass formative assessment and feedback and to involve actions such as 'evaluation, grading, marking, rating, critiquing, reviewing etc.' (following Adachi, Tai, & Dawson, 2018, p. 454). Mindful of feedback as one of 'the most powerful influences on learning and achievement' (Hattie & Timperley, 2007, p. 81), we sought to develop an awareness among learners on the programme that they should view themselves and their peers as both producers and consumers of feedback (Andrade, 2010). As such, we sought to shift traditional student conceptions of the 'teacher as expert' – and consequently the sole source of feedback – to place greater emphasis on learners' agentic engagement with feedback processes (Winstone, Nash, Parker, & Rowntree, 2017).

2. Context

This study concerns an accredited professional development programme for Higher Education teachers delivered at a Higher Education Institution (HEI) in Ireland. It is an evening postgraduate programme – comprised of 60 ECTS credits at Level 9 – delivered over two semesters and is aimed at offering professional development opportunities for those teaching in a Higher Education context. The programme aims to develop student teachers' knowledge, skills and dispositions in a variety of key areas, including: theories of learning and teaching, educational assessment, strategies of teaching and learning, technology and learning, coaching, mentoring and philosophy of education, amongst others. Learners also undertake a supervised practicum/placement in the course of the programme, offering supported opportunities to apply and reflect on the use of a variety of teaching, learning and assessment strategies. Applicants to the programme tend to be early-career teachers in a HEI or those who work in administrative functions and are interested in developing their teaching abilities further. The theories and strategies discussed and applied in the forthcoming sections were introduced on modules throughout this one-year postgraduate programme.

3. Theory: using self- and peer-assessment to develop assessment skills

As Biggs and Tang (2011, p. 196) point out, 'assessment is the senior partner in learning and teaching. Get it wrong and the rest collapses'; consequently, it is critically important that a professional development programme for Higher Education teachers develops competences

and confidence in the skills associated with assessment and feedback to support student learning. While students on the programme undertook one 5 ECTS module entitled 'Educational Assessment' which introduced many of the theories and practices of assessment, the programme team recognized that skill development is maximized when a programmatic approach is adopted (Jessop & Tomas, 2017). Consequently, a key design feature of the programme was the inclusion of multiple opportunities for formative peer-assessment and feedback - as well as self-assessment - throughout all modules. From the perspective of both the learner and the programme team, embedding self- and peer-assessment across the programme allowed for additional formative assessment tasks to be introduced and for student learning to be maximized through their active involvement in the learning process (Gibbs & Jenkins, 1992; Ramsden, 1992). Higgs and McCarthy (2005, p. 37) point out that 'students do not internalize and cannot understand nor apply learning, unless they are actively involved in it'. Therefore, by embedding effective practices throughout the programme through the design of a programme-wide assessment strategy, we aimed to promote best practice to allow for a 'congruence between assessment practices and the kinds of learning a course aims to promote' (Boud, Cohen, & Sampson, 1999, p. 413).

The programme team recognized that assessing effectively along with giving and receiving feedback are not innate skills and that learners on the programme need multiple opportunities to practice these skills (Adachi, Hong-Meng Tai, & Dawson, 2018; Cassidy, 2006). Consequently, the programme adopted a scaffolded and incremental approach to developing skills, exemplified in this model (Egan and Costelloe, 2016):

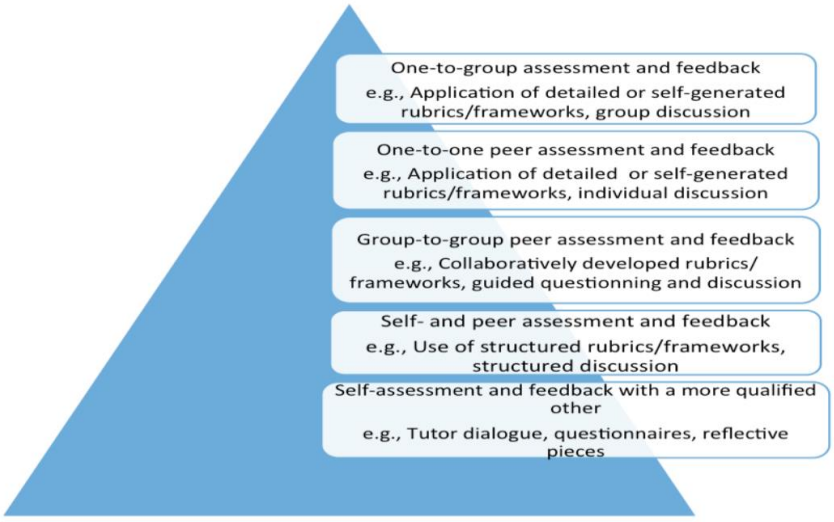

Figure 1: Theoretical Feedback Skills Development Model.

This model supports incremental skill development, particularly (i) the ability to assess others, (ii) the ability to give and receive feedback and (iii) the ability to make judgments. The model suggests that learners should firstly become comfortable engaging in self-assessment tasks, which should incorporate a form of feedback from a more competent other in other to validate their judgment of their own performance against given criteria. Mindful of the potential of self-assessment as a useful first step to support peer assessment (Carnell, 2016), the model proposes a movement towards combining self-assessment and peer-assessment to allow the learner to understand how a peer may perceive elements of assessment and feedback differently. Following this, group-to group peer assessment and feedback is encouraged, as this can enhance confidence in judgement and communication of feedback, supported by the relative "safety" or anonymity of making and communicating group judgments. From this point, one-to-one and one-to-group peer assessment and feedback can commence, as learners develop the confidence and competence to lead assessment tasks and provide constructive feedback.

4. Examples from Practice: self- and peer-assessment activities

The programme was designed to be highly experiential, therefore a range of practice opportunities were included to challenge learners' thinking and skills in different ways. For example, the "High 5" presentation was the first exercise which introduced learners to self-assessment. This exercise was designed to provide learners with the opportunity to appraise their own five-minute delivery of a topic relevant to them (placing them as experts) to their peers. This exercise challenges learners in a number of ways including; selecting a relevant aspect of a topic, sticking to time constraints, delivering a clear message and engaging their audience – all important skills for a Higher Education teacher. Although it might be possible to identify strict assessment criteria for this exercise, given the length of the presentation and the variation of presentation topics, it is more useful to ask the participant to respond to key questions as a formative self-assessment activity. To begin with, a broad question such as "how did you feel that went?" is asked and then followed by regularly interjecting with "what are you basing your view on"? This approach enables the learner to reflect on aspects of the presentation that hold personal meaning. For example, they may describe the sense of control they felt over their delivery or the level of engagement they reached with their audience or their ability to speak clearly or manage time. This free-flow of conversation supports personal reflection on performance, while understanding the basis of their views helps to focus the learner into the assessment space. This leads to a conversation about data evaluation and subjective influences in assessment. This exercise also creates the space for learners to identify personal developmental areas in relation to both task performance and self-assessment.

Another approach used on the programme was the "Gist Exercise", which was designed as a means of supporting skills associated with peer-assessment and feedback. This is a group exercise which begins with one member speaking uninterruptedly for two minutes on a preselected topic. Once the two minutes are up, the next member uses his/her uninterrupted two minutes to add to the discussion. The exercise ends when all members have had their two minutes to contribute to the topic. An important caveat to highlight is that members should focus on providing novel or new information that adds to the discussion rather than summarizing or repeating previously stated content. This exercise supports both self- and peer-assessment, and in particular, it can enable quality feedback conversations which are based on dialogue, questioning, and a focus on developmental points. In providing space for group members to voice their perspectives and experience, an opportunity can emerge for deeper knowledge sharing and understanding, which helps to develop skills in crafting rubrics or feedback structures that focus on criteria in a clear and unambiguous way.

While the above practice exercises focused on oral tasks, it is possible to modify them to focus on written tasks. An alternative approach to assessing writing is an exercise that invited learners to write in a certain way, on a specific topic, for example, a review of online engagement strategies. To assess the written responses, clear criteria are identified for learners to consider. The first step in the assessment process is for learners to self-assess their work based on the criteria. Next, their work is assessed by their peer. The final step is for the learner to compare and contrast the self- and peer- feedback to gain awareness regarding differences that may exist. This exercise is optimized if the opportunity for dialogue can exist between peers as this will serve to enhance understanding of feedback as well as providing the opportunity to ask questions regarding performance or development.

Finally, it is worth noting that while these exercises are optimized in face-to-face learning environments, they can also take place virtually through webinars and web-based technology. Through the creation of learning hubs on Moodle, the programme offered learners an opportunity to interact virtually and to practice providing informal self- and peer-feedback to contributions from a group of learners on discussion topics. The practice exercise designed to support this skill invited learners to contribute to a post from a member of the programme. There was a period of three weeks given to learners to contribute and engage in the discussion that would emerge in the hub. Once the time period had lapsed, learners were invited to assess their individual contributions and to give feedback to one other learner in the group, with the proviso that all learners must receive at least one piece of peer feedback. All feedback was posted in the hub to provide learners with the opportunity to examine how self- and peer-feedback was provided by different learners in the group.

5. Discussion: student feedback from focus group

Our experience suggests that for programmes that seek to develop teachers' skills in assessment and feedback, it is of critical importance that the programme design recognizes the somewhat dual role of learners undertaking professional development programmes for Higher Education teachers. While they may be practicing teachers, or looking to move into roles that may involve more teaching activities, when participating in assessment activities they very much self-identify as learners. In a focus group conducted on completion of the programme to probe their experiences of self- and peer-assessment to support confidence and competence in assessment and feedback, learners reported that they valued the incremental approach taken to the development of skills and the opportunity to practice. As one participant commented, "*because I think that, as a teacher, giving feedback and assessment is actually really difficult*"; these sentiments were echoed by another participant who observed that "*I didn't find it [...] easy, but that's because I'm not used to it, I'm not used to getting constructive feedback, I'm not used to giving it*". Thus, there were tensions very clearly emerging from this dual identity of both teacher and learner, which led to participants articulating low self-confidence in their ability to assess.

One element of the incremental approach to developing confidence and competence in assessment and feedback capabilities which was viewed as particularly beneficial by participants in the focus group was the emphasis in the early stages on group-to-group peer assessment and feedback. One participant explained the benefit as follows: "*I prefer when it's the whole group giving feedback together, I think it's easier than giving it 1-1. You might say 'oh I really liked when they did this' and then [another student] would jump in and say 'oh yeah, that was really good'. So you didn't feel like you were just one person*". Similar sentiments were articulated by another participant: "*when we were marking them we could see what other people were scoring and we could say it as a group...safety in numbers!*". These comments confirm that some students on the programmes struggled with making evaluative judgments and sought the security of knowing that their own judgments aligned with those of their peers.

Finally, participants welcomed the use of rubrics, guidelines and templates to structure the assessment and feedback activities embedded throughout the programme. The group discussed how challenging it can be to give constructive feedback, in particular their unease at commenting on a peer's performance. A clear template/rubric to guide conversations were deemed extremely useful: "*I think if you have a structure then you know what you are looking for, rather than just being like 'I really liked this'"*. A scaffolded approach to peer assessment also helps to address any challenges that can be posed by a sense of distrust among peers and concerns relating to fairness, should peer assessment be used summatively. While peer assessment was only used formatively on this programme - and there were no marks attributed to the process *per se* - some learners nonetheless expressed a lack of confidence in

the ability of both themselves and their classmates to accurately and fairly apply assessment rubrics. Thus, through their participation in peer-assessment exercises, students on the programme experienced many of the challenges that their future learners are likely to experience should peer assessment be introduced in their own academic practice. Their experience on this programme underscored the importance of rubrics, templates and clear guidelines to scaffold learners in order to maximize the benefits that can accrue from peer feedback (following Adachi, Tai, et al., 2018; Evans, 2013; Topping, 1998).

6. Conclusions

The interventions described above relate to the deliberate use of formative self- and peer-assessment activities to develop early career Higher Education teachers' confidence and competence in assessing student learning and providing constructive feedback. The programme team recognized the challenges that face these teachers in the domain of assessment and feedback and sought to offer multiple opportunities to develop these skills throughout the programme. Using a variety of means in both face-to-face and online environments, learners were supported to engage with their peers to comment on, critique and evaluate learning against a given set of criteria. Students on the programme experiencesd these activities using their dual identity as a learner and a teacher. Indeed, it is perhaps in this dual identity that the true benefit of this approach comes to the fore; as one participant commented:

> *To be able to have a space to do that to learn how to build up that skill is really good. So then you at least have the tools to use it when you are teaching. And it's good to give you a sense of how does that feel for me, as a learner being assessed* […]. *And then how is it for me as a teacher?*

As a programme design team, we sought to model best practice and to introduce learners on the programme to innovative pedagogical approaches which can best support student learning.

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Virtual Technologies possibilities for improving background knowledge of Civil Engineering Education

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Abstract

A new era with rapid technological changes, digitization, new forms of labour organization requires innovative ideas for modern education using a virtual learning environment and available technical means. This article discusses the prerequisites for creating a concept of a universal curriculum for first-year students in construction specialities for teaching the fundamentals of technical disciplines - that means basic engineering education, with integrating the Building Information Modeling (BIM).

The Building Information Modeling (BIM) methodology includes the concept of combined information about all the parameters of a three-dimensional object. This is universally supported by modern technology and can be used to develop innovating teaching methods.

To identify the prerequisites for the concept of a universal electronic course, an analysis of the IMD statistics was carried out and a generalized overview of the content of educational programs in the main technical disciplines of higher educational institutions of the countries of one graphic region was conducted.

Keywords: *BIM; Virtual Technology; First-Year Student; Civil Engineering Education.*

1. Introduction

The main task of modern higher technical education is to provide the labour market with specialist engineers with the necessary knowledge and skills to perform work tasks of various levels of complexity (Tabas at. all, 2018).

The need to review and analyze the curricula of several higher educational institutions of the countries of one graphic region to study the main technical disciplines is probably due to the difference in the teaching of higher technical education in neighbouring countries, which affects the statistical indicators of the countries competitiveness as a whole and the success of specialists' work.

Comparison, analysis and generalisation of learning outcomes of first-year basic technical subjects will help assess the possibility to use an integration of BIM - Building Information Modelling (Hjelseth, 2018).

The three-dimensional modelling program Revit allows us to create different three-dimensional objects for visualizing and a better understanding of educational topics since it is Revit objects that contain complete parametric information about the object and its parts, as well as use information parameters a particular object throughout its entire life cycle.

2. Research methodology

2.1. Analysis of statistical information

Analysis of the statistics of the world ranking of countries' success is necessary to determine and select universities with similar ratings and geographic positions, whose curricula are supposed to be analyzed.

For the study, it is necessary to analyse statistical information of the world and regional ratings taking into account the regional grouping of countries (Table 1).

Table 1. Composition of sub-regions and regions of Europe.

Western Europe	Austria	Netherlands	France	Switzerland
	Italy	Denmark	Spain	Iceland
	Belgium	Norway	Germany	United Kingdom
	Luxembourg	Finland	Sweden	Ireland
	Cyprus	Portugal	Greece	
Eastern Europe		Bulgaria	Estonia	Hungary
		Latvia	Romania	Slovak Republic
		Czech Republic	Croatia	Lithuania
		Poland	Slovenia	Ukraine

Source: IMD WORLD TALENT RANKING 2019 (November 2019)

Then, according to the analysis of the Global Talent Rating, it is necessary to find out in which countries of the same region IMD indicators are approximately at the same level.

IMD evaluates three factors: the Investment and Development, the Appeal, and the Readiness factor (Table 2) .

Table 2. The IMD World Talent Ranking 2019.

Overall Rank 2019	Country	One Year Change	Overall Score 2019	Investment & Development	Appeal	Readiness
1	Switzerland	-	100.00	2	1	2
6	Norway	-3	85.95	3	10	21
8	Finland	-1	83.14	10	16	3
11	Germany	-1	80.78	11	9	14
27	Estonia	+1	66.88	21	23	35
28	Lithuania	+8	66.51	14	35	33
31	Slovenia	-1	64.16	22	42	30
34	Latvia	+1	62.08	12	48	40

Source: IMD WORLD TALENT RANKING 2019 (November 2019).

One of the key characteristics of leading economies is that they strive to achieve alignment between talent the demand they face and the internal supply of talent they are able to offer.

In the Table 3, there is showed the ranking of the three leading economies in the region with indicators for three factors. It can be seen that regions have different strengths in relation to the factors studied.

Table 3. Ranking of Eastern Europe countries.

Ranking	Country	Investment & Development	Appeal	Readiness
27	Estonia	21	23	35
28	Lithuania	14	35	33
34	Latvia	12	48	40

Source: IMD WORLD TALENT RANKING 2019 (November 2019).

This sub-region is led by Estonia, Lithuania follows, and Latvia closes the sub-regional top (IMD, 2019). The ranking shows the proximity of positions in the economic achievements of countries, which is the rationale for the choice of educational programs of universities for further study.

2.2. Learning outcomes of higher technical educational institutions

According to the above world ranking data, universities from the countries of one subregion - Eastern Europe - Estonia, Lithuania, Slovakia, as well as countries with a high rating of Western Europe - Norway, Finland and Germany - were selected for comparative analysis of programs of basic technical subjects of the first year of study and summarizing the results of the analysis. The results of training in the specialities of construction (Tabas, B., Beagon, U., & Kövesi, K. (2018) were summarized by teachers of the TTK UAS Estonia, Relevance of competence according to Graduate Attributes and Professional Competencies (2014), and are shown in Table 4.

Table 4. Construction specialty programs' learning outcomes.

Learning outcomes	Relevants of competence
1. the commonly used principles of building construction, design and building materials using. 2. legislation, standards and technical norms in the construction field. 3. the technology of main building processes. 4. the principles of building cost estimation and is able to compile a budget with time estimation. 5. the main requirements of occupational safety and the ability to evaluate the effect of building on the environment. 6. ability to use field-specific computer programmes.	1. the need to study and understand the design and construction processes, interaction and coordination of work processes between partners of the construction process both locally and internationally. 2. acquisition of the fundamental knowledge on building technologies, on managing execution of smaller structures, on production of building materials for designing of simple constructions, presenting own solutions of technical and economical issues within construction of various types of constructions.

The educational outputs of all programs correspond to the tasks of training competitive specialists - civil engineers design and calculate, build, plan and manage the work of the industry. Requirements of qualified preparation for solving today's construction problems, such as changes in the environment and climate, due to industry expectations regarding innovation and production, since Civil Engineering goals are the development of the main infrastructure needed for society: the assessment, planning, design, construction, operation and maintenance of infrastructural works (Hjelseth, 2015).

3. Background for the development of a modern universal curriculum design

3.1. The meaning of engineering thinking

Engineering thinking should ensure the use of acquired knowledge to solve practical problems that were or were not taken into account during his training. In other words, the engineer must be able to apply all the knowledge gained and find the optimal solution for a standard or non-standard task, which means processing the initial data about the object, creating and regulating the relationships between the parameters of the object or between objects, or between the object and the environment.

Therefore, the task of higher technical education is to choose such subjects that provide the necessary set of knowledge to ensure engineering thinking, and it is very important to start with basic technical subjects of the first year of study. The first year of study is difficult for students - entering a new learning environment with new information, requirements, terminology, the need to independently plan and carry out academic work. Therefore, the content and form of basic technical subjects should be intuitive, interactive, with mandatory feedback so that the student can work independently to achieve the desired level of knowledge.

The problem of using innovative teaching materials after changing them is to update the content, develop new exercises for students' practical and independent work, require their implementation and adaptation, and then track the success of their use. This process takes some time, and by the time it is accepted and approved for use in training, often innovative teaching materials are outdated and lose their innovative value.

The use of BIM in education is possible for the creation of small courses or modules of large course-integrated interdisciplinary projects and distance cooperation between higher education partners.

The task of integrating and adopting BIM into existing courses and curricula is more important because it is primarily a convenient visualization tool.

3.2. Mobile learning

Accessible basic education should include various teaching methods. New technologies have greatly expanded learning opportunities with mobile devices. Now users can access a huge amount of the data they need without restrictions at a convenient time for them.

The younger generation is very interested in learning through interactive mobile applications - whether it be videos, presentations, virtual reality VR, augmented reality AR or gaming learning applications. This democratization of VR/AR will increase accessibility and affordability of VR/AR, and these technologies will be something as usual as mobile technologies within next few years, making it easier to integrate VR/AR (Martin-Gutiérrez, 2017).

Online training courses consisting of short videos and game exercises, simulators, tests are very effective due to their simplicity, cost-effectiveness and form of the game (Ovtšarenko at. al, 2019).

Group training is also very effective using mobile devices - between groups of people in discussion forums, blogs, social networks there is an exchange of ideas and information.

E-books also provide an excellent opportunity for mobile learning.

Mobile learning expands the scope of training by providing access to quality content not only from the classroom.

Investment in this field of mobile learning using technologies such as AR/ VR, Artificial Intelligence AI, robotics, and blockchain in education is rapidly growing and in 2025 it will be $22 billion compared to 2018 $4 billion (Thomas A Singlehurst et. al, 2019).

3.3. Learning modules

The concept of creating small training modules for one course has many advantages, including the sequence and coordination of training topics with each other, the repetition and consolidation of basic knowledge on various topics with the creation of logical chains of connections, additions to the knowledge gained. There is possible to use small training modules to create intersubject communications, which is an indisputable advantage. E-learning can also be used as timely support for a core e-learning course, helping users quickly view past exercises and tests, using personalized access to digital content and speeding up the learning process.

3.4. Integration BIM into existing courses

The problem of using innovative teaching materials after their development and change is to update the content, develop new exercises for students' practical and self-work, perform and adapt them, and then track the success of their use. This process requires considerable time and often innovative teaching materials - by the time it is accepted and approved for use in training, it is outdated and loses its innovative value. The integration of BIM into existing academic subjects will help, first of all, to visualize any topic of a technical subject, which will significantly reduce the time for understanding and mastering knowledge on this topic. In addition, to ensure intersubject communications of basic subjects - graphics, physics and mathematics - with use of the same spatial objects will significantly enrich and complement the content of these educational subjects, the teaching process will be very effective, with the introduction of parametric modelling. As the most advanced technological solution, engineers need BIM knowledge and technology. To reduce the loss of time spent learning BIM, the best solution is to integrate and adapt BIM into existing courses and training programs, rather than organizing individual BIM courses (Hjelseth, 2018).

4. Conclusion and recommendations

BIM, included in other subjects, is important as a means of improving learning, for student work and collaboration (Sampaio, 2018).

The expected impact - the inclusion of BIM in existing academic subjects can help increase the competencies of future specialists and their competitiveness.

Significant changes in the content of traditional subjects using visualization and parametric information of educational objects, the use of mobile devices will increase not only the interest of students but also increase the effectiveness of the educational process (Lassen at. all, 2018). And the use of BIM at an early stage in the training of specialists can be achieved without major formal changes in the curriculum.

Connection with modern technologies used - students' participation in ongoing work projects using BIM provides an opportunity for more in-depth training, cooperation.

Three-dimensional modelling programs allow us to create various three-dimensional objects for visualization and a better understanding of educational topics since objects contain parametric information about the object and its parts, which allows you to create intersubject communications and use them effectively for better assimilation of logically related educational material.

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Classroom Learning Motivators: Breaking ESL Chinese University Students' Passivity in Class Discussion

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Abstract

Chinese university students enrolled in overseas coursework and English as Medium of Instruction courses domestically have a reputation for classroom passivity as recognized internationally. Thus, the case study was employed to explore Wenzhou Kean University (WKU) students' 'willingness to communicate' based on motivation and attitude toward the classroom learning milieu. Purposive and convenience sampling techniques were used in the semi-structured interview of 75 informants during the focus group discussion. Thematic content analysis method was used to analyze qualitative data collected. Grounded theory was used for the generation of theories. Findings showed that ESL Chinese university students are motivated because of knowledge acquisition and English spoken ability improvement when they engage in class discussion. A relaxing classroom climate, instructor's personality and professional competence in designing the learning experiences contribute in shaping favorable learning attitudes necessary for active student participation in class discussion. Most WKU students intend to pursue graduate studies abroad and considers English speaking ability important in their future and career goals. This belief persistently motivates them to engage in class discussion. Besides, thinking skills development, self-confidence enhancement, leadership skills, team working and adaptability to new environment development heighten the importance of class discussion.

Keywords: *Class discussion, language learning motivators, career goal motivators, classroom learning motivators, content language and integrated learning.*

1. Introduction

In this era of global competitiveness and internationalism, English, as an international language, is increasingly being promoted in China. To keep abreast with this trend, the teaching of English is a prioritized reform of the Chinese government in which English is already incorporated in the curriculum as a compulsory course for college students (Zhou & Zhao, 2016). According to Wei and Su (2012) English is the most popular foreign language studied by foreign-language learners in China but a low degree of frequency in the use of 'English' was reported among Chinese English language learners.

Ample studies on the 'Passive Asian Learner' that is globally recognized have been reported. Key themes to explain the passivity of Asian learners revolve around the following: Confucian Education that teaches students to be passive (Tran, 2013); Willingness to Communicate and Anxiety (Fu & Wang & Wang, 2012); Unfamiliarity with the discussion-based pedagogy (Jackson & Chen, 2017); Neglect of speaking fluency strand in EFL education in China and the Exam oriented learning promotes linguistically unprepared Chinese learners (Yang, 2014).

The literature review fairly contradicts the findings of Echiverri and Lane (2019) study that reported ESL Chinese University students enrolled at Wenzhou Kean University (WKU) responded positively to interactive activities similar to the type common to ESL classes. Emulating ESL methods specifically Task-Based Interactive Approach (TBIA) to support student spoken interaction in a Research Methodology (RM) class strongly correlated to student satisfaction and perceived learning. An important highlight of the research was that students came to RM class, a Content and Language Integrated Learning (CLIL) course, with a tacit English learning expectation in addition to the learning of the specified course content. The researchers concluded that motivation and perceived learning were served by the language learning agenda, and that the language learning agenda was served by content-oriented in class speaking tasks.

In WKU, the English Immersion Program is used where all classes are taught in English. Consistent to the 'Passive Asian learner' phenomenon, a widespread challenge encountered by majority of WKU instructors relates to ESL students' passivity when it comes to class discussion. According to Cortazzi and Jin (as cited in Tran, 1996) Asian students' passivity is described and criticized as being quiet, "reluctant to participate in classroom activities, unwilling to give responses, avoid asking questions and over-dependent on the teacher".

The literature on the passiveness of Asian students abounds already. Instead, the researcher focused its investigation on the factors that motivate ESL university students to be active in class discussion (speaking class task) and its importance to their future and career goals. Besides, there is still a paucity of research on promoting English in CLIL courses.

Motivation plays an essential part in language learning (Zhou & Zhao, 2016). According to Dornyei (as cited in Zhou & Zhao, 1994), "Motivation is responsible for why people decided to do something, how long they are willing to sustain the activity, and how hard they are going to pursue it." Zhou and Zhao further cited the integrative and instrumental classification of motivation. "Learners with 'integrative motivation' want to learn a language in order to communicate with people of the target society and culture. In contrast, learners with 'instrumental motivation' want to learn a language because it will be useful for certain goals, such as passing a test, getting a job, improving status, obtaining certificates and so on."

Gardner (2006) described 'integrative motivation' a combination of three components made up of the individual's desire to learn the other language plus willingness to communicate with other members of the other language plus the favorable attitude toward the language learning situation (pp.11-12). According to Heckhausen and Kuhl (as cited in Gardner, 1985) two types of motivational constructs are emphasized in the study namely: the motivation to learn (and acquire) a second language and the classroom learning motivation. Gardner described these aspects in the learning situation that will have influences on the individual's classroom learning motivation namely as follows: "the teacher, the class atmosphere, the course content, materials and facilities, as well as personal characteristics of the student (such as studiousness, etc.,)."

The researcher assumed that students enrolled are integratively motivated to learn the English language in order to communicate with the target society and culture particularly so when WKU students intend to pursue graduate studies abroad. Researcher was interested in how can WKU instructors design the classroom learning milieu that fosters students' favorable learning attitudes to elicit active participation. Thus, the study aimed to explore the motivational factors in the classroom learning milieu that aids to encourage ESL university students to actively participate in class discussion in both English language courses and CLIL courses. Secondly, the study investigated the learners' attitudes on the importance of English speaking ability to their future and career goals.

2. Methodology

This exploratory-case study design conducted at WKU used the qualitative mode of inquiry to be able to collect in-depth information and extent of variation of responses from participants of the study. Purposive and convenience non-random sampling technique were used in the selection of informants. Upon reaching saturation point, the sample size was composed of 75 cases, representing 3% of the 2018 academic year student population. Cross-sectional representation of the sample composed of nearly 50% freshmen students while the remaining 50% were a mixture of sophomore, junior, and senior students.

Ten groups of six cases and three groups of five cases participated in the focus group discussion (FGD). The informants were asked to discussed the following questions: a. *What classes motivate you? Why did you feel motivated? Was discussion part of that lesson? b. What are your future and career goal/plans? How important is English speaking ability (class discussion) to your plans?* Flexibility and spontaneity throughout the semi-structured interview process by applying follow-up questions and asking for or giving explanation of terms were applied for clarity and shared understanding.

Thematic content analysis method, both semantic and latent analysis, was used to analyze collected descriptive data although outliers were noted as well. Grounded theory was used in theory generation.

3. Findings and Discussion

WKU students defined discussion as a "face to face and see each other talk with professors and the whole class." Interestingly, participants consider these class activities as types of discussion like small group discussion, class interviews, debate, role-playing and presentations. Whole class discussion was portrayed as "in circle formation." Small group discussion was *often* at the top of students' minds; many would unhesitatingly offer answers such as "Oral English class, because we get to have conversations."

3.1. Language Learning Motivators (LLMs)

3.1.1 During the FGD, discussion was for the majority a component of motivation. When further asked what motivates them to actively participate in discussion, unsurprisingly the students' responses consistently supported Gardner's language learning motivation with these statements "learning new ideas" and "when professors teach a lot, I learn a lot" thematically labelled as *knowledge enrichment.*

3.1.2 Similar statements such as "I practice English in presentations and discussion", "Discussion improves my ability to communicate with others"; "discussion gives more 'freedom' to practice in English and express my 'voice'"; and "everyone expresses his/her thoughts and learn to talk with others." were thematically labelled as *English spoken language improvement.*

3.2. Classroom Learning Motivators (CLMs)

Students' responses on the motivational factors in the classroom learning milieu that foster favorable attitudes were remarkably consistent to Gardner's aspects of classroom learning motivation detailed in themes as follows:

3.2.1. Relaxing Classroom climate. Most students described a 'relaxing environment' motivates them to actively participate in class discussion. This summarizes the statements

described as "being with a classmate who is also a friend"; "there is familiarity' between and among themselves", and "three to four students engaged in group discussion." Linking statements to make them feel "relax" were "Good relationship with classmates", "team working" and "when professors interact with them." Some WKU students cited that "group rotation" to expand their circle of friends" was good.

3.2.2. Teacher's personality. This factor represents the teachers' qualities like "humorous, makes jokes, kind, helpful, easy going, and patient made them say "I felt good and enjoyed that class". Professors that are enthusiastic and they 'can talk and interact with' were often cited too. A surprising common pattern mentioned frequently was professors who 'talk slowly and clearly' for students to understand better' was likable contrary to some professors who talked "fast" and "use strange words".

3.2.3. Professional Competence in Designing the Learning Experiences. This factor encapsulates the professional competence of the instructor in designing the events of instruction that respondents find motivating and were thematically labelled as follows:

3.2.3.1 Learning objectives to represent statements of "professors give clear instructions what we need to do in class and after class."; and when "aims or objectives of the class are clear."

3.2.3.2 Curriculum Content to represent 'interesting topics' furthered explained by students when "topics have relevance in their study life and daily life like food, sports and news"; and "topics that are not too hard and appropriate to their understanding." Few students mentioned that the "professors' style of using the current news to connect with the lesson catch their attention to actively listen."

3.2.3.4 Instructional strategies to represent 'active learning' portrayed by these statements: "give students more chances to speak and express ideas"; "let students speak; not the professor does all the talking". It was surprising to hear students' fondness to engage in active learning events such as "brainstorming, drama, role playing, debate, small group discussion and presentations." These activities made them "think" and "practice English" all the time. Moreover, students expressed liking to "professor gives examples for clarity and making use of stories for clearer understanding"; "professors start the class with a review and ends the class with a summary" and technology integration such as "use of videos, WeChat and kahoot".

3.2.3.5 Assessment to represent statements that "professors give feedback of our presentations and affirmation for good work" and "rewards for the best group and giving of bonus points".

3.3. Career Goal Motivators (CGMs)

During the FGD regarding the perceived importance of 'class discussion' in relation to learners' future and career goals, many had clearly unambiguous answers. Worth noting is the respondents' intention to return to China to share their 'knowledge and learning' after completing a master's degree abroad, although a minority of them said they would want to look for a job thereafter. Very few responded to look for a job after their WKU graduation.

Most WKU students presumed that graduate studies and future career will require English speaking ability in instances like admission to graduate school, job recruitment and promotions, and value to employer. Hence, respondents stated the perceived benefits of the importance of class discussion to career and future goals thematically labelled as follows:

3.3.1 Thinking skills development encapsulates students' comparable pronouncements of "discussion is helpful for mind development"; "discussion improves my thinking abilities"; "discussion makes me think and stimulates my critical thinking"; "discussion opens my mind to be creative." Striking statements were "I am able to listen to different opinions and learn from the ideas of others"; "Other ideas inspire my thoughts and broaden my horizon" thereby subsequently, "makes me rethink of my ideas to make changes as to what is right."

3.3.2 Self-confidence enhancement portrays associated statements of "I used to be shy but presentations make me brave"; "I practice to deliver talk in public" and "Discussion makes me outgoing."

3.3.3 Team working, leadership and adaptability development encapsulates related statements of "I learn to work as a team"; "I learn to respect the ideas and opinions of other people" and "discussions make me learn to work with others and adapt to new people." A number though stated that "discussions can develop my leadership".

3.4. Conceptual Framework and Implications

Overall learning from the perspective of the student is highly influenced by three main factors – namely, career goal motivators (CGMs), language learning motivators (LLMs) and classroom learning motivators (CLMs) see Figure 1. Career goal motivators are determined by the student themselves as they decide what career they want to pursue. However, since this is a long term goal, the determination of the student is a manifestation of the depth of the student's desire for such a career.

Language learning motivators may push the student to further get acquainted with a language which he or she believes will significantly contribute to his/her success in his/her chosen career. Hence, he/she may want to get into exchange programs which will allow him/her to be immersed in both the culture and language of his/her choice.

Classroom learning motivators then becomes critical in the further reinforcement of the career goal motivators and the language learning motivators. In the classroom, if a positive learning environment is created, it can further enhance the career goal motivation as well as the language learning motivation of the student. Therefore, the role of the classroom learning motivators, and hence the role of the instructor, becomes crucial in the making or breaking of the first two motivators (CGMs and LLMs).

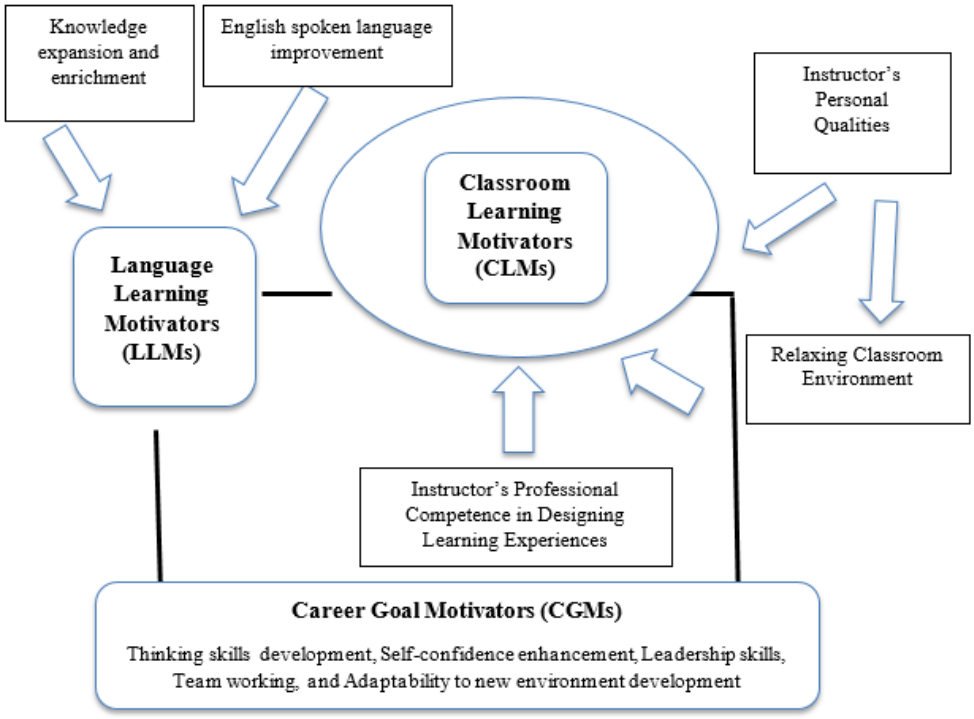

Figure.1. Class Discussion Learning Motivators

The CLMs that shape a favorable attitude to ESL university students towards active participation in class discussion are a relaxing classroom climate, personal qualities of instructors, and instructor's professional competence in designing the learning experiences.

Classroom instructors are advised to create a *relaxing classroom climate* whereby students feel comfortable and relaxed. Such conditions require familiarity with classmates, formation of groups in small sizes, and entailing professors to mill around and interact with students during small group discussion. Students' favored *personal qualities of instructors* such as being humorous, friendly, enthusiastic towards teaching, kind, helpful, does not talk too fast, interacts with students, and paying attention to them. Hence, instructors are encouraged to consciously manifest these personal qualities that will contribute in creating a comfortable and relaxed mood classroom climate.

The following events of instruction are suggested to advance *Instructor's Professional Competence* in designing learning experiences: 1. presentation of objectives, 2. building on students' prior knowledge using 'active learning' as springboard to knowledge expansion on course topics 3. application of Task-based interactive approach (TBIA) in processing technical knowledge transfer and technology integration, 4. relating content to real life situations, 5. giving of timely feedback and 6. giving of awards or rewards for best individual/group outputs.

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A Systematic Assessment Framework for Higher-Education Institutions

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Abstract

The multiple criteria of ranking, rating and accrediting the higher education institutions in India and across the globe have de facto become the lens for viewing the institutions. There is an increasing number of assessment systems used by multiple agencies. With the public policy emphasis on assessing higher education institutions, it is necessary to use a systematic and systemic framework for assessment. For this purpose, this paper proposes an ontological framework for assessment of higher education institutions. The ontology's dimensions, sub-dimensions, and their constituent elements are derived from higher-education assessment systems that are well known globally and in India. The framework can help higher-education institutions: (a) assess themselves systemically and systematically; (b) highlight the bright, light, blind, and blank spots in their performance; and (c) correct their trajectory to fulfil their vision. Such a framework would assist in identifying the gaps in and pathways to improve their position in assessments.

Keywords: *Accreditation; Assessment; Framework; Ontology; Ranking; Rating.*

1. Introduction

The exponential growth of higher education institutions (HEIs) in India and globally has increased the complexity of assessing the institutions holistically. The complexity has been further compounded by the proliferation of ranking, rating, and accrediting agencies of HEIs in the past decade. The scores institutions obtain on these assessments play an increasingly important role in determining their reputation, the quality of students and faculty members they can attract, the resources they can generate, the autonomy they have, and their brand value. Similar to the national and global trend amongst HEIs to become a world-class university (Altbach, 2004) rating, ranking and accreditation is gaining traction globally. There is a paradigm shift in policies related to higher education, which are considering a position in global rankings, ratings and accreditation as a criterion for giving funds and autonomy to HEIs. The guidelines to categorize HEIs in India is one such illustration. The Ministry of Human Resource Development (MHRD), Government of India is using the Quacquarelli Symonds (QS) world university rankings, Times Higher Education Ranking (THER) world university rankings, National Institutional Ranking Framework (NIRF) and National Assessment and Accreditation Council (NAAC) assessment for categorizing HEIs for granting autonomy (Government of India, 2018). This shift in policies of the government and the globally emerging trend have influenced the institutions to align their management policies along with the strategy of governance to such assessment systems.

Globally there are multiple assessment systems to rank, rate, and give accreditation to HEIs based on their defined criteria. The criteria of each assessment system do not systematically encompass multiple aspects of HEIs for a comprehensive assessment, which if done, could lead to the holistic development of the institution. There is an absence of a single assessment system that could capture the entire vision of HEIs. The bias in assessments would only reinforce the institutions' skewed approach to governance, management, and delivery of education.

The absence of a comprehensive assessment system can undermine higher-education policymaking, governance, and regulation. It could also exacerbate conflicts and prove to be a hindrance to HEIs to improve their position in the assessment. In this context, it would be appropriate and pertinent to have a framework that could give a big picture of the existing unwieldy assessment systems. Such a framework would avoid the fragmentation engendered by the present system. The comprehensiveness of the framework would complement the efforts of HEIs for assessment. It would further ease the process of getting assessed by multiple assessment systems. This paper systematically develops an ontological framework of higher-education assessment, by deriving its elements from well-known global and national ranking, rating, and accreditation systems and organizing them. It also discusses the validation of the framework and its application to the analysis and advancement of HEIs.

2. Ontological Framework for Higher-Education Assessment

The multiple assessment criteria of different agencies are varied in nature. For instance, some might focus more on the research dimension and others less on research but more on teaching and reputation. For instance, neither Shanghai nor THER emphasize the quality of teaching (Marginson & van der Wende, 2007). Further, there is a variance in assessment systems at national and global levels (Çakır, Acartürk, Alaşehir, & Çilingir, `2015). It is challenging to bring these varied criteria under a comprehensive framework to make the metaphorical assessment elephant visible. In this context, an ontological framework can help conceptualize the domain (Gruber, 2008) and systematize its complexity (Cimino, 2006). Similar frameworks have been used in higher-education to envision world-class universities (Ramaprasad, 2011), and to analyse the state of aspiration of HEIs in Karnataka (Hasan, Ramaprasad, & Singai, 2014) and Chile (Coronado, La Paz, Ramaprasad, & Syn, 2015). This method has also been used in the meta-analysis of higher education policy (Ramaprasad, Singai, Hasan, Syn, & Thirumalai, 2016). The method is applied to meta-analyse and synthesize a research domain systemically and systematically (Ramaprasad & Syn, 2015).

In the ontology, the terminologies and taxonomies of the domain are systematically organized (Cameron, Ramaprasad, & Syn, 2017), which is explained below. The ontological framework for higher-education assessment (Figure 1) includes all the elements derived from the following ranking, rating, and accreditation systems criteria: Academic Ranking of World Universities (ARWU); Bloomberg; Leiden; National Assessment and Accreditation Council (NAAC); National Institutional Ranking Framework (NIRF); Quacquarelli Symonds World University Rankings (QS); Times Higher Education World University Rankings (THER); U-Multirank World University Rankings; and, US News & World Report. Using the criteria of all the nine assessment systems, the ontology was constructed through an iterative process amongst authors, as explained by Ramaprasad and Syn (2014, 2015). The ontological framework of higher education assessment constructed is logical and parsimonious. It is logical as it deconstructs and organizes all the assessment criteria; it is parsimonious in that it encapsulates the elements and the logic of assessment in one concise figure.

The Ontology of Higher Education Assessment (Figure 1) has three parts: Inputs to the HEIs system, Processes of the system, and Outputs of the system. Each part has three dimensions, each represented by a column of the framework. Each dimension has been articulated by a one-, two-, or three-level taxonomy of elements. Thus, the Outputs of HEIs is defined by three dimensions, i.e., HEIs Reputation, Research, and Students. They are represented in the three rightmost columns. The HEIs Reputation can be assessed among Peers, Employers, Research Investors, Public, and Competitors.

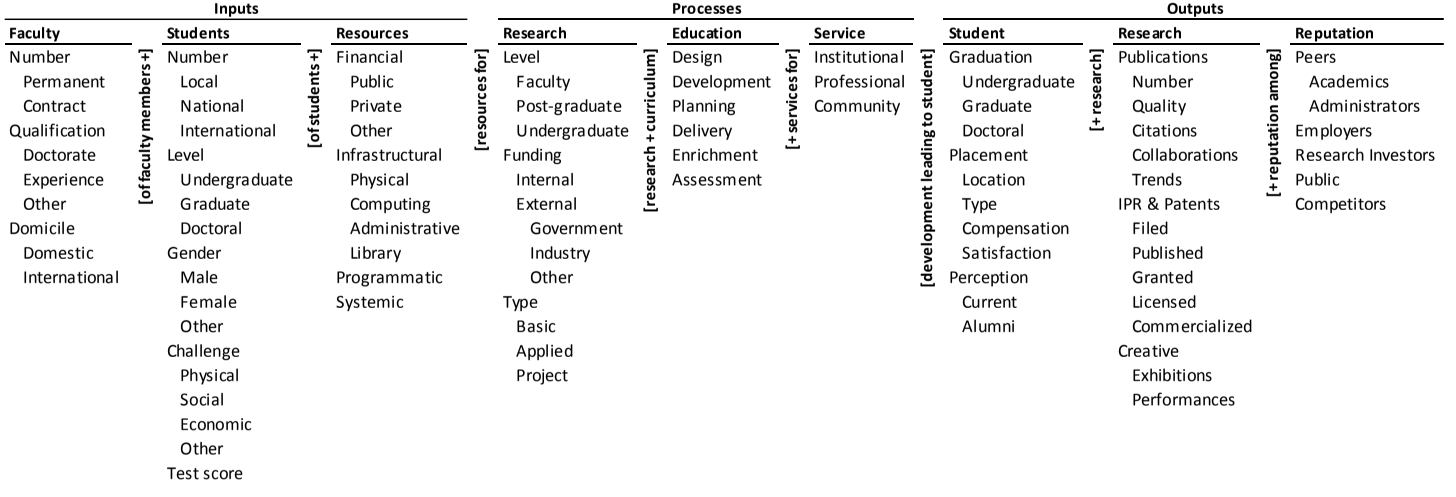

Figure 1: Ontological Framework for Higher-Education Assessment

The HEIs Research is assessed based on Publications, IPR & patents, and Creative activities. The Student assessment is based on Graduation, Placement, and Perception. Each is further defined by their sub-elements. The Processes of HEIs is defined by the Research, Education, and Service dimensions. The combination of these three dimensions affects the Output of HEIs. Research or the dimension of Research can be assessed at different Levels of researchers, their Funding, and Type of research they engage in. The assessment of Educational processes includes the full cycle of Design, Development, Delivery, Planning, Enrichment, and Assessment of the curriculum. The Service elements are the institutions' engagement with Institutional, Professional, and Community services. The three dimensions of Processes are listed in the middle three columns of the framework. The inputs to HEIs will affect its processes and outputs. The dimensions of Input are Faculty, Students, and the Resources. Assessment is based on Financial, Infrastructural, Programmatic, and Systemic resources. The elements of Student resources are their Number, Level of study, Gender, Challenges, and Test score. The elements of Faculty resources are their Number, Qualifications, and Domicile status. The three dimensions of the inputs are listed in the first three columns of the framework.

All the issues affect all the three categories of Inputs, Processes and Outputs of HEIs. For holistic development, they need to be considered together. In the outputs-based issues, the students and research outputs determine the reputation of the institution. A positive reputation would trigger a virtuous cycle of better inputs and improved processes. A symbiotic relationship, as opposed to a siloed one, between research, education, and service processes, will be critical to the success of student, research, and reputational output for the institution. The simultaneously complementary and contradictory societal pressures of equity, expansion, and excellence are reshaping the contours of higher education in the 21st century. It is affecting and will continue to affect the recruitment of faculty and students and the allocation of other resources, and consequently affect the processes and outputs of higher education institutions.

The above framework may be extended by adding categories or reduced by eliminating categories, refined by adding sub-categories and coarsened by combining categories/sub-categories. Thus, one can make and study the assessments of HEIs at different levels of granularity. The present framework encapsulates 7*14*9*10*6*3*9*12*6=10,28,76,480 possible first-order potential components of measures on higher education. It provides a comprehensive picture of the assessment of HEIs.

3. Validation of the Ontological Framework

The above ontological framework underwent face, semantic and systemic, and external validation following traditional construct of validation (Brennan, Voros, & Brady, 2011; Horn & Lee, 1989). The face validity is high as it made sense on 'its face' when the framework was presented to education experts and formed the basis of a roundtable discussion on higher education. The design of the roundtable discussion was structured, wherein, the participating stakeholders of higher education domain were informed about the discussion with a concept note and framework. The stakeholders during the discussion agreed with the structure, dimensions, sub-dimensions, and the elements of the framework. The discussion which took place in a natural English language was coded onto the framework, so it has a high semantic validation. It is a comprehensive framework deriving its dimensions and elements from nine assessment systems of higher education, so its systemic validity is high. Its external validation is high, as its application was tested by mapping the discussion on higher education by a group of external experts and its dimension and elements are not external to higher education domain. Subsequently, feedback by the stakeholders established the validity through confirming the utility and relevance of the ontological framework in assessing and understanding the HEIs.

4. Application

The comprehensiveness and logical taxonomies of elements in the framework would assist in applying the framework for systematic identification and addressing the gaps in HEIs. The mapping of data on HEIs onto the framework would give us a visual image and help in ascertaining high or medium or low emphasis given by the HEIs. The theme map based on cluster analysis tool would show the cross-dimensional thematic representation of elements. This would help in identifying the gaps in the functioning of the HEIs and identify the logical pathways to improve their position in assessment systems. The assessment could raise questions and make recommendations on Inputs, Processes and Outputs based issues. For instance, the ontological framework could bring out outputs issues such as institutions training students to be employable, knowledgeable, or both; institutions aligning their education with employment opportunities; institutions balancing the quality and quantity of research, and balancing the market need for qualifications, competencies and vocational skills. Assessment could raise issues related to the processes such as the need for institutions to balance research, education and service; balancing levels of research, and funding different types of researches; mixing face-to-face, online and blended education, and balancing quality and quantity of credit hours for the various degrees. Concerning inputs, the assessment might raise issues related to challenges of equity, expansion and excellence; balancing the regional diversity of faculty members and students; the issue of educating the educator, and cost and quality of education.

5. Conclusion

The HEIs could use the ontological framework for a comprehensive assessment of their performance, evaluating their database management systems, policies and so on. Its comprehensiveness could assist the management and policymakers in avoiding the blind spots and in facilitating systematic discourse. It can be used for mapping the state of practice in higher education institutions, discover the gaps in aspiration and practice, identify the pathways and formulate a strategy. By making the 'elephant visible', the ontology of higher education assessment will help in framing the policy problems. The framework would prevent the policymakers of and stakeholders in higher education from getting trapped in the policy fallacies as they endeavor to analyze the problem, predict the future, and make decisions.

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Augmented reality to aid retention in an African university of technology engineering program

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Abstract

Whenever complex threshold concepts are covered facilitators need to take extra care that students retain the new knowledge for future application. The problem encountered was that certain concepts, like digital logic gates with its layers of information are harder to retain. The purpose of this paper is to investigate the students' perceptions on the possible use of a custom design Quick Response code and Augmented Reality application in an Electrical Engineering subject. Evaluation was done on Logic Design III a 2nd year subject where the threshold concepts should have been imprinted. An exploratory design is implemented with data collected using an online survey tool. The results were promising as 88.89% of students felt that they will remember the content better with the use of the application and 83.33% were positive about adopting the technology in class. The paper shows that technology like Quick Response code and Augmented Reality in the classroom is not only beneficial for improving retention but is also welcomed by students.

Keywords: *augmented reality; educational technology; logic gates; electrical engineering.*

1. Introduction

Edgar Allen Poe said that "To observe attentively is to remember distinctly" (Cave, 2019). A university facilitator's main aim is for their students to remember distinctly and are therefore always researching ways of helping students retain their skills and knowledge learned in class. The challenge comes within where students have to observe attentively.

In the subject Logic Design III at the Central University of Technology it was found that students have trouble remembering the threshold concept of logic gates. The concept of logic gates was first introduced in the first semester with basic electronic fundamentals and then revisited in semester 4 with Logic Design III. It was clear that the concept had to be revised in depth for students, to be able to continue with advance theories; and this raised concern over why students were not retaining this valuable information and how to address it.

The aim of this paper is to discuss the perspectives of students of a custom designed and programmed Quick Response code (QR) and an Augmented Reality (AR) application that was introduced in a lesson on logic gates. The AR was experienced through a smart phone application that showed students the operation, different manufacturing layers and types of logic gates - to assist in circuit design and understanding. The paper looks specifically at students' opinions of their retention of information using the QR and AR program.

Firstly, a literature review will look at retention and its relation to visual stimulation and AR. The context and AR activity are then elaborated on after which the methods and results are discussed. Finally, the paper is concluded with a discussion on the possible implications of the research.

2. Literature review

Preparing a student for the world of work means not only to provide them with the necessary skills and knowledge but also the ability to retain it for future application. The onus of retention does not only lie with the student but the lecturer as well. As Halpern and Hakel (2003) states: "What learners do determines what and how much is learned, how well it will be remembered, and the conditions under which it will be recalled" and what students do during the learning experience is up to the lecturer. Therefore, lecturers spend most of their time out of class researching different ways in which students acquire and retain new skills.

Seeing is believing isn't just an exclamation we use daily. Many studies have been conducted to show the correlation between visual feedback and the acquisition and retention of new skills and knowledge; in particular motor tasks (Batcho, Gagne, Bouyer, Roy, & Mercier, 2016). The idea is that if the outcome predicts a student will be able to dig a hole, instead of having an in-depth theoretical discussion on soil and shovels, just have students dig a hole and see the results for themselves. Then when the theory is discussed the student has visual

and other sensory experiences to connect it to. There are many ways to have students perform tasks in class and technology makes it easier all the time.

AR a key stone in Industry 4.0 (Alloghani, et al., 2018), with its potential for layering information in a 3-dimensional space, it is a perfect tool for creating an in-class visual learning experience. AR is introduced as a tool to train industrial operators (Nazir, Totaro, Brambilla, Colombo, & Manca, 2012). AR expands on the existing space by overlaying objects and information that can be viewed through a smart device, resulting in a mixed reality (Chen, Liu, Cheng, & Huang, 2016). Using AR tools in class will not only enhance the learning experience, but also the retention of the skills for future application.

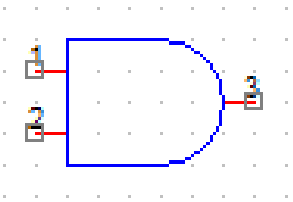
3. Context

Central University of Technology (CUT) is a small university of technology catering mainly for students in the central region of South Africa. The department of Electrical, Electronic and Computer Engineering trains students for industry especially designing of electronic circuitry. One of the key threshold concepts in the discipline is logic gates, but it was found that when students revisited the concept in semester 4, their retention from semester 1 was very poor. As the concept of logic gates is complex with many layers an intervention, it was necessary to help students remember for later application.

4. Augmented reality activity

The main objective is to use a new method to visually introduce the theory of logic gates and their manufacturing layering process. There are seven logic gates namely (Floyd, 2015); NOT, AND, NAND, OR, NOR, XOR and XNOR. Each one has a function, symbol, truth table and Boolean equation. See the example of the AND gate below:

AND gate



(a)

Boolean equation $X = A * B$ (b)

Truth table

A	B
0	0
0	1
1	0
1	1

(c)

X
0
0
0
1

Figure 1. Example of AND logic gate symbol (a), Boolean equation (b) and truth table (c)

The custom written application uses QR code for identification. QR code is the trademark for a type of matrix barcode designed in 1994 for the automotive industry in Japan (Somayya & Ramaswamy, 2015). A barcode is a machine-readable optical label that contains information about the item to which it is attached. The nature of QR code makes it ideal for a tracer for AR. In the AR the internal layout of the "NAND gates only" or "NOR only" for the corresponding logic gate is overlaid as on screen of the student.

A QR code is generated for each logic gate. It's so programmed that it would produce the truth table and Boolean equation if scanned with a smart device with any QR code scanning application. The AR of the "NAND gates only" or "NOR only" visualisations however will only function with the custom programmed application, provided to the students to download to their smart devices. The overlay of the AR shows the manufacturing layer of gates as based on the theory of the "NAND gates only" or "NOR gates only" manufacturing principle. Students are supposed to be able to take a design, convert and simplify it for a "sea of NAND gates" or "sea of NOR gates", which is an integral design step for integrated circuit layer manufacturing.

Below is an example of a laminated card with the QR code for the AND gate:

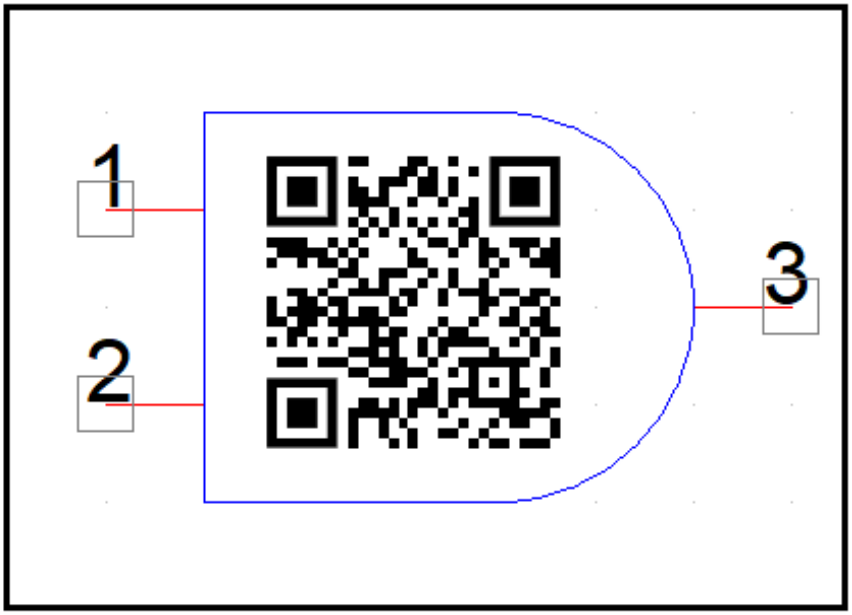
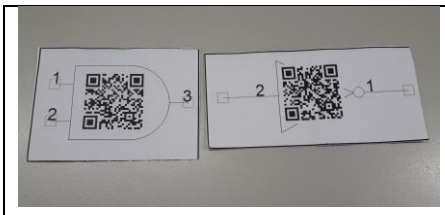


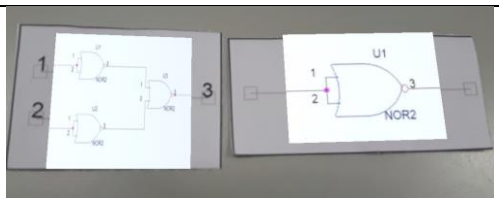
Figure 2. An example of a laminated card with the QR code for the AND gate

If scanned with any generic QR code scanner the truth table and equation is displayed.

The custom programmed AR app real-time example is as follows:



(a)



(b)

Figure 3. Example of the custom programmed AR application showing the cards before (a) and after (b) scan

This is an example for the "NOR gate only" substitution of gates. The APP runs on an android device. Note how it overlays the gates with their relevant substituted "NOR gates only" equivalents. In the case of XOR compiling where there needs to be some simplification steps, these simplification steps can be seen as an animation AR overlay. All overlays track the QR code and would move and orientate itself in real-time.

5. Methodology

QR code and AR applications was programmed and installed on android devices and laminated cards made with logic gate symbols and codes as seen in figure 3. This paper used an exploratory design which collected participants' perspectives of their experience during the QR code and AR activity, which is then analyzed with quantitative descriptions. Exploratory design means to understand a phenomenon better which has been previously not well understood (De Vos, Strydom, Fouche, & Delport, 2011) while a descriptive analysis requires that the experience of the phenomenon is discovered (Foster, 2016). Data was collected with an online survey conducted directly after the augmented reality activity.

The target population of the study was the 52 students enrolled for the subject Logic Design III where the concept of logic gates was revisited and a sample of 18 completed the survey.

6. Results

Following is a breakdown of the results from the survey. Figure 4 and 5 was done before app and figure shows results after the app.

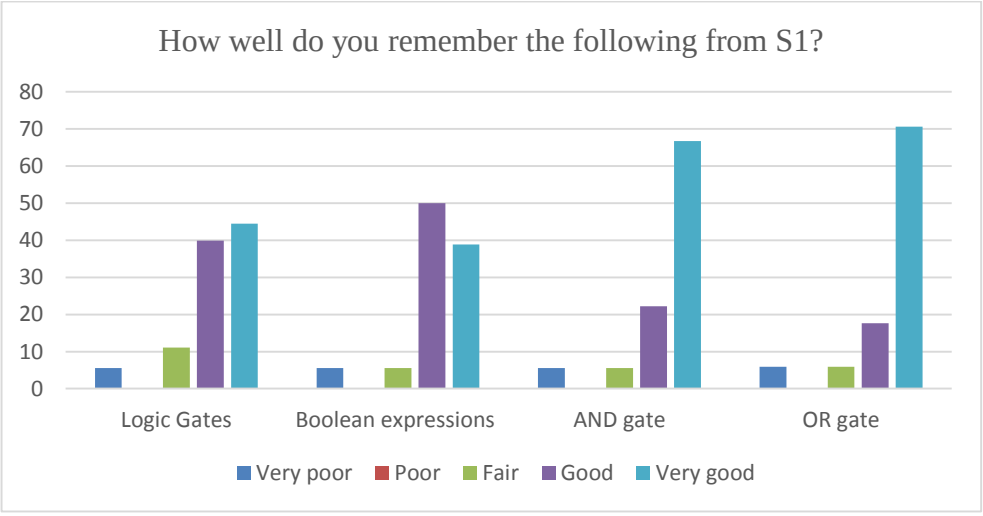


Figure 4. Participants' perspectives on how well they remember logic gates, Boolean equations, AND and OR gates.

Over all students indicated with a tendency towards good (38.89%) and very good (44.44%) that they remember the basic theory of digital logic gates. However, there is a very poor section as well (5.56%) which is a matter of concern at this level. It is not overwhelmingly positive, and this is the "alphabet" of logic circuits especially for this level.

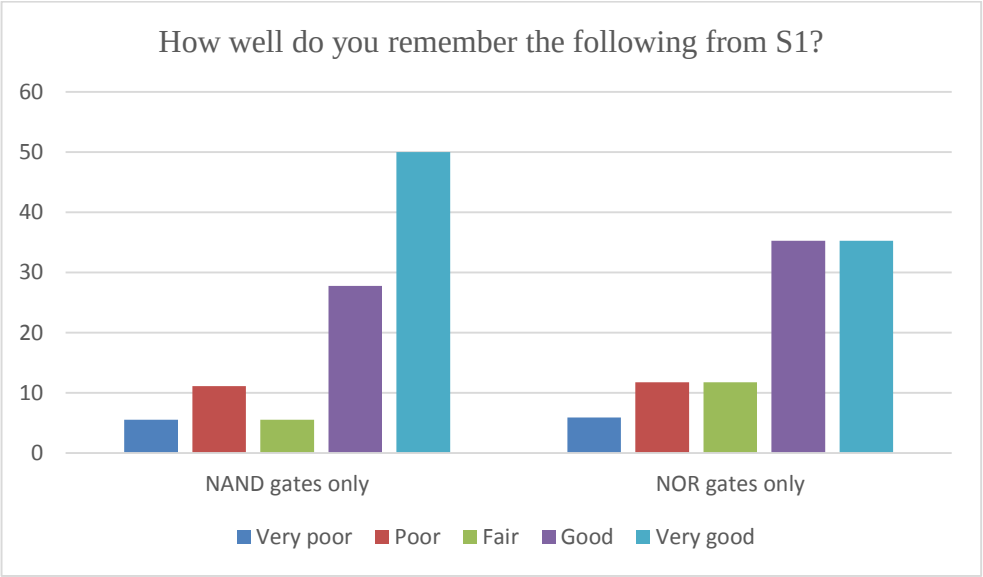


Figure 5. Participants' perspectives on how well they remember NAND and NOR gates only.

The "NAND gates only" and "NOR gates only" theory shows more uncertainty with 16.67% and 17.64% respectively admitting they do not remember that well which indicates the intervention should especially focus on these areas.

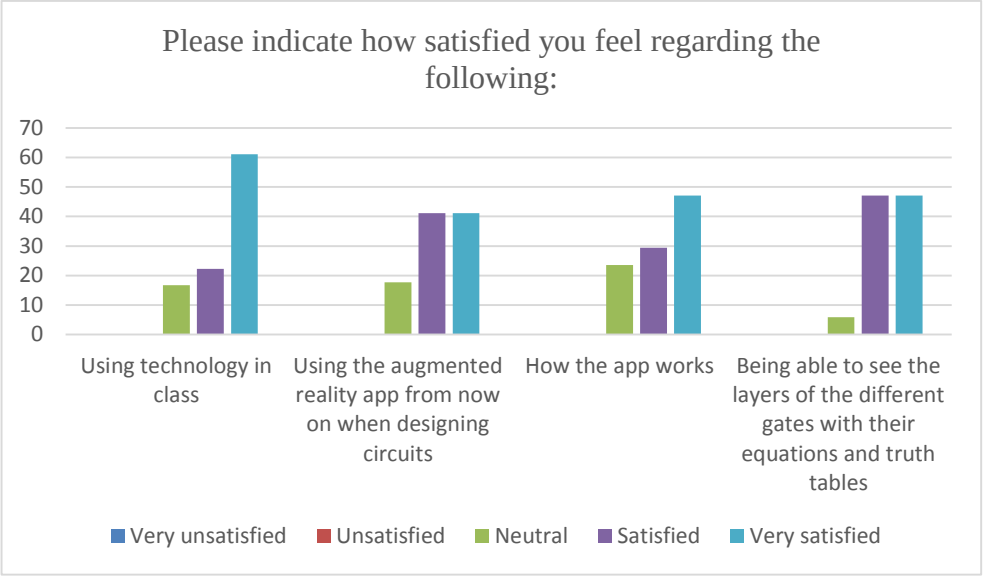


Figure 6. Participants' perspectives on the use of the AR application in class.

Students indicated that they feel satisfied (22.22%) to very satisfied (61.11%) using technology in the class room indicating technology will be well received as a solution. The positive tendency also indicate that students would use the application and were very satisfied (41.18% -using it and 47.06% - how it works) on the operation of it. They were mostly very satisfied (47.06%) to be able to see equations, truth tables and layers with it.

Finally, when asked: "Do you think you will remember the different gates and their functions better if you use the app regularly?" A majority of 88.89% answered yes.

7. Conclusion

This paper investigated the perceptions of students on the use of AR to help them remember the concept of logic gates. The literature review showed that the facilitator is in part responsible for student success and that visual stimulus and technology could assist them to remember difficult concepts. Eighteen students completed a survey in this exploratory design to determine their feelings toward the technology and their memory of the concept from a previous semester. The QR and AR technologies were well received with one student saying: "*This app would be useful because sometimes we are lazy to study but having to scan and get information you need would produce great results"* and another pointing out that the use of technology suits the student of today by saying: "*It's an interesting app to learn different gates. And in this generation, we prefer technology more than anything so it will be much* easier to learn and memorize the work". The results show that most of the students felt they remembered logic gates from semester 1 still well enough for application in semester 4, which is contraindicative of what the facilitator experienced and may need deeper investigation. On the matter of the use of AR in the classroom the results showed very positive feelings (83.33%) towards the adoption of this technology. The main result is 88.89% of students saying that they feel the technology will help them remember the difficult concept better with continuous use. Application of the software should be introduced at the earliest possible levels.

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Education technology based on a 3D model of house VirTec

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Abstract

In modern teaching, it is necessary to use modern technological achievements to involve students in the learning process, to create and constantly develop interesting and relevant teaching materials.

Educational materials in a playful form have the appropriate qualities. Game effects are associated with user participation in the interactive process and provide a high interest in the information offered. Getting feedback in the gameplay is not only an indicator of the success of the educational process but also a guide in the step-by-step movement of the student in the learning process.

Simulators of different objects are effective educational material that is available to students, contains the necessary information and functions, is simple and intuitive to use. This article provides an overview of different simulators with the study of the impact of their use on the effectiveness of the educational process.

One of the simulators is created in the teamwork of the project "Development of a virtual learning environment in technical higher education" (VirTec, 2018), funded by the Erasmus program for 24 months, which includes organizations from four countries: Estonia, Lithuania, Poland, Turkey, and Croatia.

Keywords: *Virtual Learning Environment, Engineering Education, Simulator, Digihouse, Life-Long Learning, First-Year Student, Construction Specialties.*

1. Introduction

Rapidly developing technologies, fast information transfer, competition requires a new approach to planning and conducting the education process. Students are interested in the learning process, which is interactive, which you need not only to listen to but also to analyze, summarize and evaluate the information received.

Simulators of different objects are effective educational material that is available to students, contains the necessary information and functions, is simple and intuitive to use. This article provides an overview of different simulators with the study of the impact of their use on the effectiveness of the educational process.

One of the simulators is created in the teamwork of the project. It aims to create a digital house simulator and a set of training materials for construction specialities freshmen. The tasks of this simulator are to allow a learner to independently obtain knowledge about the details of the structure through the internet without special equipment.

The main objective of the project is to conduct a virtual learning environment on the base of the component parts of the house and its various modifications in order to increase interest and support the participation of students who has no experience in construction industry. Using the latest modelling technologies and graphic technologies allow to present more modern virtual models in training, which increases the visibility and interactivity of training materials.

2. Background

Educational technology is the use of both physical hardware, software, and educational theory to facilitate learning and improving performance by creating, using, and managing appropriate technological processes and resources. Every subject seeks the conceptual structure of the simulation in different ways. Innovative materials and new tools for teaching, educational technologies grow on many years. From the time when the first game Space War was developed by Steve Russell at the Massachusetts Institute of Technology, games have a massive growth (Jayakanthan, 2002). Implementation of simulation games in civil engineering education has shown encouraging results where the students learned various skills including management, engineering cost control, and teamwork (Scott et al. 2004). That is very important in the new era of BIM (Building information modelling) implementation to the construction industry. Computer simulation, refined graphics and multi-media can be developed to present engineering topics in ways that are not possible within the limitations of the traditional lecture format. Using animations, graphics, and an interactive environment, the instructional media can be designed to engage and stimulate students to effectively explain and illustrate course topics, and to build problem-solving skills

(Deshpande & Huang, 2011). Simulations, serious games and role-play activities can be useful tools to develop student-centred and problem-based learning environments because these activities allow students to apply their knowledge, skills and strategies practically while representing specific roles (Gradler, 2004). Every subject needs the structure of the simulation differently. For example, economists use a typically mathematical structure, for social education in the conceptual structure might be sets of social interactions. To civil engineers, the conceptual structure is often based on mathematical, physical and constructive elements. Computer models require that students complete several assignments taking a significant time. Simulations may be conducted with computers, pencil-and-paper, or physical models of constructions.

2.1. Simulators in education

The idea of using a computer simulation or management game to help students learn about complex issues is not new. Gilgeous and D'Cruz (1996) describe games stretching back over many years. The use of management games for teaching and learning about project planning and control is also not new and was described by Scott and Cullingford in 1973. Different simulators were developed over the years. Simulations are models where the student participate in a space defined by the teacher. They represent a reality within which students interact. The teacher controls the parameters of that space and uses it to achieve the desired instructional results. A simulation is a form of experiential learning. A simulation is a mix of model elements, game and instruction parts. There are a large number of custom and very specialized simulations, there are also many simulators which can run an infinite number of models. Examples are MATLAB Simulink (engineering and manufacturing), ANSYS (engineering), Gazebo (robotics), etc. (Simulators: The Key Training Environment for Applied Deep Reinforcement Learning, Cyrill Glockner).

Learning simulations historically have fallen into two categories. There are educational simulations that follow the rigour and fidelity of flight simulators. And there are serious games, that follow the entertainment model of a SimCity. Civilization V is an example in Figure 1. The role that the player is put in has no real world counterpart. One of the best parts of a simulation is that you can learn rigorously and predictably without ever being taught anything. Students can customize some of their experience. Debriefing can subsequently make sure all is covered. No student learns everything presented in any medium. This is true of lectures, textbooks, sports drills, and apprenticeships. Clark Aldrich posited that the more students actively engage the material and see consequences good and bad that are based on their strategy and tactics, the greater the material does stick.

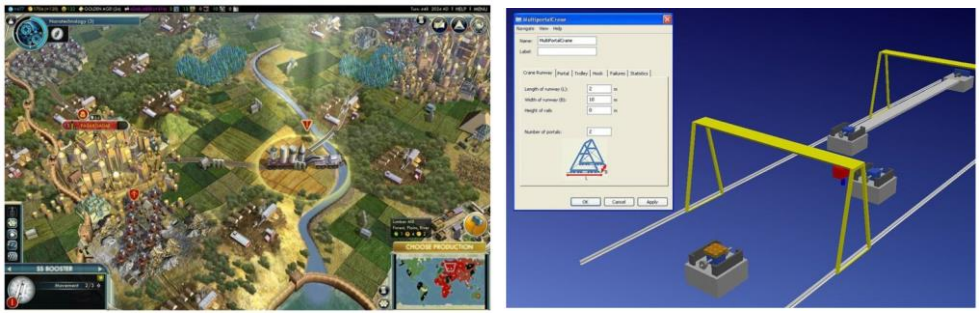


Figure 1. Application of simulation games in engineering education. Source: Deshpande and Huang. (2011).

For example, ForgeFX Simulations developing over 100 simulation training programs and applications, across many of different subjects and curricula, they help deliver digital learning products that transform students from passive audience members, to active participants in the learning process. The ForgeFX website includes information about their works. The real-time 3D wave simulator demonstrates the connection between wind speed and ocean particle motion depth. BeardedBrothers.games ask to become a motorcycle mechanic in Biker Garage, mechanic Simulator (Figure 2).

Figure 2. ForgeFX and BeardedBrothers.games simulators screenshots. Source: http://forgefx.com/, https://store.steampowered.com.

2.2. Simulation in Engineering education

In the academic environment, the Engineering teachers usually find students who have difficulties for solving tasks requiring spatial reasoning and viewing abilities. Deshpande and Huang (2011) posited that simulation games have been applied in various educational domains. Authors cited Au&Parti suggested that computerized heuristic games could be used for the education of engineers and planners in the construction industry. Abou Rizk and Sawhney posited that they developed an Internet-based Interactive Construction Management Learning System (ICMLS) with a rich graphical user interface, Virtual Reality

Modeling Language (VRML), and discrete-event simulation for construction management education. Crown developed many web-based games using simple JavaScript code to enhance visualization skills essential in engineering graphics. Taxonomy of simulation games application in engineering education is shown in Figure 3.

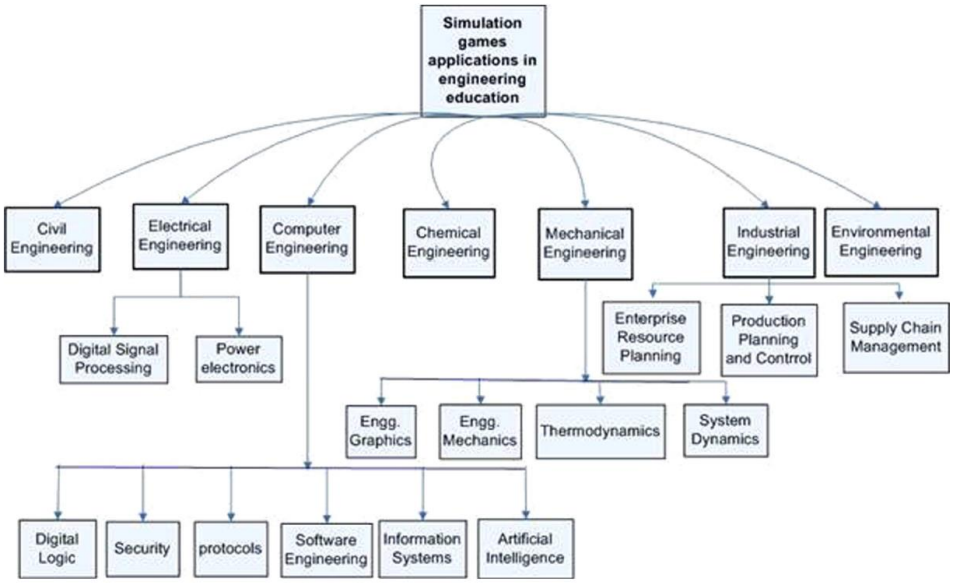


Figure 3. Application of simulation games in engineering education. Source: Deshpande and Huang (2011).

The new teaching methodology using simulation will transform the teacher's role to a "bringer" of knowledge as opposed to that of some agent in the common educational environment.

3. 3D model simulator VirTec

Educational technology is the use of both physical hardware, software, and educational theoretic to facilitate learning and improving performance by creating, using, and managing appropriate technological processes and resources. The idea of the simulator' creating is the simplicity of its usage. A student does not need either the knowledge and skills of three-dimensional modelling no the availability of a licensed program. A simulator has to be done as a web page that opens quickly and also quickly responds to user requests, having the same possibilities of turning, scaling, viewing an object in parts, and using cutting planes that provide specialized viewing software. In this article are presented the 3D model part of the project „Development of Virtual Learning Environment in Technical Higher Education" (VirTec, 2018), which was co-founded by the Erasmus+ KA2 program and started from

October 2018. The partners of the consortium are organizations from four countries: Estonia, Lithuania, Turkey, Poland and Croatia. To create educational material, it is necessary to take into account the general principles of teaching and learning design and above all what is planned to study, what are the goals / desired outcomes for students, what is a possible form of training material, what are abilities of control and evaluation of the knowledge gained, how to provide feedback to consolidate the material and create prerequisites for further development.

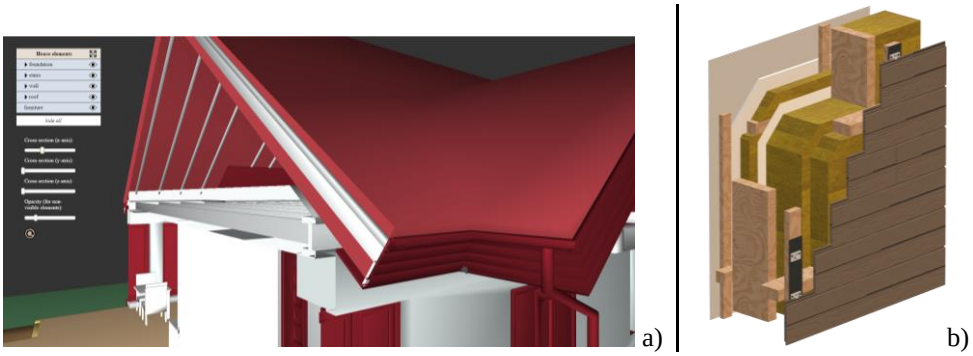
It aims to create a digital house and a set of educational materials for first-year students of construction specialities and for learners without knowledge about the construction industry to promote effective lifelong learning through simulation. The task of this simulation is to allow a learner to get knowledge with parts of construction by himself. Game form of learning, the possibility to test knowledge and register results, quick and independent assessment, feedback and recommendations – all this is provided by modern virtual technologies. For the modelling of the 3D house, *TIMBECO LLC* (timbeco.ee) drawings set of a near-zero energy small houses have been used. It is quite simple to use the simulator because it is equipped with a logical and user-friendly interface. On the viewing screen next to the model of the house, there is a menu indicating the parts of the building structure. The menu allows for choosing different parts of the house for detailed consideration: the foundation, stairs, wall, roof. Now functions of the simulator made it possible to use cutting planes - (horizontal and two vertical) to obtain cuts at the house. This opportunity is a great success for the project and provides students via the simulator' use to learn the basics of the constructions' structural components. And the expected effect of the simulator' use is a first acquaintance with the structures, materials, technologies, and the relative position of the elements in a user-friendly viewing mode. Also, one more important task of the simulator is to support an interest in the speciality and the desire to get solid professional knowledge. Based on the created 3D model, it is possible to prepare simulators for more complex objects, structures, or connection nodes.

Nowadays students seek to get new methodologies for studies. There are a lot of scientific works. Scientists are presenting a methodology to evaluate the use of personalised learning scenarios. High-quality learning scenarios should consist of the learning components (i.e. learning objects, learning activities, and learning environment) optimised to particular students according to their personal needs, e.g. learning styles (Kurilova et al. 2017). Authors of articles say, that future education means personalisation plus intelligence (Melesko &Kurilovas, 2016). Analysis of students' preferences to certain learning styles according to Felder and Silverman Learning Styles Model (Felder & Silverman, 1988) is widely recognised the most suitable for engineering disciplines and e-learning. Felder and Silverman learning styles model has four dimensions type. Each dimension shows a different aspect of learning with a linguistic variable. These dimensions as "sensing" or "intuitive" learners, as

"visual" or "verbal" based on the way they receive information (virtual house), as "active" or "reflective" according to the way they process information (preparing of tasks), as "sequential" or "global" based on the way they understand information (Ciloglugil & Inceoğlu, 2018).

Intelligent personalised learning using information technologies can provide better results for adaptivity and VirTec project result can be an attractive type of learning using intelligent IT tools.

In December 2018, pollmill.com conducted a survey of building teachers - colleagues from different countries - Estonia, Lithuania, Poland, Turkey, Finland. The purpose of the survey was to obtain information about their interest in using the virtual home simulator in teaching. Analysis of the processed data led to the conclusion that the high interest of collegues - teachers of construction specialities to the virtual home simulator and confirmed the correctness of the project participants' intentions - to create a simulator that will fundamentally change the work of teachers and improve the quality of the learning process.



a) b)

Figure 4. The main window of the simulator VirTec with vertical cutting (a), visualization of house and part of the wall (b). Source: VirTec, 2020.

4. Conclusions

Rapidly developing technologies, fast information transfer, competition requires a new approach to planning and conducting the education process. Students are interested in the learning process, which is interactive, which you need not only to listen to but also to analyze, summarize and evaluate the information received. Simulators of different objects are effective educational material that is available to students, contains the necessary information and functions, is simple and intuitive to use. One of the simulators is created in the teamwork of the project. It aims to create a digital house simulator and a set of training materials for construction specialities freshmen. The tasks of this simulator are to allow a learner to independently obtain knowledge about the details of the structure through the internet without

special equipment. The use and development of simulation software will give new power for engineering education. It will also give satisfaction for students having the ability to work in inter-functional, individual and group environments. The simulator becomes a very useful assistant for students at the stage of primary vocational education, because it has all the functions of specialized programs for viewing a complex object: it is a free web page that loads very quickly into the gadget, opens without specialized programs (does not require a license) and is easy responds to user requests.

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Methodology based on collaborative problem solving implemented in a high academic achievement group

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Abstract

The High Academic Achievement (ARA, by its acronym in Spanish) group began its course in the 2011/12 academic year to reinforce the potential of the most outstanding students since the beginning of their university studies.

In order to improve the employability of this students, at least 50% of basic or compulsory credits of the degree are taught in English. In addition, a series of language training aids are provided, which also has advantages in obtaining Erasmus scholarships. The ARA group only offers 25 places each academic course. Being a small group, personalized teaching is enhanced while the schedule is compacted.

In this contribution the methodology used in the subject of Signals and Systems of the Degree in Sound and Image in Telecommunication Engineering of the Alicante University (Spain) is presented. The methodology emphasizes the practical application of the subject and its direct applicability in real systems.

Keywords: *Education; learning environments; partnership; collaboration; evaluation.*

1. Introduction

The ARA groups was promoted by the Valencian Ministry of Education in 2010. The ARA program is intended for university students who accredit better skills. The program provides all available aids and supports in order to obtain the highest possible academic performance. Currently, many universities in the Valencian public system have taken advantage of this teaching method.

The University of Valencia participates with the degrees in Medicine, Psychology, Law, International Business; with shared subjects in the degrees in Business Administration and Management, Tourism, Economics, Finance and Accounting;, and with subjects in the degrees in Pharmacy and Pharmacy and Human Nutrition. For its part, the Polytechnic University of Valencia has an ARA group in each of the following degrees: Biotechnology, Computer Engineering, Aerospace Engineering, Electronic, Industrial and Automatic Engineering, Business Administration and Management, and Technology and Services Engineering Telecommunications

At the the Universitat Jaume I, ARA groups are offerted in the shared subjects of the degrees in Industrial Technology Engineering, Chemical Engineering, Mechanical Engineering and Electrical Engineering.

For its part, the Miguel Hernández of Elche University has an ARA group in the Biotechnology Degree. Finally, the University of Alicante participates with ARA groups in the degrees in Computer Engineering, Law, Biology, and Sound and Image in Telecommunication Engineering. The present study focuses in this last engineering degree. Specifically, the ARA group of the subject of Signals and Systems, historically one of the subjects with the lowest passing rate among the second-year students.

Commonly, Signals and System subject of the Degree in Sound and Image in Telecommunication Engineering provides the student with the necessary tools on the basic concepts related to analog and digital signals and systems. These concepts are essential for future subjects in which signal processing is performed. The different types of analog and digital signals and systems are studied both in the time and frequency domainx, as well as the different tools that serve to characterize them in the corresponding transformed domains. The digitization of analog signals, which is necessary to perform digital signal processing, is also studied. The subject requires a non-negligible knowledge of the purely mathematical subjects studied in previous courses. However, this is the first time that students of this degree face a course where mathematics must be applied in real systems. Certainly, many times students do not have the required tools to understand the real application of the problems raised.

Some of the objectives normally necessary to pass the subject include:

- Know and analyze the different elements and signals involved in telecommunication or remote communication, both analog and digital.
- Understand the process of digitizing analog signals.
- Develop the ability to analyze and design systems.
- To be able to characterize and analyze the signals and systems, continuous and discrete, in the time and frequency domains.
- Know the advantages and limitations of digital signal processing.

One of the potential challenges of this work has been to promote a flipped classroom system. Although the flipped classroom idea has been around for quite some time (Bland, 2006), it has recently been getting much interest for use in engineering courses at the university level. The basic premise of the flipped classroom is that active learning in the classroom is more effective than passive listening lectures. There is no doubt that active learning is effective in teaching signal processing (Fowler, 2014).

2. Methodology

The total students enrolled in the subject were 50, of which only 13 belonged to the high academic achievement group (as they must also fill in certain requirements).

Of the 13 students, 11 of them attended more than 90% of classes. Only some sporadic absences were recorded for justified reasons. The assistance was completely voluntary. Only two students attended less than 30% of classes.

The subject is structured in 5 major topics distributed during a period of 15 weeks, with 3 hours of class per week. The way to work each of the topics was to provide all the theory material the previous week of introducing a new topic. Students were encouraged to read it calmly.

In the first of the weekly sessions, the students were asked about all those doubts that had arisen in the theory. In this way, the teacher detected the general difficulties they have. Once the doubts were collected, there would be a debate for the whole class to explain these concepts. In this way, the most successful students in one part could strengthen their

knowledge and those who had not understood it could expose their doubts without fear in front of the rest of the classmates and the teacher. Obviously, this can be done since the number of students in the class is only 11. Hardly, if not impossible, such detailed monitoring could be done with more than 25 students.

This theory review task used to last an hour. In case there were still doubts, which was common, the teacher encouraged students to come to tutorials so as not to slow down the progress of the class and advance the problems.

The following two hours per week established the following routine. By lot (weekly) workgroups were established, that way the groups were rotating and everyone helped everyone. Different problems were proposed with a degree of increasing difficulty that they had to solve in groups of 2 or 3 people. Finally, individually, they had to explain how they had reached the resolution of the problem in front of the rest of the class.

On the one hand, the way of working in group favored empathy with the partners and group work. On the other hand, the oral presentation challenged them to defend their knowledge in public so they knew that they should understand what they were doing (or if they do not understand, ask for an explanation).

This also favored the motivation for attendance and the challenge of wanting to solve the problems before the "competing" groups.

3. Results

In this section, the particular and preliminary results are presented. The way to evaluate the subject is more conventional since it is done through 3 partial individual and written exams, some problems proposed for each topic and a final exam. If the average of the three partials and the proposed problems is greater than 5, the final exam is not necessary.

On average, the final grade of the 11 students who actively attended class was 8.06 over 10 and none of them needed to attend the final exam. The two students who did not actively follow failed to pass either by continuous evaluation or with the final exam. When the students were consulted, their methodology was individual study. Fig. 1 summarizes the grades obtained by the 13 students in the group. It is noted that those who actively followed classes well approved all partials. Only low performance was observed in student 2 in the third part. All students attended more than 90% of the classes, except for students 1 and 6, as previously mentioned. It is worth say that it must be carefully analyzed what has failed. For example, in the case of student 3 and what strategy can be used in those students who for whatever reason cannot actively follow the classes.

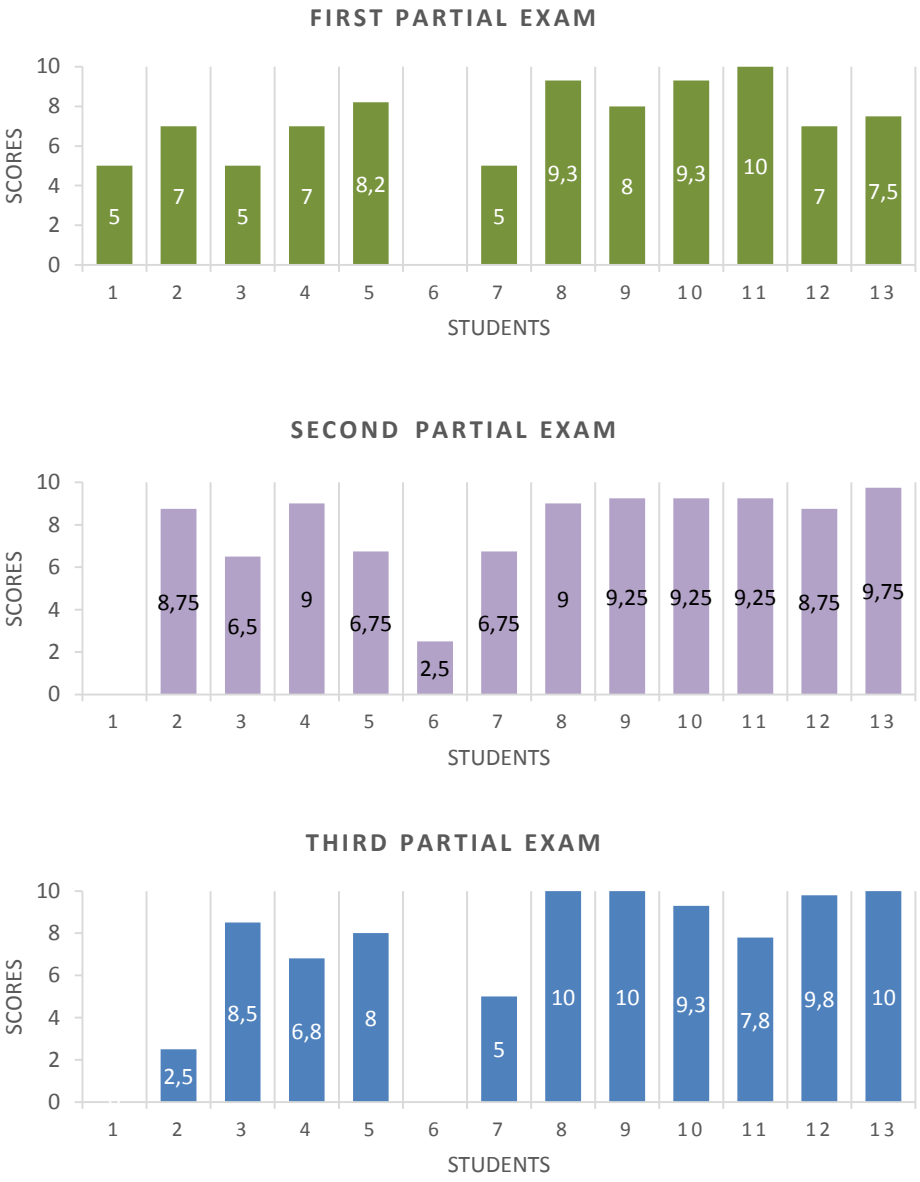

Figure 1. High-performance group ratings throughout the four-month period.

4. Conclusions and discussion

It is usual for second-year students in technical careers to have difficulties when looking beyond a physical or mathematical problem and try to understand the applicability of the problem in a global way. There are many ways to approach and explain this connection between a problem and your future academic career. In this case, three fundamental tools have been chosen that make them think and not only have master classes where their participation and involvement is scarcer.

In the first place they must do an exercise of personal study, in the second a collective work and in the third place, a public and individual defense of the acquired knowledge. In addition, this methodology was constant throughout the four-month period, which gave them a routine, which, once achieved, is no different from any other.

The results validate that the methodology is very satisfactory, although certain considerations must be taken into account. In the first place it is a methodology suitable for small groups and secondly they are groups with students whose qualifications are over the average. In any case, the methodology has achieved that absolutely all the students who followed the methodology passed the subject. Even more important, all of them attended voluntarily and actively the classes from which it follows that they considered it a methodology useful for their studies and training.

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Challenging students to develop work-based skills: A PBL experience

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Abstract

In today's changing world the skills and habilities required for getting a job are rapidly changing. New trends such as globalization, data science, artificial intelligence and the never ending expansion of information and technology communications are changing the demands of the labor market. Accordingly, new skills are needed in order to succeed and get a job. As noted by the OECD, educators' challenge lies in helping students develop their unique capacity to create, innovate and add value, skills that distinguish humans from machines. With this aim in mind, this study reports the results of a challenge-based activity (based on project-based learning) targeted to undergraduate students in Business Administration. The results reveal a positive impact of the methodology on students' learning process, their satisfaction and a positive improvement on a series of skills, namely teamwork, writting and oral skills, digital skills, capacity to identify and solve problems, capacity to work autonomously, analytical capacity and capacity to think critically.

Keywords: *Project-based learning; skills; B-Smart; operations management.*

1. Introduction

The 21st century is characterized for being full of innovations. All these innovations bring both opportunities and challenges which make businesses change their traditional way of operaring. Workplace, is not aside of these changes as job positions are becoming more flat, open, flexible and transparent.

In this context, there is a wide consensus about the importance of education, and more specifically on how students, during their years of schooling, can develop the skills that will be later required in their professional careers. Accordingly, we argue that as the market labor requirements are changing, also the way we teach students needs to be updated and ensure that when graduating, they are equipped with the right skills.

Universities play a crucial role in providing highly-educated people and in contributing towards fulfilling the needs of the industry. So relevant is the role of education that the Organisation for Economic Cooperation and Development (OECD) has launched a project (OECD Learning Compass 2030) in which it specifies which skills and competences should be taught and learned up to 2030. According to this project, skills are of three types (OECD, 2018): 1) cognitive and meta-cognitive skills, which include critical thinking, learning-to-learn, creative thinking, the capacity to find solutions to complex problems and self-regulation; 2) social and emotional skills, including empathy, self-efficacy, responsibility and collaboration; and 3) practical and physical skills, such as using new information and communication technology devices, or digital skills.

To cope with these demands, many universities have started changing their traditional way of teaching and align it better with the OECD's requirements. One strategy to address these demands in teaching is through active learning methods in which students become the center of the education processes being responsible of their learning process. Literature on active learning methods is rich and the advantages it provides are widely documented (Åsvoll & Jacobsen, 2012). Among the different strategies, Project-Based Leaning (PBL) stands as one of the most appropriate methods for the development of professional skills (Saorín et al., 2019).

PBL consists in presenting to students real problems that they must solve. As the project develops, the core concepts are progressively introduced and put into practice. In PBL the instructor acts as a mentor, guiding the learning process, and students become active parts, learning-to-learn as they develop an autonomous work, develop teamwork skills, and combine different knowledge areas that revolve around a common project (Disla García, 2013; Tippelt & Lindemann, 2001).

Several studies empirically validate that those students that used PBL are better at solving problems, have a higher capacity to pay attention and are more commited than those taught with traditional methods (Finkelstein et al., 2010; Thomas, 2000; Walker et al., 2009).

This article aims at describing and discussing a PBL activity implemented during the academic course 2019/20 at the Universitat Internacional de Catalunya (Barcelona, Spain) at the Operations Management course taught to third-year students enrolled in the Bachelor's Degree in Business Administration.

2. Description of the activity

2.1. Project description

The activity described is part of a teaching innovation project called B-SMART (which stands for Be Socially-engaged, Motivated, Agile, Resolute and Talented). This project is funded by the Fundació Puig through the Aula d'Innovació Docent of the Universitat Internacional de Catalunya and is lead by a group of lecturers from this university. The ultimate goal of this project is to narrow the gap between universities and businessess through the teaching mission. Specifically, the B-SMART project responds to those calls that ask for universities to enhance students' capacities and skills and for a closer cooperation between science and industry. To articulate the project, B-SMART challenges students to work in real-world projects posed by companies. By working side by side with the industry, students can apply their knowledge while develop some of the skills that the marketplace requires (e.g. entrepreneurship, creativity and innovation, critical thinking, teamworking).

2.2. Teaching method

Business challenges, which take the form of PBL, are solved using the design thinking, a methodology that is gaining momentum in the business world and is often refereed as anything from "a unified framework for innovation" to the "essential tool for simplifying and humanizing" (Kolko, 2015; Tuanli, 2016). It is a solution-focused, problem-solving and hands-on method that is extremely useful in tackling complex problems. While traditional business education has mainly relied in lectures and case studies, design thinking offers the unique opportunity to introduce real world challenges in the classroom. Following the model proposed by the Hasso Plattner Institute of Design at Stanford (commonly known as the d.school), design thinking is structured in five stages which, rather than being conceived as sequential steps, should be understood as different approaches that together, contribute to the entire design project: empathize (investigate users' needs), define (put all the information together and characterize the problem), ideate (think creatively challenging assumptions), prototype (start creating solutions) and test (try solutions out and get feedback from users).

2.3. The challenge

The challenge described in this study was conducted at the Operations Management course, taught to third-year students of the Bachelor's Degree in Business Administration at the Universitat Internacional de Catalunya. For the academic year 2019/20, 30 students were enrolled, coming from different parts of the world, mostly from Italy and Spain, but also from Germany, Sweden, Peru and Ecuador.

This challenge involves different stakeholders: the company, the lecturers and the students. Starting with the first one, a company is invited to propose a real situation (or challenge) that it is facing to a group of students. With the support of the lecturer, the company prepares a case-study in which the challenge is described. A face-to-face conference with the students is organized in order to introduce them the company, explain the problem and provide students with all the information needed to solve the challenge. Additionally, the organization is also involved in the assessment of projects, taking part in the grading of the reports submitted by students. The top ten groups are given the opportunity to present their work in front of the CIO.

The second group of people involved are lecturers. In activites like the one described here, lecturers adopt a secondary role, acting as facilitators of the learning. This role also implies motivating the students and ensuring they complete the tasks. Besides clarifying concepts and ideas when needed in class, and grading the exercises afterwards, working with companies (using a challenge-based approach) requires extra time prior to the activity (e.g., contacting the company, preparing the case-study, etc.). Nevertheless, despite the extra work this activity implies, the lecturers participating in the teaching experience were happy with the results and showed interested in repeting the experience.

Finally, but not least, the last group of stakhodelrs are students. For the specific case of this activity, students were divided in groups of 5 and use the design thinking methodology to solve the challenge and suggest potential solutions. Each group delivered a report with their proposals. Also, students had to present their ideas in an oral presentation. As a way to give more credibility to the project, students also had to include a detailed list of the operations needed to implement their solutions and the costs that might entail. Both the instructor of the course and the industry partner were in charge of grading students as it is forementioned. .

2.4. The company

ADER Taxi Comercial (http://www.taxicomercial.com/en/) was the company in charge of posing the challenge. It is a freight company specialized in providing exclusive services to its customers with a driver. With almost 30 years of history, it offers specialized transportation services in the areas of distribution, freight and logistics. The challenge students had to solve consisted in providing solutions to improve the final consumer's

experience in the delivery of orders. Students also had to evaluate how their solution will impact on the operator's resources and the potential influence on their business processes. Finally, they had to develop an action plan.

3. Results

In order to evaluate the usefulness of this activity, information on students' performance and satisfaction was collected.

Concerning skill acquisition, students were asked to anonymously respond a survey. Table 1 displays students' perceptions about skill improvement. Each item was evaluated in a seven-point Likert scale, were 1 indicates "strongly disagree" and 7 "strongly agree". As it can be inferred from the figures, students believed their skills to be enhanced thanks to the activity (average scores are over 5.5 in all instances). Particularly, the capacity to identify problems (6.13) and oral skills (6.07) are those skills that students felt that they developed the most. The item with the lower average score (5.52) referred to analytical capacity.

Table 1. Students' perceptions about the skills developed

	Average score	**Standard dev.**
My teamwork skills have improved	5.70	1.09
My oral skills have improved	6.07	1.11
My writing skills have improved	5.80	1.16
My capacity to identify problems has improved	6.13	1.11
My problem-solving skills have improved	5.73	1.28
My capacity to think critically has improved	5.67	1.25
My analytical capacity has improved	5.52	1.31
My capacity to work aunomously has improved	5.60	1.22
My digital skills (use of technology) have improved	5.80	1.32

Source: Own elaboration

As for the academic performance, grades were given based on the final report students submitted. The average score was 7.42. From the 6 groups that participated in the activity, one of them obtained the highest score (10). Three other groups were graded with a 8.5, one with a 6.5 and one group obtained a 5. In the light of the results we can conclude that the activity was helpful for skill development and that students suggested relevant solutions with a real impact on the company.

Concerning students' satisfaction, a survey was designed aiming at finding out their thoughts about the activity. The questions included in the survey, along with the average scores, are shown in Table 2. Each item was evaluated following a seven-point Likert scale (1 = strongly disagree, 5 = strongly agree).

The results show that students were highly satisfied with the activity as the average scores for all items range between 5.23 and 6.75. Overall, students were satisfied with the activity (5.93) and they believed that it was very useful for their learning process (5.93). The item that students valued the most was the fact that the activity was real and that by solving it they were able to better understand how a company operates (6.23). They also valued high the chance to go depper into problems companies are facing nowadays (6.53). The methology used and how the activity was organized were also rated high (5.77 and 5.70, respectively). Students also expressed that this type of activity helped them to better understand the subject, and consequently, that they were more motivated and committed with the course. Contrarily, areas of improvement include a better definition of the activity. This perception of lack of a proper definition might be due to the fact that students are used to solve problems with only one solution and one (or few) possible(s) way(s) of reaching it. Real-world problems are typically ill-defined, and this type of activity trains them to open up their minds and think more creatively.

Table 2. Students' feedback (scale from 1, ''strongly disagree'', to 7, ''strongly agree'')

	Average score	**Standard dev.**
The lecturer gave clear explanations	5.23	1.25
This activity made the subject more interesting	5.60	1.19
This activity motivated me to work	5.67	1.15
The use of design thinking is suitable to facilitate the learning process	5.77	1.17
This activity made the subject easier	5.73	1.26
This activity helped me to better understand companies' real problems	6.53	1.20
This activity helped me to better understand how a company works	6.23	1.01
The activity was well organized, prepared and structured	5.70	1.12
I think this activity is very useful	5.93	1.01
Overall satisfaction	5.93	1.11

Source: Own elaboration

4. Conclusions and discussion

In today's changing world, universities are expected to provide students with the right competences, skills and knowledge that will prepare them for the labor market. However, these requirements are constanly changing and consequently, it is necessary to continously adapt to the market. In this context, universities have aligned their courses with the labor market requirement. This study describes an activity conducted with students enrolled in a course on Operations Management, showing positive results on both students' performance and satisfaction. The ultimate purpose was to challenge students with a real project (with a company posing and evaluating it) so that by solving it, they develop some of the most relevant skills that the sector is asking for.

We argue that this type of activities is worth of being explored and implemented in class. First, the activity made the course more enjoyable for both the instructor and the students. Students felt more involved in the subject, but what is more important, the activity fostered deep learning, meaning that what students learnt was much better interiorized that by using traditional teaching methods. Additionally, the activity contributed to boost students' skills development, such as teamworking or problem-solving capacity, to name just a few. From the companies' perspective, the activity also had positive implications, as students are now better prepared, they are able to face, react and solve real problems and show higher commitment at their workplace.

Notwithstanding, based on the students' feedback, some ideas for improving this activity are envisioned. On the one hand, students reported some difficulties in understanding the main problem of the challenge. On the other hand, students found hard to complete the task within the given amount of time. More time to develop the project with the instructor and the industry partner –to make sure that all doubts are solved before the class ends– would had been helpful.

Despite this study provides useful insights for other educators, universities and companies, there are some limitations, which in turn represent new opportunities for future research. First, the number of students participating in this activity was low. Therefore the analyses of the students' performance, their feedback and skill acquisition were only discussed based on descriptive data. Additionally, with the data collected it was not possible to evaluate the degree of acquisition of the skills of interest, as there was no evidence of students' skills before the activity.

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Supporting deep understanding with emerging technologies in a STEM university math class

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Abstract

In this work we present an innovative learning environment format, based on student-centred activities, that may support undergraduate students to deep understanding mathematics in the first year of engineering degree. In particular, we refer to the difficulties students meet in the transition from the high school mathematics to the one they meet at university, which requires a significant shift to conceptual understanding, especially in Calculus courses. The goal of this presentation is to investigate the case of multivariable functions, a topic at the foundation of many mathematical models and its application. We show the results of the first pilot study which involves 160 undergraduate students. More precisely, we report how a flipped-learning approach based on online activities and working group allows students to deep understand the main properties concerning multivariable functions.

Keywords: *Flipped learning; Calculus; First-year engineering degree; Multivariable functions; Matlab; Instructor videos.*

1. Introduction

Mathematics courses are pivotal in STEM programs; however, many scholars show that first-year students face with difficulties (see, for instance, Gamer & Gamer, 2001; Gueudet, 2008; Andrà, Bernardi & Brunetto, 2019). The reasons of such difficulties are rooted in the differences between high school and university (Gueudet, 2008). For instance, student face a more conceptual mathematics at university (Clark & Lovric, 2008), and they perceive different importance of the available resources at university compared with high-school (Kock, Brunetto & Pepin, 2019).

In engineering programs calculus course are the most spreading, their syllabus is composed of many topics that may range from the foundations of mathematics to multivariable integration. The notion of a multivariable function is fundamental in mathematics and its applications; Martínez-Planell and Trigueros-Gaisman (2012) show that students need more opportunities to reflect on actions related to the construction of the domain, range and graphs of a rich diversity of functions and the transformations among representation registers. Hence, we argue that multivariate function has a strong conceptual nature. However, students are used to viewing only the procedural one, such as the integration rules, which is a not neglectable aspect of this topic. Therefore, the dual nature of the topic poses specific challenges to the students. On the path of Andrà and et al. (2019), in this work we address the problem to support the move from procedural to conceptual approaches to mathematics in first-year calculus courses, focusing on multivariable functions.

To that end, we agree with Gamer and Gamer (2001) who show that student-directed learning promotes conceptual learning more effectively if compared to teacher-directed approach. In particular, we resort to relative new flipped-learning formats (Bergmann & Sams, 2015) that encourages student-directed learning.

The presentation of this work unfolds as follows. Firstly, we briefly recall the main students' difficulties with the mathematical content. Then, in Section 3 and 4, we describe how we designed and carried out a student-centred activity in a first-year calculus course for Environmental Engineering students at Politecnico di Milano. In Section 5, we report the data analysis, and in Section 6 we briefly discuss the main results and report the conclusions.

2. Mathematical content: students' difficulties with multivariate functions

Every high school student has experienced functions of a single independent variable, that is $y=f(x)$, where x and y are the independent and dependent variables, respectively. Moreover, many students of the first calculus course know how differentiating and integrating such functions work. Furthermore, the graphical representation is generally a beneficial register for understanding all the conceptual concepts. For instance, the differentiation is related to

the tangent of the function $f(x)$ while the integration concerns the area bounded by the function.

However, almost all the functions that model phenomena in nature do not depend on a single independent variable but is usually determined by two, three or more independent variables. Thus, for example, the volume (V) of an ideal gas depends on the pressure (p), and the temperature (T), therefore, the volume is a two-variable function, that is $V=f(p,T)$.

Jones and Dorko (2015) provide evidence that the students' conceptualizations of multivariate function (e.g., the boundary volume) are rooted in and connected to prior understandings of single-variable function. However, students demonstrate a very limited understanding of two-variable functions and its geometrical interpretation (Martínez-Planell & Trigueros-Gaisman, 2012).

According to the above authors, instructors use to present multivariate functions starting from the case of only two-variables, e.g., x and y and provide the graph of a function $z=f(x,y)$ as a surface in a Cartesian reference system in the space (x,y,z). Then, exploiting graphical register, the main conceptual aspects are developed. However, the object representations, both the three-dimensional surface on two-dimensional "canvas", and the two-dimension contour map of $z=f(x,y)$ are all but easy. Moreover, even the former representation is easily readable only if a student has understood the underlying three-dimensional object.

3. Research methods

3.1. The context of the research

In this work, we consider the data collected during the first-year course named "Mathematical Analysis and Geometry" (MAG), in particular, the "Matlab course" that supports the mathematical understanding. The whole course is a 1-year long mathematics course (September-June) devoted to Environmental Engineering students. The total number of students enrolled in each year is about 200, with 30% of female students (for instance, in 2019, 57 are female and 139 are male) the most majority of them is 20 yo. Another interesting aspect of such course is that, the 30% of students enrolled in the course has low level of mathematical skill because of these students performed bad at entrance test (score < 60pt over 100). Such data informs us about their potential difficulties with the mathematical contents and in particular the multivariate functions.

The Matlab course, composed of six laboratories sessions (two hours each), aim at supporting the deep understanding of the basic concepts of mathematical analysis and linear algebra. The software Matlab, produced by Mathworks (www.mathworks.com), is worldwide used both in academic and in professional fields, such as data science and scientific modelling.

We proposed the implementation of some math procedures related to the syllabus of the math course encouraging the usage of its graphical toolbox to prompt students in the deep conceptual thinking of the topics.

3.2. The new innovative learning environment

The structure of the Matlab course was unchanged from three academic years but in the last a.y. (September 2018-June 2019) we adopted the flipped learning methodology. In particular, we set a new learning environment composed of online asynchronous *instructional videos* and *online quizzes* with instant feedback as the "out-of-class" part in the flipped learning, and in-presence group work activities as the "in-class" part (Bergmann & Sams, 2015).

More precisely, before each of the six in-presence parts, students were invited to watch an instructional video (10-15 minutes long) and to answer a Google form in order to self-assess their learning. The instructional videos have been recorded by the professor of the Matlab course (one of the authors) using Screencast-O-Matic tools (screencast-o-matic.com) and has been posted on YouTube. While the Google form is composed of multiple-choice questions about both the Matlab commands and the relative context (e.g. Which of the following commands would you use if you want to clear that specific variable?).

In each meeting, the professor shows and comments the quizzes results, then students are asked to work in small groups. After that, lesson ends with a class discussion and followed by a teacher-directed moment, where the professor provided further insights about the mathematical content, its applications and the Matlab commands.

3.3. Data collected

The data of this work is composed of students' attendance in the Matlab course, the mark of the students both in the Matlab test and the MAG exam.

The Matlab course attendance is certificated by the answers to the google form and the presence in the laboratory. Those students, who have a more than 70% of attendance, gain the Matlab certificate. Such certificate allows students to make a non-compulsory Matlab test, gaining extra-bonus (up to 2 points) on the final MAG exam.

Moreover, at the end of the course, we proposed a satisfaction questionnaire about the new learning environment of Matlab course, 58 answers were collected. Only two questions are strictly related to the issue of this work: Q1 concerns what they like/dislike while Q2 ask for general comments.

Finally, we can compare the Matlab test marks of the cohort of students 2018/19 (C2019) with the cohort of the three previous academic years 2017/18 (C2018), 2016/17 (C2017) and 2015/16 (C2016) when the Matlab course was not delivered as "flipped".

3.4. Research question

To recall, this work deals with the two-variables functions, a mathematical topic that is not well studied in the literature, but it is relevant due to two main reasons: on the one hand, the topic is at the centre of many applications in modelling natural and social phenomena, on the other hand, students have difficulties in dealing with such topic.

Hence, our research questions are: RQ1) *How can we support the conceptual learning of two-variables functions?* RQ2) *To what extent the new innovative learning may support the deep understanding of two-variables functions?*

4. The lesson on two-variables functions

In order to answer RQ1, we designed a lesson about the two-variables functions within the context of the new learning environment described above. This lesson was the fifth (over six) delivered in the Matlab course. The main goal was the representation and interpretation of three-dimensional mathematical objects.

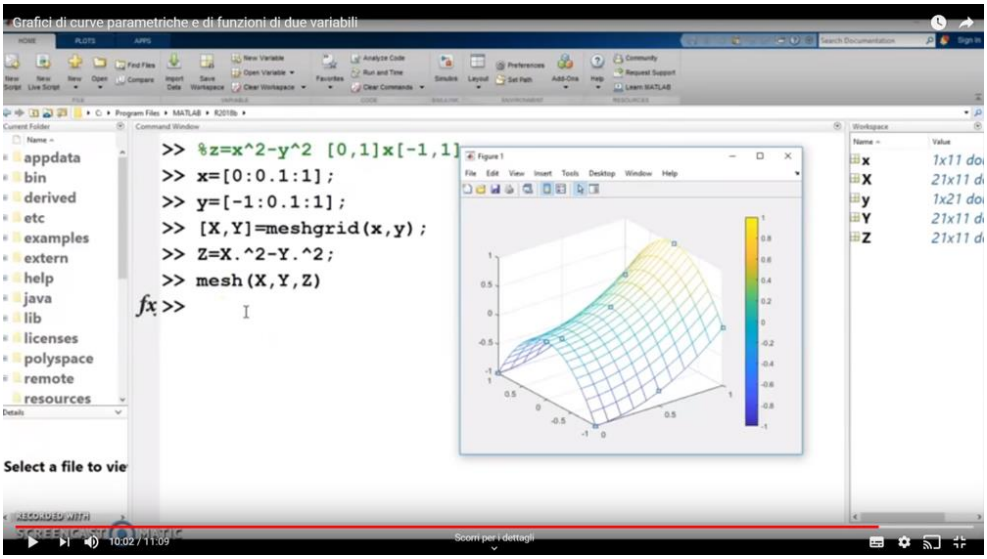

Figure 1. Overview of the instructional video about three-dimensional graph of a two-variable function z=x2-y2 using the command mesh. Source: authors, using Matlab and Screencast-O-Matic.

In the video, the instructor presents an exercise, for instance, "represent the graph of $z=x^2-y^2$" (see the green text in Figure 1). Then the task is unfolded step by step, presenting the new commands and remarking the mathematical aspect. Finally, once the graph is shown, comments about mathematics and coding were given to make it more effective.

Moving on the online quizzes, we used *google form* with the *quizzes* options. The answers of the students allowed to argue that a good understanding of the topic is achieved since the average score was 6.32 out 8. However, some issues emerged: one is related to the use of a new tool, the so-called "instrumental genesis" (see, for instance, Rabardel, 1995), the other one concerns the conceptualization of the domain and its sampling.

The in-presence lesson was designed from the issues mentioned above. More precisely, at the beginning of the session, the instructor comments about the answers and addressed the issues. As regards the issue about the domain, she reported the lecture notes that accompany the course and clarified the use of the sample in terms of density. Then, students were invited to work in groups to solve three kind of tasks act to clarify the issues manipulating the mathematical objects: 1) direct application of procedures shown in the videos; 2) graphical representations in which the choice of the grid was crucial; and 3) integration of both mathematical content and software tool (e.g., calculation of a tangent plane).

During the lesson, the instructor noticed that students have watched the video, read lectures notes and knew the commands. At the end, the professor addressed the main difficulties and misconceptions, avoiding to provide solutions for the tasks because students were expected to compare and discuss within and among groups.

5. Data analysis and results

In order to address RQ2, in this section we report the data relative to students' performance and their answer to the satisfaction questionnaire relative to the C2019.

The average mark to the Matlab test of the students in C2019 is 24.19 (out of 30), which is better than the previous years since in C2017 is 22.37 and the others are below 20/30 (18.55 in C2018 and 19.96 in C2016). The employed ANOVA test shows that the four cohorts are statistical different (p-value≤1e-6), in particular C2019 strongly differs from C2018 and C2016 (p-value<1e-6) and weakly from C2017 (p-value=0.05). Looking closer at the marks distribution, see Table 1, we observe that the percentage of students who gain the lowest levels in C2019 is quite different to C2017, while those who gain the highest levels (A and B) is slightly the same in C2019 and C2017. We can argue that a shift of the performance occurs from the lowest level (E and D) to the medium one (C).

Table 1. Percentage of students divided into five levels. The distribution concerns the Matlab tests related to the four years under investigation.

	C2019	C2018	C2017	C2016
Level E: Mark≤ 14	5.68%	32.95%	18.75%	23.76%
Level D: 15 ≤ Mark ≤ 17	10.23%	9.09%	5.21%	13.86%
Level C: 18 ≤ Mark ≤ 23	23.86%	23.86%	17.71%	26.73%
Level B: 24 ≤ Mark ≤ 29	48.86%	28.41%	47.92%	25.74%
Level A: Mark=30	11.36%	5.68%	10.42%	9.90%

Source: Authors (2020).

Now we focus on the two tasks of the Matlab test (Task 5 and Task 6) that refer to three-dimensional representation of a function $z=f(x,y)$. The two tasks aim at prompting students in conceptual understanding because they require students to distinguish maxima/minima (along *z-axis*) from the range of the domain (along *x-axis* and *y-axis*). Moreover, the tasks require to distinguish and compare between global and local maxima/minima, and more generally between open and close sets. The students' marks in these two tasks along the last four years reveal that in C2019 students perform better for both tasks. Indeed, the average marks for Task 5 (max 5pts) were 3.62 in C2019, 2.57 in C2018, 3.5 in C2017 and 2.46 in C2016. Similar behavior for Task 6 (max 5pts): 3.59 (C2019), 2.52 (C2018), 3.36 (C2017) and 2.89 (C2016).

As regards the MAG test, we consider the exams passed by September 2019, and the relative exam mark averages. The number of students enrolled in C2019 MAG course is 196, and 99 (about 50%) students passed the MAG exam with an average mark of 25.9 out of 30. However, the number of Matlab certificate obtained is 110, among them 81 students (about 74%) have passed the MAG exam with an average mark of 26.5. We can infer that 18 (99-81) students have passed the exam but have not gain the Matlab certificate, those 18 students' average mark is worst (23.2/30). Since the difference is about 3 points, can we conclude that the new learning environment for the Matlab course had a reinforcing impact? Firstly, we recall that the MAG grade is influenced by the extra-bonus due to the Matlab test, which contributes for just one point on average in MAG grade C2019. Therefore, we can infer a good mark in Matlab test influences the performance in MAG exam. Moreover, in the previous year 2017/2018, attendance at Matlab course was far lower and, even though the percentage of students who passed the exam by September (C2018) was exactly the same (about 50%), their final grade average was 23.90, exactly two points lower.

Finally, we report the most significant answer related to questions of the satisfaction questionnaire. Q1 was about what students liked most about the course: the 38% of the

students liked the new approach (e.g., work in groups during the in-class moment, and the link between the software and the mathematical content); the 36% liked the content, in particular, visualizing three dimensional objects and to have a deeper understanding of two-variable functions; the other appreciated the materials of the course (videos, lecture notes, online quizzes). Finally, answering Q2, most of the students would have suggested the course to their friends, because they appreciate the Matlab course and a software itself as an instrument to support their studies more in depth.

6. Conclusions

The focus of our research is on how to support the students' conceptual understanding of two-variable functions (RQ1) and to what extent this support can influence the conceptual understanding (RQ2). In particular, we are interested in developing a deep understanding of the topic resorting graphical representations using Matlab software. To this end, we designed a new learning environment according to the flipped learning methodology. The results of our investigation reveal that the new learning environment, that is the group work activities during the in-class moment paired with the instructional video and the quizzes, reached the goal of supporting students to the conceptual learning of two-variables functions. More precisely, the out-of-class moment was effective both in activating the students thinking and in sharing an instrument that the professor and students know and can use (Andrà et al., 2019). Moreover, the possibility to gain extra points for the exams prompted students in engaging the out-of-class activities and in attending the in-class moment, that effect their conceptual knowledge of the topics. In this way, emergent technologies sustain the students' deep understanding of a challenging topic. Finally, we conclude adding that this approach can be used in other STEM topics with the appropriate adjustment.

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Scientific Discourse: Can Our First-Year Students Express Themselves in Science?

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Abstract

Scientific discourse is a specialized, semantically dense language used to formulate clear, objective arguments around experimental results. However, science classrooms are practically void of scientific argumentation and this important skill is rarely modelled or developed in these spaces. Yet, students are expected to engage with complex disciplinary texts and then demonstrate their mastery of scientific subject matter using appropriate scientific discourse. Students find this extremely challenging and many are implicitly excluded from successful engagement with the subject.

The aim of our study was the assessment and development of first-year biology students' scientific discourse skills through collaborative pedagogy, to make aspects of biology discourse explicit to all students. We drew on Legitimation Code Theory's concept of semantic density, which considers complexity of meaning, to design a learning opportunity and then analyzed selections of students' summative assessments.

Results showed profound variation in the proficiency of the students' scientific vocabulary and language functions, and the discourse of the school and first-year biology textbooks. We therefore argue for science pedagogy that would allow students time and opportunities to mindfully engage with complex disciplinary text and then demonstrate their mastery of their learning using appropriate scientific discourse.

Keywords: *Science discourse; skills; Legitimation Code Theory; semantic density.*

1. Introduction

Scientific discourse is a semantically dense specialized language (Marshall & Case 2010; Ambitious Science Teaching 2015) as it involves argumentation which proposes rational explanations of empirical data. Scientists use language in a very specific way to present their findings, construct their arguments and probable explanations, share ideas and draw conclusions (Krajcik & Sutherland 2010).

Current science classrooms, however, do very little to model scientific practices or develop its specialized discourse. Most still follow a traditional lecturing format where instructors tend to do most of the communicating, not encouraging participation in scientific argumentation, sharing of ideas or understanding (Ambitious Science Teaching 2015; Archila *et al*. 2018). Students, however, need to become familiar with and skilled in using the specialized language and argumentation in science. Educational researchers therefore petition for the "rules of the game" to be made explicit to the students. This is why more opportunities are needed for students to engage with the language, practices, "values and ways of thinking" in science. If not, they will implicitly be excluded from successful engagement with the subject (Marshall & Case 2010; Case *et al*. 2013). Science lecturers are after all the "insiders" of their discipline, and as such have a responsibility to allow their students, the "outsiders" entry into the disciplinary community and its practices, by teaching them "the rules of the game" (Marshall & Case 2010). The code of conduct in science should thus be taught in science classrooms by modelling its "ways of reasoning", practices and the use of science discourse (Ambitious Science Teaching 2015).

McNeill *et al*. (2005) showed that scientific discourse is demanding for the majority of students, even for English-speaking students writing in their home language. It is therefore necessary to also consider the impact of students' general language proficiency on their ability to use scientific discourse. In many higher education environments (such as South Africa), a large proportion of the students do not speak English at home, although many are instructed in English (Jacobs 2007; Archila *et al*. 2018). According to Boughey (2002), problems surface when students struggle to "manipulate the forms of the additional language in a way that would allow them to receive and pass on the thoughts developed in the disciplines." Some authors consequently argue for a pedagogy that will recognize that students may not have the necessary language skills required to succeed in some disciplines such as the sciences (Hurst 2010; Kirby 2010). Moreover, Maton (2013) pointed out that there is often a disconnection between complex disciplinary reading which he termed "high stakes reading", and the production of appropriate discourse, also known as "high stakes writing". Thus, students need to attain a certain level of language proficiency for them to gain epistemological access in general (Valencia 2014). This challenge led many institutions of higher education to introduce academic literacy (AL) components to their undergraduate offerings, with free-standing modules being the most dominant format (Boughey 2002;

Jacobs 2007). There are however a substantial number of papers that argue AL being most effective when part of a collaborative pedagogical approach, thus where AL practitioners and disciplinary specialists collaborate to develop language skills within the disciplines (Boughey 2002; Jacobs 2007; Case *et al*. 2013).

Science students need to be given opportunities to develop and practice their general language proficiency, but also fundamental skills in science, including argumentation, the use of evidence to support knowledge claims, constructing hypotheses about scientific phenomena and writing up experiments according to scientific procedures. Such pedagogy involves students in metacognitive activities where they have to consider how to communicate their scientific thinking, while also reflecting and clarifying their thoughts in the process (Institute for Inquiry 2015), thereby developing their discourse while improving their scientific reasoning (Dirrigl & Noe 2018). The aim of this study was to gain insight into first-year students' use of scientific discourse and explore ways to develop this fundamental skill. Furthermore, we aimed to gain insight into how lecturers can support students' development of scientific discourse by assisting them in the transition towards higher levels of discipline complexity and content volume.

2. Theoretical Framework: Legitimation Code Theory

Legitimation Code Theory (LCT) is a social realist framework that considers knowledge practices. It is a multidimensional toolkit that offers different dimensions to analyze particular sets of organizing principles, also known as legitimation codes, which underlie these practices. LCT conceptualizes complexity of meaning as *semantic density* (Maton 2013, 2014a, 2014b).

Scientific discourse represents complex condensed meaning and therefore strong *semantic density*. Moreover, *semantic density* also conceptualizes complexity in terms of the condensation of meaning within a practice, and furthermore explores the relationality of meanings. Thus, scientific terms or concepts that have a number of relations to other meanings (also known as a 'constellations' of meanings), represent stronger semantic density. Studies showed that in knowledge practice such as pedagogy, recurring shifts between more complex and simpler meaning (stronger and weaker semantic density), also known as *semantic waves*, are essential to support cumulative knowledge building for all students (Maton 2013). Furthermore, the use of complex language in discourse is also associated with these semantic shifts (Martin 2013).

The rationale of this study was therefore to use the concept of *semantic density* to assess students' science discourse, but also to teach these newcomers the "rules of the game" within the discipline, and thereby develop their scientific discourse, prior to summative assessments when well-developed scientific language and writing is expected.

3. Methodology

3.1. Project-based, Collaborative Pedagogy as Learning Opportunity

We identified a specific section of a first-year biology curriculum where students typically find it difficult to engage with their first-year textbook and then formulate their understanding using appropriate scientific discourse during summative assessments. We decided to follow a project-based learning approach (PBL; Lee *et al.* 2014) to allow students time and opportunity for engagement with this relatively new level of discourse before having to demonstrate their understanding and proficiency during a summative assessment. To further model the importance of language skills in scientific writing to these first-year students, the project was implemented as a collaboration between the biology lecturer and the academic literacies lecturers from the Language Center at Stellenbosch University (collaborative pedagogy; Jacobs 2007). Following this learning opportunity, six randomly selected students' test papers from a cohort-representative range of achievement levels were used to perform the semantic density analysis. This process involved assigning each word in the students' discourse to a category in the translation device with an assigned numerical value (Figure 1), to reveal the semantic profile of the discourse. The semantic profiles exposed the students' use of appropriate scientific discourse, varying between complex condensed meaning and simpler meaning of everyday discourse, thus semantic waves. Data from one of the analyzed concepts is presented in this paper: the description of the eukaryotic nucleus.

3.2. Translation Device for the Analyses of Epistemic Semantic density

Maton and Doran (2016) proposed an extensive translation device for discerning how epistemic–semantic density (ESD) realize in discourse (Figure 1). This translation device allows us to distinguish between higher-level scientific concepts that represent very complex meaning, and more mundane talk (simpler meaning) in discourse. Thus, it can be used to analyze the complexity of meaning expressed by the words in the discourse, and, how meaning may be added or increased through combining words with additional words. The translation device therefore provides an indication of the relative complexity of meaning or *semantic density*, at the level of words and wording.

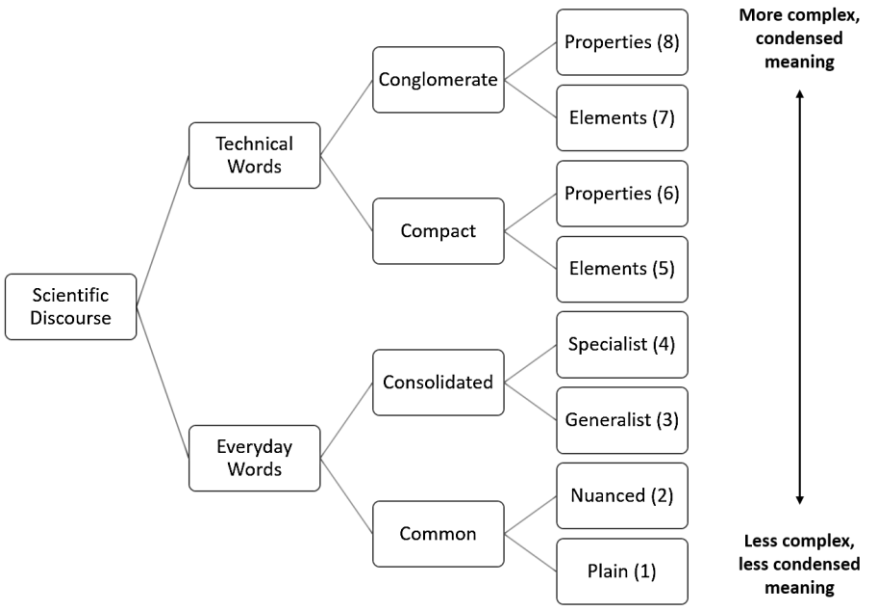

Figure 1. The wording tool (Maton and Doran 2016) for the analysis of complexity of meaning, also known as epistemic semantic density. The device shows the range of categories of words, varying from simpler meaning (bottom) towards complex condensed meaning (top).

4. Results and Discussion

Our analyses of the students' biology discourse showed that their proficiency varied substantially across the group as shown by the longer and shorter bars in Figure 2. Firstly, it became evident that the scientific vocabulary of the students varied substantially, with some students showing mastery of the content terminology (complex meaning), as well as the ability to demonstrate how these terms relate to one another within constellations of meaning. Also, these more proficient students (students 4 & 5) were able to "unpack" the complex meaning systematically as indicated by the longer bars in Figure 2, as they were able to use more discourse in their descriptions. In contrast, students1 to 3 struggled and did not display adequate command over these power words and/or could not explain relations and the constellations of meaning for the greater topic. From these findings it became clear that the students have to be made aware of the much needed disciplinary vocabulary they first need to master, in order to construct powerful scientific discourse and thereafter, how these power words relate to one another. In response to these findings, the succeeding cycle of the project was amended to include two additional stages: (1) the students had to read through a given section in their first-year textbook and then, within their groups, prepare a list of the terms (power words) needed to describe certain concepts. (2) This was followed up with group discussions and the construction of concept maps for each bigger concept, e.g. the eukaryotic

nucleus. Concept maps has been shown to lighten cognitive load during learning (Kinchin 2017) and were meant to elucidate the constellations of meaning by revealing how these terms relate to one another. The group discussions were meant to encourage "science talk", which has been found to be cognitively less demanding than science writing and therefore good preparation for the writing part (Institute for Inquiry 2015).

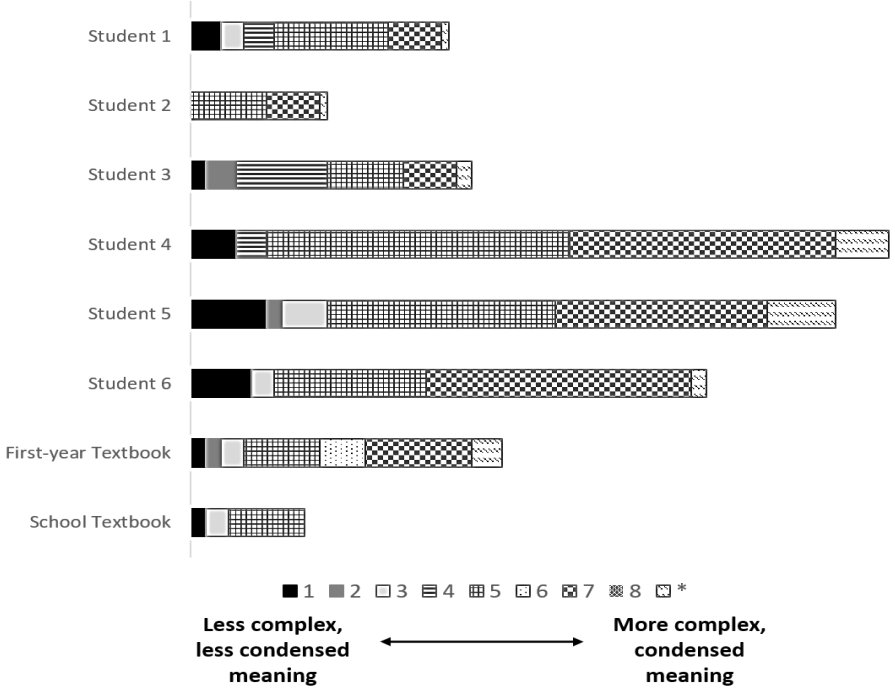

Figure 2. Semantic density analysis of students' discourse, as well as the school and first-year textbook. The bottom of the bars (towards the left) shows the proportion of simpler words used, progressing towards the most complex words at the top of the bars (towards the right).

When we considered and compared the discourse of the school and first-year biology textbooks (Figure 2), we found rather thought-provoking disparities. An academic stretch was obviously expected from the school to the first-year textbook, but the extent thereof was not anticipated. Our analyses exposed the magnitude of this gap and provided much needed insight into why students often grapple with the content and style of their first-year textbook. Not only is the volume substantially higher than that of the school textbook, but the increase in degree of complexity, as well as condensation of meaning, is significant. Moreover, this text-book's discourse is exceptionally condense with very little "unpacking" of meaning as shown by the compactness of this bar in Figure 2 (compared to students 4 to 6). Lecturers are mostly unaware of this extreme, steep increase in complexity. Students with proficient

language skills and sound disciplinary background seem too able to navigate this transition, but a significant proportion of students find this gap very problematic. Educators should therefore be aware of this phenomenon and explore ways to assist first-year students during this transition when new skills need to be developed to allow epistemological access and learning for all students.

5. Conclusions

Academic discourse, including science discourse, uses 'power words and grammar' to package the knowledge of their fields into text (Martin 2013). Moreover, Biology and all other disciplines are characterized by their own unique genres and students need to develop skills to master the unique power compositions of each discipline to know how to scaffold and organize these genres for discourse and especially assessments. We believe that this study brought some aspects to light: Firstly, the are startling differences between the school and first-year biology textbooks in terms of volume, complexity and condensation of meaning. The gap between these two resources is substantial and educators need to be aware of this to assist students in this transition. Secondly, the variation in the proficiency and command of the students in terms of scientific vocabulary is noteworthy, as well as their ability to manipulate the forms of their additional language in a way that allow them to receive and pass on the thoughts they have developed in Biology. These students need time and opportunities to practice using the specialized language of scientific discourse. And finally, the scholarly approach of "collaborative pedagogy" (Jacobs 2007) revealed the importance of academic literacy, and how it contributes to the development of the fundamental skill of scientific discourse in the students. We believe that learning activities such as the one featured in this study, contributes to the development of students' scientific discourse, but also their identities as future scientists.

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A concept of a mainly digitalized course on control theory including problembased practical units and digital supported exams

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Abstract

This paper decribes the concept of a course on control theory as a minor subject in the department of electrical engineering at the OTH Regensburg. The basis for a new concept is the idea of contructive alignment. The whole teaching module is devided in two blocks. The first block contains the teaching of the knowledge about control theory with an integrated approach for lectures, exercises and practical sessions. In the second block the students attent a practical work package to have the possibility to applicate and deepen their knowledge. To foster active participation the students are asked to document and reflect their work with the course context in an electronic portfolio. The exam of this module consists of three parts with respect to the different competencies obtained during the module.

This concept develops not only the knowledge on control theory but personal and social competencies which are of growing interest. The aim of the paper is to present the idea of the concept. Following papers will illustrate the development process and the results obtained later on.

Keywords: *constructive alignment; integrated approach; knowledge based working unit; electronic portfolio; develop competencies.*

1. Introduction

A digitalized concept for teaching control theory as minor subject with an integrated approach for lectures, exercises and practical sessions in the department of electrical engineering at the OTH Regensburg was established by the author in winterterm 2016/17. The concept uses activating methods like blended learning and possibilities of digitalization of teaching implementing Just in Time Teaching and Peer Instruction. The basis of this concept is the idea of constructive alignment. [Köhler, Th., Rösel, B. (2019)]

In winterterm 2019/20 a new course of studies was found on the department of electrical engineering at the OTH Regensburg. This course contains control theory as well, but due to a different set of courses the control theory can be set up on a higher level. Thus the concept presented here is based on the experiences obtained with the concept shown in Köhler and Rösel (2019) but contains additionally a three-week problem based practical work package. Furthermore the students are requested to work with a digital portfolio to document their working results and reflect their own work. The whole module is worth seven credit points.

The exam of this modul consists of three parts – a pre-test based on a concept inventory on signals and systems, a classical theoretical exam where the usage of the digital portfolio as exclusive resource is allowed and finally the outcome of the practical work package.

2. Teaching concept

2.1. Development of the concept

The development of the concept for the new module of control theory started with the definition of learning objectives for the whole module based on the learning objectives of the module started in winterterm 2016/17 by taking into concideration what students already learned in the first three terms of their studies. It was an aim to achieve a strong relationship between theoretical concepts and their practical relevance. Consequently there are lessons to impart theoretical knowledge, exercise units to recognize the practical use of this knowledge and practical work units to improve the understanding of the theory. To achieve that aim a structure for the whole teaching module was created giving a defined sequence of lessons, exercises and practical work shown in figure 1. This structure formed the basis for the acquisition of learning objectives for every lecture, classified according to the taxonomy of Biggs (2003). Furthermore each learning objective was associated with one of the following aspects: technical, methodical, social or personal.

According to the idea of constructive alignment the classification of learning outcomes was important for the decision which content should be dealt with which didactic approach.

To foster active participation during the whole module the students are asked to document and reflect their work with the course context in an electronic portfolio.

The whole teaching module is divided into two blocks – the teaching of the knowledge about control theory with an integrated approach for lectures, exercises and practical sessions and the application and deeper routing of this knowledge with a problem based practical work package. Both blocks consist of several units.

The first two units of the module are used to explain the didactic concepts, to make the participants familiar with the digital portfolio and to do the pre-test. Refering to Figure 1, this two units are marked with greek letters.

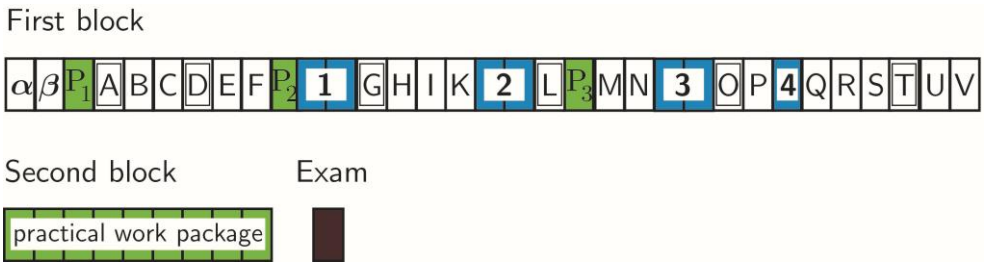

Figure 1. Structure of the whole teaching module with lessons (latin letters, with frame – blended learning unit), exercises (numbers on blue ground), practical work units (PX on green ground) and the problem based practical work package. Each frame represents on session of 90 minutes.

2.2. Integrated approach for lectures, exercises and practical sessions

The first block of the module adopts the concept as described in Rösel and Köhler (2018) and Köhler and Rösel (2019). This concept uses activating methods like blended learning and possibilities of digitalization of teaching implementing Just in Time Teaching and Peer Instruction. Just in Time Teaching or JiTT is a strategy based on several principles of pedagogical best practice. In the concept described in this paper, students must read a specific teaching text before a blended learning unit. Furthermore, it is required to answer several questions regarding the content of the text. The decision which content is taught with a JiTT strategy depends on the level of learning objective in a technical or methodical aspect. The highest level of learning objective was the essential criterion for this decision. That is why the most difficult content can be specifically adopted by the lecturer to each group and discussed during the attendance phase of the blended learning unit. Thus students attend class well prepared and the lecturer is primed for this particular group of students while attending class, as stated by Gavrin (2006).

After more than four terms experience with this integrated approach it can be stated that participants complain about the higher effort at the beginning of the semester. But then up to 80% read and work through all teaching texts or leave out only one text. Teaching evaluation

shows an substantial improvement especially regarding the categories “interest for the course” and “increase in knowledge”. The self-assessment of the students shows furthermore that they feel more competent regarding methodical and professional competencies which leads to a higher satisfaction of the students regarding the teaching method.

The teaching texts were written by the author of this paper based on several approved literatur for control theory. By that the possibility of adopting the texts to the specific needs of this particular module is given and additionally students have the opportunity to become familiar with different textbooks. Each teaching text has the same structure and is roughly six to eight pages long. The teaching texts are given to the participants at a dedicated eLearning platform of our university. This starts the online phase of a blended learning unit. The students need to read the text during their self-learning time before the attendance phase. Furthermore, they must answer questions belonging to the text during the online phase. The answers have to be delivered at least 24 hours before the attendance phase starts by using the eLearning platform.

There are questions testing a basic understanding of the content as well as conceptual questions or exercises. Furthermore there is an open question asking if there are still issues outstanding. If this is the case, the participants may ask their question. If there is no issue open, they shall give a statement on the most important message in the text. The evaluation of this open question from the students must be done by the lecturer. The attendance phase starts with a summary of the correct answers of the questions given to the students. But the questions and statements from them to the final open question form the main part. The questions raised by the students present a new viewpoint for the lecturer, providing the possibility to explain what the participants really want to know and not what the lecturer thinks they may need. As a result, the number of participants in the attendance phase is equal or even higher than in classical lectures. The attendance phase may end with additional conceptual questions to be discussed in class using Peer Instruction. Peer Instruction or PI is an interactive teaching technique that promotes classroom interaction and thus complements the idea of JiTT, as stated by Watkins and Mazur (2010).

In the concept presented in this paper not every communication of theoretical knowledge is done by a blended learning attempt, as there are classical lectures as well. The decision which content is provided with which didactic approach depends on the level of classification of the learning outcomes. Based on four terms of experience a ratio of 3 to 1 of classical lectures and blended learning units seems to be an optimum regarding workload for students and lecturer. Refering to Figure 1, lessons are marked with a letter, the blended learning units have an additional frame.

The exercise units are placed on the end of a certain theoretical chapter to recognize the practical use of the content discussed in this chapter. There are tasks given to be prepared by the students and to be discussed during the exercise units. To ensure enough time to discuss

the tasks there are two successive exercise units planed for some chapters. Refering to Figure 1, the exercise units are marked with numbers on blue ground.

There are three practical work units during the first block of the module. Refering to Figure 1, this practical work units are marked with "P_X" on green ground. This units take place during a normal teaching unit of 90 minutes focusing on one specific aspect discussed in the lectures before. The aim of these units is to improve the understanding and to recognise possible deviations between theory taught and the practical behaviour of systems. As the aim is a deeper understanding of the topics discussed in the lectures before there is no obligation to attend these units. The feedback of the students regarding this integrated approach is very good. Normally, more then 80% of the attendants of the lectures participate the practical work units as well.

2.3. Problem based practical work package

The first block is followed by a second one, a set of problem based practical work units covering three weeks during the semester. As there are three lectures per week within this module there are nine lectures to work on the problem. Refering to Figure 1, this practical work package is marked as one block on green ground.

The students work together in groups of up to six participants. First, they choose a system out of a set of possibilities given by the lecturer. The systems are mainly real objects such as small vehicles, water tanks, inverted pendulum, not simulation models. The task is to analyze the system and to develop a control for it. The concrete formulation of the task of the own group is the first challenge in this work package. The aim is not necessarily a proper control but three weeks of intensive work with the system choosen. Maybe one group is working hard on a proper model for its system so the design of the control might be less challenging. Another group might use a given model and focuses on different control strategies and their advantages and disadvantages. Thus, the students review the control theory given to them in the first block and try to solve a real problem with restrictions as they will have in their future life as electrical engineers.

The participants have to define and describe the task they plan to solve using the digital portfolio. The steps they do in the development process of the control has to be documented and reflected in this portfolio as well. Finally, they have to present their task and results to their peers by a presentation. Thus during the second block the students are forced to use the knowledge abtained in the first block. Additionally, they develop social and personal competencies which are essential for their future work.

3. Concept for the exams

The exam of this module consists of three parts with respect to the different competencies obtained during the module. That is a test based on a concept inventory on signals and systems, a classical theoretical exam where the usage of the digital portfolio as exclusive resource is allowed and finally the outcome of the practical work package. All three parts are mandatory to succeed in order to pass the whole module.

3.1. Concept inventory

As the base of control theory is signal and system theory it is obvious to define knowledge about signal and system theory as a prerequisite for a module on control theory. Thus it is planned to use a concept inventory on this field of knowledge.

Concept inventories measure the understanding of concepts rather than the ability to solve computational tasks by standardized tests. This method is well known and quite often used in the US but still relatively unknown in Germany. There is a concept inventory on signals and systems developed by Wage et.al. (2005), containing exactly the concepts needed for control theory. The author plans to apply this concept inventory to confront the students with their level of knowledge at the beginning of the module and to sensitize them to the need of this knowledge. The results obtained by this concept inventory make up 10% of the overall result.

3.2. Exam with digital support

The main part of the overall results are a classical theoretical exam on control theory examing the ability of the students to choose the right method to describe and solve a control problem by processing conceptual and computational tasks. This exam will take place after the three weeks practical work unit (refer to Figure 1). Thus students were able to consolidate and deepen their theoretical knowledge. This exam determines the overall results as it has a 60% share of it.

The tasks will be given on paper and the students have to work on it. But in contrary to other exams the usage of the digital portfolio as exclusive resource provided by an electronic device is allowed. The students are asked to document their learning process in a personal digital portfolio. This portfolio might content all teaching texts and the related answered questions to each text as well as all tasks concerning control theory worked on during the whole module and processed parts of the script. Thus the personal portfolio shall be structured and developed by each student according to his or her personal need in order to give the best support during the exam.

3.3. Presentation of the results of the practical work package

The student groups working together on one control task during the practical work package shall present their self-imposed task and the results obtained to their peers. Therefore they shall create a special site in their digital portfolio. This site and the presentation will be evaluated using a rubric. A rubric is a evaluation matrix where several aspects of a task can be marked in a range of points. The outcome is a number of points as a sum of all aspects.

To improve personal and social competencies this rubric will be filled out not only by the lecturer but by students as well. This will be done at the last unit of the practical work units. The actual grading will be given by the lecturer as a mean value of the rubrics. This third part of the exam has a 30% share of the overall result.

4. Implementation plan and expectations

The first ideas regarding this concept were developed during the setup of the new course of studies. Based on the concept presented in this paper the details as learning texts, working and examination documents will be worked out during summer term 2020. Additionally, some technical questions regarding the digital portfolio and its usage in an exam have to be answered. In winter term 2020/21 some parts of the concept will be evaluated and tested with volunteers and finally in summer term 2021 the module will be started for the first time.

The new concept described in this paper is based on the experiences with the integrated approach described in Rösel and Köhler (2018) and Köhler and Rösel (2019). The author expects that students accept the additional workload because they recognize the positive effect of continuous work during the semester. The problem based practical work package simulate a real life problem leading to a deeper understanding of control theory by directly implementing it. Furthermode the module improves social and personal competencies of the students which are essential for their future work.

As usual the participation of each student on every lesson is not mandatory but of course highly recommended. The author expects a high participation rate and satisfaction with the module as students normally appreciate courses giving them the possibility to work like in their future job life.

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Teaching Security in Introductory C-Programming Courses

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Abstract

The challenges in the age of digitalization demand that universities qualify their computer science and engineering graduates well with respect to IT Security (information technology security). In engineering education such lectures are often offered as an elective subject, only. We propose to teach security aspects with respect to robustness and correctness already in the introductory programming course and therefore to cover at least parts of the overall field of IT Security as a compulsory subject for all students. The paper describes the integration of some rules and recommendations from the SEI Cert C Coding Standard into our introductory C programming course and discusses our experience with the course over the last two years with respect to its contents, realization, evaluation and examination.

Keywords: *Teaching Programming; IT Security; Cybersecurity.*

1. Introduction

In the context of digitalization, computer security is playing an increasingly important role. Since the turn of the millennium, the ACM (Association for Computing Machinery) and the IEEE (Institute of Electrical and Electronics Engineers) have been calling for computer science education to be further adapted to secure software development and cybersecurity, compare ACM and IEEE (2016). For computer science degrees, this topic is usually covered in advanced courses such as *IT Security* or *Secure Software Engineering*. With respect to engineering education, *IT Security* is often an elective course. Analysing the module descriptions for the undergraduate degree programs *Electrical Engineering and Information Technology* of 17 universities in Bavaria shows that only 4 programs request IT security as a compulsory subject in 2020. This represents less than 24 %. About 35 % of the university degree programs offer elective courses, resulting in 41 % not covering such subjects at all. Due to the significance of the topic Williams et al. (2014) suggest introducing security aspects already in introductory programming courses. This approach could simplify the integration of IT security aspects in Bachelor degree programs that currently lack such content. As our analysis relies on the module descriptions only, we expect that some introductory courses already embed these subjects without having mentioned it in their description.

We have integrated at our university IT security aspects with respect to robustness and correctness in our introductory C-programming course for our electrical engineering degree program in the last two years and propose the idea that describing security issus can arouse the students' interest and might even help with understanding the execution of a computer program. In this paper we describe our experiences with the course, present the students' evaluation of the course and discuss the assets and drawbacks.

2. Related Work

An extensive set of rules, examples of vulnerabilities and instructions on how to properly program in C with security awareness can be found in the SEI Cert C Coding Standard (2016) by the Software Engineering Institute of the Carnegie Mellon University. However, the security subjects have to be carefully chosen, to fit in with the scope of known concepts for the novice programmers. As Bandi et al. (2019) discuss, secure coding is often not covered by classical *IT Security* lectures. Therefore, dealing with security aspects in an introductory programming course cannot replace an advanced course on IT security; and vice versa. Subjects focus mainly on the aspects robustness and correctness, as required for secure coding and less on integrity or confidentiality, like e.g. cryptographic protocols, compare Williams et al. (2014). Another promising way to easily integrate IT security topics in the curriculum is a game based approach, compare e.g. Anvik et al. (2019).

Novice programmers often find unexpected ways to solve their programming issues. As Gómez-Martín et al. (2009) propose, teachers have to counteract the "but it works"-syndrome; meaning that some students fiddle through their programming assignments by trial and error and stop as soon as they think it fulfills the main requirements of the task. Such solutions are often open for many security issues, hard to maintain or to adapt. Applying security requires a more abstract and model-based thinking and to think outside the box. All of these competencies we would expect from students enrolled in engineering or computer science programs, but are rarely to be found, compare e.g. Zehetmeier et al. (2019).

The importance of teaching students programming with security awareness from the beginning is obvious, because it is difficult to adapt bad habits or to eliminate misunderstandings later. Furthermore, as Zhu et al. (2013) point out: many textbooks on programming provide little information on security or may even contain vulnerabilities. In addition, modern compilers print warnings about security issues, so students need to learn early how to deal with them. As compiler messages in general are "considered unhelpful" – compare Becker et al. (2019) – security diagnostics require further understanding.

Although previous research as e.g. by Williams et al. (2014) reports about successful integration of secure coding into introductory courses – even without changing the workload of the students, compare e.g. Bandi et al. (2019) – we have to keep in mind, that many students already struggle with programming itself and security aspects can also be seen as an add on. Still, IT security topics, cybersecurity, hacking competitions etc. arouse the interest of many students and might help to foster students' intrinsic motivation with respect to programming. We even propose that demonstrating security vulnerabilities might actually help with understanding the execution of a computer program.

3. Teaching Security within the Introductory C Course

Based on the SEI Cert C Coding Standard (SEI, 2016) we identified rules and recommendations, and derived use cases, that can easily be integrated into an introductory course. Exemplarily we describe two use cases we applied in the course and evaluated the results in the examination. We selected these two for the paper because both were tested in the course examinations. Overall, we addressed 17 rules of the standard in the lecture.

3.1. Use Case 1 – String Input Results in Buffer Overrun

Figure 1 shows a simple constructed example of a buffer overrun that bypasses a password check by overwriting the stack memory beyond the reserved memory for the user name. During the demonstration of the example it arouses the interest of students especially as we show an incomplete password check that will deny any user by just returning 0 (i.e. false), compare line 5 in Figure 1. Thus, the expectation is that the program will hang in an endless

loop requesting the proper password. As the program's output shows on the lower right in Figure 1, we can successful log in without entering any password by partly overwriting the contents of the variable checked because of an input beyond the reserved 12 characters. This results in skipping the while-loop and the password check in line 14 ff.

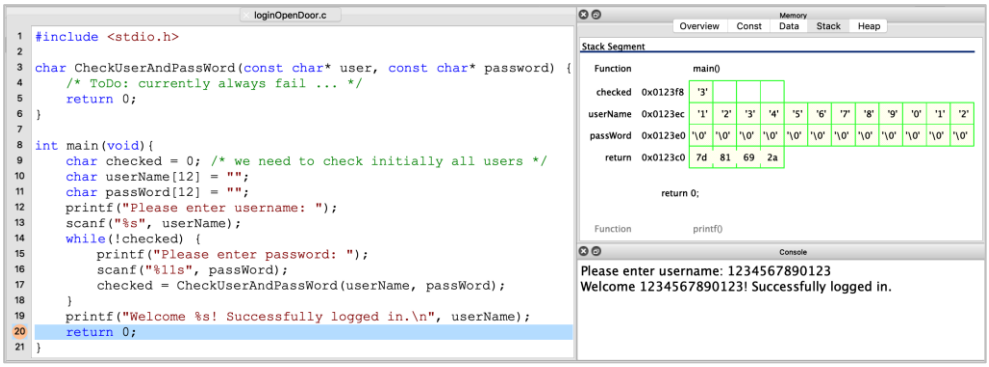

Figure 1. Example erroneous program to demonstrate a buffer overrun and to explain the memory model of fixed-length string arrays in C. Screenshot of the programming environment (Virtual-C IDE) as shown in the lecture.

The example can serve to demonstrate multiple issues. The vulnerability of software and the requirement to properly handle user input are both obvious. We show this example when learning how to read strings from the console. It also demonstrates the memory model of C with respect to local variables and fixed length arrays: local variables are assigned to addresses in ascending (or descending, dependent on the compiler in use) order. Thus writing beyond the reserved memory space of variable userName will affect the succeeding variable checked. Last but not least, we identify the defective instruction due to a compiler warning according to SEI Cert rule FIO47-C (SEI, 2016) in line 13, which is found in the parameters to scanf(): we have to explicitly define the maximum length to read (compare line 16), which is 11 characters due to the array size and because scanf() will automatically add a terminating character; thus we also repeat how strings are stored in C.

3.2. Use Case 2 – Proper Use of Input and Output Parameters

In the context of passing arguments to a function by the use of pointers, we discuss the concept of input and output parameters. While the first is used to pass information to a function, output parameters allow a function to pass information back to the caller. As a rule, an input parameter must be declared as const in order to prevent the function from modifying the information. The standard library according to ISO C18 implements all function declarations accordingly, thus we can read from the signature of a function, which parameters are input and which are output parameters. Figure 2 shows a misuse of that rule: a function calculating the length of a character string will also modify the string; both the stack contents before and after the call to this defective function are illustrated.

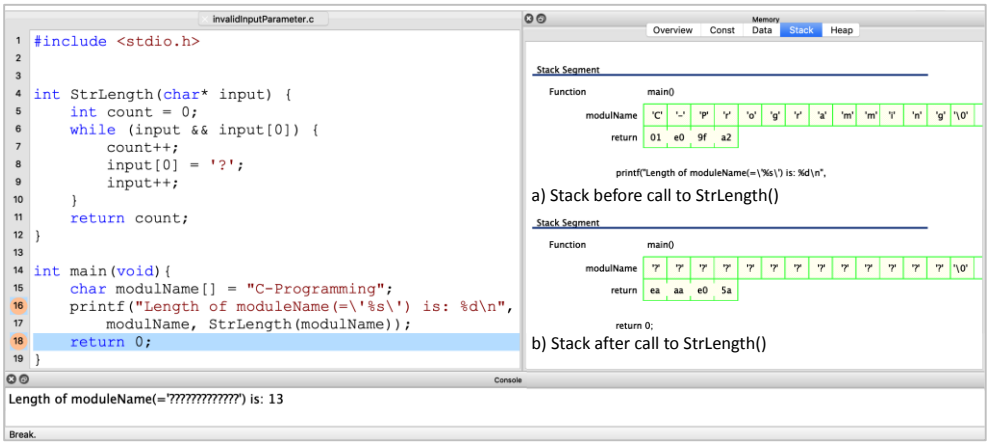

Figure 2. Example erroneous program to demonstrate wrong input parameter handling.

Although this example is obviously wrong, it shows that we should not call a function expecting an input parameter, which is not declared as constant. Especially as we usually use functions that were third party developed with no access to the source code. Declaring the parameter input as constant would lead to a compiler error and thus show the defective line of code (here line 8 which overwrites the string). As a side effect, we also learn about the parameter passing to a function: most students do not expect, that modulName has already been modified as the parameter seems to be passed to printf() before the call to StrLength() has been invoked.

4. Review of the Course

4.1. Examination

Adding security aspects to our introductory course had no directly measurable effect on the overall examination results. Still, the results were not inferior to the preceeding examinations, although additional subject matters were assessed in the examination: both use cases from Section 3 were expected to be handled properly and incorrect answers led to a lower final score. We analysed the impact on the examination results. For both course years, we took 81 exams into account; we excluded exams that left the corresponding tasks blank as we could not tell the reason (out of time or lack of knowledge). About 51 % of the students prevented a possible buffer overrun by limiting the input length (use case 1). Only one third of the students declared input parameters properly (use case 2). Interestingly, the percentage differs for students who failed the examinations 41 % of that group passed use case 2, while only 18 % passed use case 1. It is also noticeable, that students with good grades in particular answered these cases wrong, while the majority of students with

average grades answered them properly. An explanation could be that students with previous knowledge of C either found the security aspects less important, or that they did not attend the lecture and therefore couldn't achieve these points in the examination. That would confirm the statement of Zhu et al. (2013), that there is a lack of security awareness in existing programming courses and that textbooks still contain vulnerabilities.

4.2. Evaluation

Students gave us feedback with respect to secure coding on the following four questions, compare Figure 3:

A) Course contents regarding secure coding are very important.

B) Examples of security vulnerabilities deepens my understanding how C programs works.

C) Course content regarding secure coding complicate my understanding of C.

D) Compiler warnings on security issues are more distracting during programming.

We received feedback from 45 students. We also asked the students to self-assess their programming knowledge before the course and evaluated the results for two different groups: 16 % rated themselves as skilled programmers before the course (group 1), while 58 % have little or no previous knowledge (group 2).

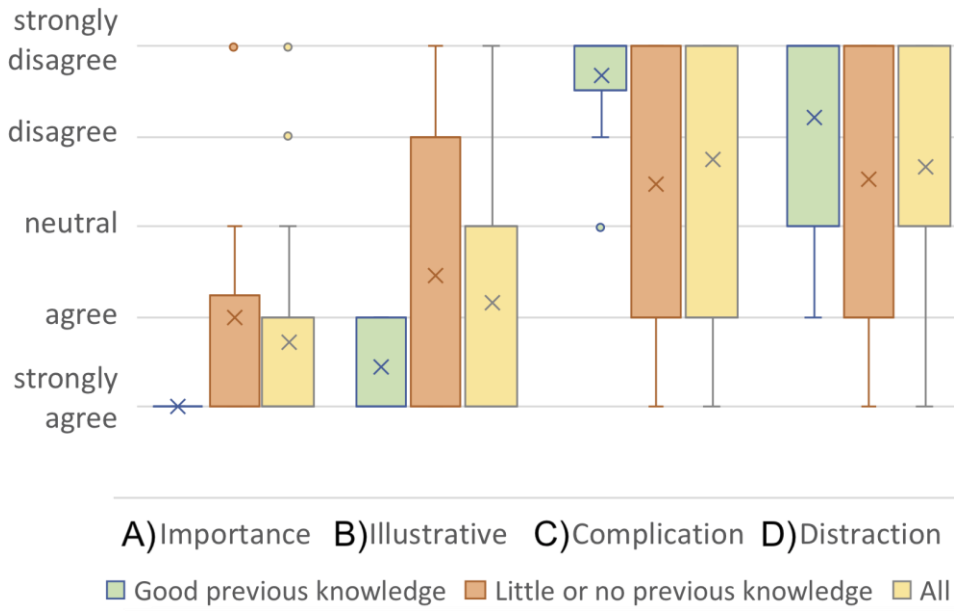

Figure 3: Results from the students' evaluation Questions A-D for the two groups and the whole class (5 grade Likert scale); the "x" represents mean values and "o" outliners.

Most students (83 %) were aware of the importance of security aspects in the C programming, compare Question A (Figure 3). Students with good programming knowledge (group 1) all agreed that examples of security vulnerabilities are helpful to explain how C programs are executed, compare Question B (Figure 3). The answer of the group 2 show a big deviation in their answer. Of course, knowledge on C and knowledge about possible vulnerabilities are closely interwoven: knowing the memory model of C allows to easily understand a buffer overrun. About 27 % of group 2 disagreed with our proposal that showing e.g. a buffer overrun helps to understand how C programs work. Still, 67 % of that group agreed with that. There is a big difference in answers between both groups with respect to Question C in Figure 3. While almost all students of group 1 disagreed that additional course content about secure coding complicates their understanding on C programming, about 33 % of the second group agreed. Some students even state in their evaluation, that this is an add-on, they have to learn for the examination. The answers to Question D showed the biggest deviation in both groups. Even some students from group 1 agreed that warnings about security issues distract them during programming. On the other hand, over 54 % of all students disagreed on this point. Becker et al. (2019) point out that more research is required for generating proper diagnostic messages by compilers, especially with respect to new learners. Future research should also include security related diagnostics.

4.3. Lecturer's Experience

Although the results in the examinations with respect to security issues were below the expectation of the lecturer, he gained positive experiences with these new subjects during the course. Showing short examples with surprising effects lightens the mood in the course and immediately initiates a discussion to debate several topics. As we found out in the first year, the examples need to be short and the surprising effect needs to be easy to grasp. If we expect too much knowledge about security, such examples will not have a positive effect even though they might be especially important for IT security. It is important to take enough time for the demonstration and the discussion of the examples. The best approach is to write the example live in the course, as students can follow the implementation better in such a reduced tempo and to stepwise fix the code to give an accurate solution. Otherwise it is hard for students to comprehend the meaning of the defective and the proper code and the learning effect is reduced to teacher's talk: "you should not do the following …".

5. Conclusion and Outlook

For two years we have been integrating security aspects into our introductory C programming course by discussing defective code snippets and correcting them, especially with respect to robustness and correctness. We see the need to foster the security awareness of our engineering students in order to prepare them for their future tasks in a more and more

digitalized world. We also found a lack in the engineering education in Bavaria with too little coverage of this topic in compulsory subjects and see our approach as one possible way to increase IT security awareness in engineering education. Properly selected examples like for instance the example of a buffer overrun (compare Section 3.1) can in addition to the security aspects also serve to enhance the understanding for the programming language; the majority of the course participants agreed on this in their evaluation feedback. From the lecturer's point of view, such demonstrations arouse the interest of students much easier compared to standard programming examples. In accordance with Bandi et al. (2019), we did not increase the workload for students in the course. But due to the importance of the topic and the positive experience, we plan to extend the weekly lecture hours for the course from 4 to 5 hours. This shall give more time to discuss these examples in more detail. Thus, all our engineering students get an introduction into computer security. Since 2019 we offer students having specialized in the field of applied computer technology an advanced compulsory module on computer security.

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The power of peer-review: A tool to improve student skills and unit satisfaction

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Abstract

Providing higher education students with opportunities to participate in peer-review feedback activities may facilitate interaction between students and enhance academic skills. Such activities are reported to help students transition from passive to active learners whilst increasing social connectedness and developing employability skills. This research aimed to evaluate student perceptions of a peer-review of assessment process offered in an undergraduate Health Science unit at Edith Cowan University in Western Australia, and their subsequent unit satisfaction.

Before students began the peer-review process, a sample assignment was used to coach them on how to provide constructive feedback. They subsequently prepared a draft of their assignment for peer-review, and then reviewed the work of another student. Pre- and post-surveys were administered to assess students' perceptions about the usefulness of the peer-review activity.

Thirty-two students completed the pre-survey wherein 94% (n=30) reported the peer-review coaching helped them prepare their own assignment and 85% (n=27) reported learning how to provide constructive written feedback. Twenty-one students completed the post-survey, 76% (n=16), reporting they modified their own assignment as an outcome of their peer-review participation. Many respondents also reported improvements in their critical thinking (76%; n=16) and written communication skills (62%; n=13). Overall unit satisfaction increased exponentially.

Keywords: *Peer-review feedback; higher education; assessment.*

1. Introduction

Effective feedback is important for student success (Wanner & Palmer, 2018). Providing effective feedback on student assignments is a significant issue in Australian higher education (Moore & Teather, 2013); ideally it should be considered a two-way conversation rather than a one-way communication process (Nicol, Thomson, & Breslin, 2014). Feedback has been described as a 'loop', whereby the process can be considered complete once the feedback results in improved performance, demonstrating that learning has occurred (Moore & Teather, 2013).

Although there is evidence that university students benefit from student-centred learning opportunities, these are not always provided in Australian universities (Wanner & Palmer, 2015). To prepare for future workplace roles, it is important that students are provided with opportunities to develop confidence in their work and be able to measure their competence against appropriate standards (Boud, 2015). To develop such skills, students need opportunities to both judge the quality of others work, and to compare their work with others work. One such mechanism for providing these opportunities is peer-review activities.

Giving students opportunities to receive and provide feedback to peers can improve student learning without increasing lecturer workload, moving students from passive to active learners (Wanner & Palmer, 2018), whilst increasing social connectedness (Crowe, Silva, & Ceresola, 2015), and social networking opportunities for some (Harland et al., 2017). Peer review not only leads to an improvement in students' ability to judge and improve their own work (Boud, 2015; Harland et al., 2017) but also develops employability skills such as critical thinking; collaboration; sensitive and constructive communication, while supporting independent, self-regulated learning (Moore & Teather, 2013). Students who engaged in peer-review processes demonstrated increased ability to provide constructive feedback; avoided common writing errors; experienced exposure to different ideas and perspectives (Gaynor, 2019); were more engaged with their work (Dowse, Melvold, & McGrath, 2018); and were provided with opportunities to reflect on the shortcomings of their work and subsequently improve it (Mulder, Pearce & Baik, 2014). Peer-review processes increased student awareness that feedback is available from others as well as the lecturer (Crowe et al., 2015; Harland et al., 2017), helping them to understand their work in relation to the standards required from the lecturer's perspective (Nicol et al., 2014). Yalch (2019) reports students who offered robust critique received higher grades for their own work.

Although there are many benefits for students who engage in peer-review opportunities, there are challenges. Students may perceive the time spent on peer-review as additional work that displaces other learning or teaching activities (Crowe et al., 2015). Students reported they found it difficult to: identify areas for improvement in the work of others; to write feedback (Moore & Teather, 2013); and were uncomfortable critiquing their peers' work (Harland et

al., 2017). Some felt the effort made to provide feedback was not matched by the feedback they received on their own work (Mulder et al., 2014). Students have also reported a lack of confidence in providing feedback, and those accustomed to traditional lecturer-led learning environments may struggle with the transition to learner-centred activities (Varaprasad, 2016). To simplify the peer-review process and ensure students enjoy a positive and beneficial peer-review experience, it is necessary to provide students with guidelines and criteria (Mulder, Pearce, & Baik, 2014), good support and structured processes (Harland et al., 2017), and opportunities to practice (Scherf, 2017).

The lead author is the Lecturer and Unit Coordinator for HST3100 Child & Adolescent Health, a third-year health promotion unit taught in the School of Medical and Health Sciences at Edith Cowan University (ECU) in Western Australia. Student feedback from the previous semester indicated a lack of clarity about assessment requirements and that the assignment feedback provided by the lecturer was not clear enough. A peer-review assessment was, therefore introduced the next time the unit was delivered. The original assessment tasks were changed to be 'scaffolded' in nature. That is, the original unrelated essay-style tasks were replaced with a 500-word rationale (addressing the subject of the peer-review process), which then formed the basis of the second assessment. The restructuring of the unit, including the scaffolded assessments in conjunction with peer review activities, required students from heterogeneous backgrounds to work together, exposing them to different ways of working and different writing styles (Wood, Bruner, & Ross, 1976). Scaffolded learning occurs when students can work on a small part of their assignment (in this case, the 500-word rationale), receiving feedback from their peers and the lecturer to improve their work for future assignments (Newman, & Holzman, 2013).

Peer-review processes were embedded in unit learning activities for Semester 1, 2019, and their acceptability and perceived benefit to students was assessed using pre- and post-surveys among on- and off-campus students enrolled in the unit. The overarching aim of this project was to improve student satisfaction with the unit, whilst evaluating students perceptions of the peer-review process and the student-reported outcomes associated with engaging in these learning activities.

2. Methods

2.1. Overview

The study design was based on a similar study conducted by Moore and Teather (2013). HST3100 students were asked to draft a 500-word rationale to support a proposed Health Promotion program on a health issue of their choice, relevant to child and adolescent health. Students were then asked to share their rationale with another student and provided with instructions on how to follow a structured peer-review process. Table 1 presents a structured

plan outlining the process implemented in the first six weeks of semester.

Table 1. Peer-review process

Step 1: Weeks 1 & 2	**Prior to the practice and actual review sessions** Students advised of the changes to the assignment tasks (as a result of student feedback) and advised they would be asked to complete a survey before and after engaging in the peer-review process. Students asked to introduce themselves to others in class, or via the discussion boards for online students, to negotiate with potential peers to review their draft assignment (Week 4).
Step 2: Week 3	**Prior to the actual review session** Students provided with the opportunity to practice peer-reviewing. This process involved: • Being provided with a sample assignment from the previous year and the assessment criteria to review the sample. • Lecturer provided coaching on how to provide constructive feedback. • Students reviewed the sample assignments *individually* and wrote feedback on the feedback template provided. • Students formed small groups to discuss and compare the individual feedback they had provided, and to reach consensus about the most appropriate feedback to provide (via discussion boards for online students). • Students completed a Pre-Peer Review Survey.
Step 3: Week 4	**The actual review session** Students brought copies of their draft assignment to class. Online students shared these via the unit discussion boards or student email. Students reviewed the draft assignment of one other student. Students were asked to provide considered, professional and respectful comments to their peers on the template provided. Students attached the completed template to the draft assignment, returned it to their peer and further verbal dialogue and clarification was encouraged.
Step 4: Week 5	**Post peer-review** Students were asked to consider the feedback they received from their peer-reviewer and advised to revise their assignments considering this feedback before submitting a final version for assessment.
Step 5: Week 6	**Follow-up** Students completed a Post-Peer Review Survey to assess the perceived value of the process.

2.2. Recruitment

All HST3100 students, both on- and off-campus, were eligible to participate in the evaluation of the peer-review process. Recruitment took place during class in Week 1, when the lecturer outlined the project and explained the extent of student participation. A live tutorial (recorded for students unable to attend) was hosted for off-campus students to explain the peer-review process and invite participation. On-campus students were provided with a written information letter to retain, and consent was embedded in the online survey. On-campus students who did not have access to an electronic device, were provided with a paper-based consent document, which was signed and returned to the lecturer. Off-campus students were provided with a written information letter issued via student email, and consent was embedded in the electronic survey.

2.3. Data Collection

Both surveys were based on the work of Moore and Teather (2013) and were assessed for face and content validity by the second author, an expert in research design, higher education assessment design and child and adolescent health. The surveys were administered electronically to all students via Qualtrics, and paper copies provided for on-campus students without access to an electronic device in class. Both surveys included closed and open-ended questions, but neither survey collected any identifying data, ensuring participant anonymity. In Week 3, the Pre- Peer Review Survey assessed students' prior experiences of peer-review; their experiences of the practice peer-review exercise; and their feelings about the actual peer-review process to be conducted the following week. The Post-Peer Review Survey was administered in Week 6, following submission of the revised assignment, and measured students' perceptions on the usefulness of the peer-review exercise on their own work and their feelings about engaging in similar activities in the future.

2.4. Data Analysis

Data from paper-based surveys were manually entered into Qualtrics and merged with the electronically collected data. The datasets were downloaded to SPSS and simple descriptive analytics assessed students' experiences before and after the peer-review exercise. Open-ended question responses were also collated in Qualtrics, and simple, descriptive analysis was conducted.

2.5. Ethics

Ethics clearance was obtained from the Human Research Ethics Committee at ECU (# 2019-00024). The peer-review exercise was an integral part of the first assignment and students were required to complete this. The completion of the Pre-and/or Post Peer Review Surveys was, however, voluntary. The data were stored securely on a university server, were password protected, and access restricted to members of the research team.

3. Results

3.1. Demographic Profile

The majority of students who completed the two surveys were enrolled in the Bachelor of Health Science degree on-campus (Table 2). Participation rates were higher for on-campus students pre-peer review (85%) compared to off-campus (25%), and post-peer review (53% vs 20% respectively).

Table 2. Student demographic profile Pre- and Post-Peer Review Surveys

		Pre- peer review task (n=32)	**Post- peer review task (n=21)**
What course of study are you currently enrolled in at ECU?	Bachelor of Health Science	62.50% (n=20)	52.38% (n=11)
	Bachelor of Education (Secondary)	21.88% (n=7)	23.81% (n=5)
	Other	15.63% (n=5)	23.81% (n=5)
Mode of study	On-campus	84.38% (n=27)	80.95% (n=17)
	Off-campus	15.63% (n=5)	19.05% (n=4)

3.2. Pre- Peer Review Survey results

Students were asked if they had previously reviewed another student's work, either formally (as part of a unit of study) or informally. The majority of students (78.1%, n=25) had previously engaged in peer-review activities and most of these respondents (96%, n=23) had been provided with formal guidance on how to conduct the peer-review by their lecturer. The main benefits of engaging in peer-review were identified as: helping students to reflect on the quality of their own work (72%, n=23); improving communication skills (62%, n=20); and learning how to collaborate with others (59%, n=19).

Some students identified concerns or anxieties about being asked to review the work of others, especially in terms of being able to provide constructive feedback. Other students viewed this as an opportunity to improve their own work by comparing it with the work of others and expressed confidence in their ability to provide '*polite and constructive feedback*'. When asked to describe their feelings about another student providing feedback on their draft assignment, some students expressed positive sentiments. They felt their peers would critique their work with '*honesty*' and the advantages provided through subsequent improvements would render the peer-review process beneficial. This peer-review experience was not viewed

as positive by all, and some participants noted their written English skills may make this experience '*uncomfortable*' or '*embarrassing*'.

Most students (97%, n=31) felt 'well-prepared' or 'somewhat-prepared' to review another student's assignment following the practice exercise (Table 3).

Table 3. Preparedness for peer-review following practice exercise

Level of preparedness	% (n)
Well-prepared	65.6 (n=21)
Somewhat prepared	31.25 (n=10)
Unsure	3.1 (n=1)
Slightly unprepared/ Completely unprepared	0.00 (n=0)

3.3. Post-Peer Review Survey results

Almost 90% of respondents reported enjoying the peer-review process. Three-quarters of respondents (76%, n=16) noted that the peer-review process helped them with their own assignment, 90% (n=19) modified their assignment as a result of the feedback they received, and 67% (n=14) modified their assignment as a result of the feedback they provided. The most useful parts of the peer-review activity were reported as receiving feedback (43%, n=9) or both, i.e., giving and receiving feedback (38%, n=8). Most students rated the quality of the feedback they received as excellent (71%, n=15) or average (24%, n=5).

Students were asked about other benefits of completing the peer-review activity, apart from improving their own assignment (Table 4). Critical thinking and written communication skills were the main benefits reported. The majority of respondents (81%, n=17) reported they would choose to participate in future peer-review activities, and 86% (n=18) agreed the activity should be included the next time the unit is offered.

Table 4. Benefits of engaging in a peer-review process

Benefits of peer-review	% (n)
My critical thinking skills improved	32.6 (n=16)
My written communication skills improved	26.5 (n=13)
My listening skills improved	18.4 (n=9)
My negotiation skills improved	12.2 (n=6)

Students were asked to respond to open-ended questions about parts of the peer-review process they liked or disliked. Five main themes were identified in these responses. Negative responses included the view that *'feedback [they received] wasn't helpful'*, since the reviewer might not fully understand the health topic being presented, while another student commented that the process added *extra time* to the completion of the assignment.

Positive feedback was far more common however, with students commenting that '*feedback = better marks'*; and that the process allowed them the opportunity to clarify and further focus their work. Learning from reviewing the work of another student included improvement of specific writing skills (*how to use joining words)*; how to provide constructive feedback, and improved understanding of the standard expected in the assignment through comparison of one's own work with that being reviewed. This participant quote captures the positive aspects of the experience:

> *I really enjoyed getting to see all of the different ways to write a paper, and how different everyone's train of thought works. I also enjoyed learning a bit about my peer review partner's topic.*

Use of the marking rubric, attention to sentence structure and readability were the key learnings from other students reviewing their work. Students made changes after their work had been reviewed, including editing, adding more information and closer attention to sentence and paragraph structure. This sentiment is illustrated in the following quote:

> *By peer reviewing another student's paper, I could see things that I liked structurally about their paper that I wanted to incorporate into my writing.*

An online student summarised the usefulness of the activity from her perspective:

> *"[I] liked hearing another point of view – being an online student it's nice to communicate with another student and help each other understand the topic/assignment better".*

The negative and positive aspects of reviewing another student's work are summarised below (Table 5):

Table 5. Students reported feelings about peer-reviewing another student's work.

Negative	Positive
• Hesitant	• Just focused on rationale
• Apprehensive	• Enjoyable
• Nervous	• Great
• Awkward	• Opportunity to rethink own work
• Fearful of offending	• Happy
	• Enable me to think critically
	• Beneficial
	• Comfortable
	• Not an issue

3.4. Student satisfaction (UTEI) results

University Teaching and Evaluation (UTEI) student feedback data for 2018/19 was downloaded from the University's database. Overall mean satisfaction with the unit increased threefold among on-campus students after the introduction of the peer-review assessment (Table 6). Overall mean satisfaction increased by 61% among off-campus students (61 vs. 0, Table 6). Overall university averages for 'satisfied with the unit' are typically around 50 and mean scores of around 30 or less (approx. 65% agreement) suggests room for improvement, compared to scores above 65 (approx. 90% agree) which suggest a unit in good health from a student point of view (ECU, n.d.)

Table 6. Overall student satisfaction of unit from UTEI data 2018 vs 2019

Overall Satisfaction	**Mean**		**% Agreement**		**N**	
Year	2018	2019	2018	2019	2018	2019
On-campus	17	58	62	85	21	13
Off-campus	0	61	36	100	11	9

4. Discussion

Effective feedback is essential to support student success and develop employability skills. This study aimed to improve student satisfaction with a unit of study, whilst assessing student perceptions of the peer-review process. The reported outcomes resulting from students engaging with these learning activities were mainly positive.

There was a significant increase in overall student satisfaction with the unit, especially among off-campus students (Table 6). This may in part be attributable to the peer-review activity, but also because the unit had been restructured, and two interrelated assignments introduced to support scaffolded learning (Newman & Holzman, 2013). Given the low participation rates for survey completion among off-campus students (25% pre- and 20% post-survey) it is important to encourage these students to provide feedback to inform cycles of continuous improvement in teaching and learning. Despite the low response rate, the positive results are never-the-less encouraging.

The Pre- Peer- Review Survey revealed that most respondents found the practice exercise useful in preparing them for the actual peer-review exercise. Many had previously engaged in peer-review activities and recognised how this provided opportunities to increase important employability skills such as self-reflection, communication and collaboration, findings such as those reported by Moore and Teather (2013). However, some students, for whom English was not their first language, expressed concerns that they would feel '*embarrassed*' or '*uncomfortable*' about providing peer-review feedback to their fellow students. To address this issue, future peer-review exercises could include assigning students to heterogeneous groups of three to five students (rather than the one-to-one process adopted for this study). This would expose students to different writing styles and levels of competence, whilst strengthening social connections, social skills and thus increasing confidence to provide feedback (Crowe et al., 2015).

The Post-Peer Review Survey revealed 90% of respondents found the experience useful and reported it helped them with their own assignment, similar to other research (Varaprasad, 2016). Respondents reported receiving feedback was more beneficial than giving feedback, whereas Moore and Teather (2013) reported students valued both giving and receiving feedback. This finding also contrasted that of Cassidy and Bailey (2018) who reported higher-level improvements associated with giving peer-review feedback than receiving it. This may be explained by the quality of the feedback received – in this study, two students commented that the quality of the *'feedback [they received] wasn't helpful'*. Similarly, Mulder et al. (2014) reported student concerns about the level of effort spent providing feedback not being reciprocated, and this could perhaps be mitigated in future peer-review activities by assigning students to larger, heterogeneous groups, or by assigning marks to the peer-review feedback (Moore & Teather, 2013).

Students who completed the surveys reported their critical thinking and communication skills had improved as a result of the peer-review exercise (Table 4) and the overwhelming response to the peer-review activity was positive (Table 5). The peer-review process was described as '*beneficial*', providing students opportunities to rethink their own work and enabling critical thinking. This suggests students were demonstrating important professional skills, reflecting the ability to make sound evaluative judgements and communicate them tactfully (Nicol et al., 2014).

The limitations of this study include the small non-random sample, thus these results are not generalizable to the wider student population. The off-campus student cohort was particularly small, so looking forward, more effective strategies to engage this group should be developed to gather their perceptions, as these are likely to differ from those of on-campus students. In conclusion, students reported the peer-review process as beneficial. The peer-review activity positioned feedback as an important learning tool for assessment tasks and helped students improve a range of skills required for their future careers. Overall student satisfaction with the unit increased dramatically, further supporting the worth of peer-review feedback as an important teaching and learning technique. Future research should focus on providing opportunities to engage with peer-review activities in larger, heterogeneous groups to increase student confidence and develop important employability skills. Ultimately, peer-review is a useful teaching and learning tool that can embed the concept of active learning, and nurture students to become desirable employees.

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Higher Education and Solidarity? The Integration of Refugee Students at Austrian Universities

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Abstract

The refugee streams of 2015 had a tremendous impact on European societies. In context of the influx of refugees, civil society showed large solidarity. Universities did so as well, organizing programs to accommodate asylum seekers and refugees on campus. As solidarity is necessary for social relationships and coordinating life chances in a just way, the effectiveness of such programs can only be understood, when insight into refugee students' opinions on such programs are analyzed.

In this article the case example of the Austrian MORE initiative is used to tackle the question what kind of bonds refugee students see between themselves, the universities and the goal to become part of their new host societies. Results show that refugee students are in danger of not being recognized, either because of their legal status or lack of opportunities and migrant sceptic surroundings.

Programs like MORE – and universities in general – may contribute to lessen these effects.

Keywords: *Integration; Refugee Students; Asylum Seekers; Higher Education; Solidarity; Austria.*

1. Introduction – Asylum Seekers, Refugees and Higher education?

Since the 'long summer of migration' in 2015 the topic of refugees and asylum is a key driver in shaping the societal discourse around the world, dividing many countries on ideological and political fault lines (Hess & Kasparek, 2017). The European governments seemed neither ready nor prepared to deal with the more than 1.3 million migrants that moved across the continent that summer, and in the absence of adequate infrastructure provided by the states, civil society and different institutions showed solidarity towards newly arriving refugees (for Austria see Meyer & Simsa, 2018). This is also true for universities around Europe who rallied quickly to organize programs to integrate refugees into their structures. The scope of those offerings ranged from international, national, to institutional initiatives, set up by individual universities. These included policies to mitigate financial issues – e.g. waving tuition fees, getting aid for regular expenses –, as well as organizational barriers – ranging from credit transfer to program certification – and social issues – e.g. language or cultural barriers. Some of those efforts were tied to long running, best practice programs like DAFI – the Albert Einstein German Academic Refugee Initiative—sponsored by the UNHCR, while others were more specifically tailored to national or even university level demand (for an overview see Streitwieser et al., 2018). Among those is the Austrian *MORE* initiative – a unique, national program – that provides solidarity to those who were displaced and aims to help refugees to ingrate into the new host society. This is a particular interesting case as Austria is traditionally seen as a foreign-sceptic country, where it is hard to integrate (Bacher, 2017). In accordance, Bacher et al. (2019) showed in the context of higher education in Austria that integration not only depends on characteristics of refugee students but on societal attitudes towards refugees as well, as their needs go beyond those of regular students who want vocational education or need support to complete certain substantive goals. Perceptions and struggles accompanying this integration process will be explored in the following pages. Section 2 discusses the theoretical framework, section 3 describes the case study and data used, 4 presents the results and a discussion section 5 closes the article out.

2. Solidarity as a concept?

The question of solidarity has been long central to sociology, explaining and accounting for the creation of social relationships. In classic sociology, Emilé Durkheim understood solidarity as the forces that bind societies together either by shared beliefs and commonalities or the necessities of a highly differentiated division of labor (Durkheim, 1997). His contemporary, Max Weber (2006), additionally argued that solidarity is the product of affective bonds and common goals, which can be seen as social and political solidarity, respectively. In positing solidarity as the bonds of modern societies, Durkheim and Weber constructed explanations that are looking at bonds after they materialized, implying that there must be situations where social bonds do not yet exist. Thus, their formation must be seen as

a societal process that is shaped by agency. Ipso facto solidarity is a "recurrent specification of social bonds with a political view" (Karagiannis, 2007, p. 5); a force that either sustains or disrupts social order in a general (e.g. human solidarity) or specific way (e.g. solidarity of specific individuals or organizations – e.g. universities).

In accordance, Juul (2013) argues that "solidarity is about coordinating social and cultural life chances in a socially just way", while Dean (1995) highlights that modern societies are in need of an inclusive concept of solidarity. They therefore develop a concept of reflective solidarity which goes beyond the already introduced affective (based on emotional relations) and conventional forms (based on common interests) of solidarity:

> "At the universal level 'we' refers to 'we all' as solidarity members of an ideal communication community. What is expected is the recognition of our interdependency and shared vulnerability. The acknowledgement of our relationship to one another. At a time of increasing globalization, (im)migration and individualization, we have both the opportunity and the need to see differences of others as contributions to and aspects of the community of all of us." (Dean 1995, p. 136f.)

A non-exclusive concept of solidary is rooted in recognition (Juul, 2013). As Honneth (2001) stated, recognition is a prerequisite for prosperity, self-realization and a fully integrated society. Thus, a holistic approach that addresses questions of integration or cohesion has to bridge the micro and macro level. In explaining dynamics of social cohesion, the individual perception of recognition plays a crucial role. Individual expectations and social structures of opportunities both influence the potential for recognition. Honneth (2001) differentiates between three spheres of recognition: *love*, *rights* and *solidarity*. Through reciprocal recognition realized in social relations individuals get self-confidence (love). According to Honneth this manifestation of recognition in the form of emotional attention and support is the primary form of recognition on which others build. The sphere of *rights* tangles the mutual recognition as bearers of equal rights and duties, whereas in the sphere of solidarity the recognition of *traits and competences* of a subject are addressed. Therefore, it is about the feeling that accomplishments and contributions by the subject are recognized by others. Recognition is crucial for the self-images of individuals and promotes social integration. A lack of recognition becomes a source of societal disconnectedness. Recognition theories take subjective perceptions of reality as a starting point and go beyond objective criteria like integration in the job market, legal status etc. In accordance, social comparison processes are crucial parts of recognition. People tend to compare their endowments, their opportunities and to what extent their interests are taken seriously with the success of others. Perceptions of recognition therefore always include an evaluation of justice as well as relationships.

For this article, solidarity as well as recognition become empirical questions: what kind of bonds do the refugees who participate at *MORE* see between themselves, the universities and

the (political) goal to become part of a new (host) society? Focusing on refugee students as well as incorporating the perspective of those who are teaching them and organizing the program makes it possible to understand solidarity and its limitations.

3. The selected case study and methdology

In September 2015, *Universities Austria* (*uniko*) – the umbrella organization of the 22 public universities – launched *MORE*, a program to integrate refugees and asylum seekers into universities (see https://uniko.ac.at/projekte/more), offering newly arrived migrants a possibility to (re-)join university life and tertiary education, providing opportunities beyond necessities like food, housing or medical help (Fiorioli, 2017). Offerings include language classes, academic courses, leisure activities like sports or hiking and a buddy program to foster social interaction. According to register data, the program was a success, counting more than 2000 participants. The average *MORE* student is 26 years old and male (90%). The most prominent countries of origin are Syria and Afghanistan, followed by Iraq and Iran.

To discuss the question of solidarity within this project and how the participants view their lives as students while living as refugees in a foreign country, two main data sources are referenced. 1) *Survey data:* Former as well as current participants where surveyed using an online tool as well as a paper and pencil questionnaire within German language classes. The main focus was on evaluating the *MORE* initiative (n=124; see Prandner & Moosbrugger, 2018). 2) *Interview data:* Building on the results of the survey in-depth interviews were conducted with seven participants, five so called internal experts (language trainers and administrative staff) and four external experts (caregivers and coaches). Guiding, open-ended questions targeted experiences and places of perceived recognition within and outside the educational context.

The next section gives a short overview on main findings of the survey, contextualizing the qualitative results. This is followed by the results of a focused, grounded theory based (Strauss & Corbin, 1990) analysis of the interviews: 1) Application of thematical codes (*open coding*); 2) Constant comparison of findings (*axial coding*); 3) Identification of main themes (*selective coding*).

4. Results of the case study

By design *MORE* addresses a highly educated population. About 54% of the respondents hold a tertiary degree in their home country; another 17% started one; and about 21% completed schooling, granting access to tertiary education. The reasons for participation are mainly intrinsic (e.g. because I want to learn new things). However, three out of four respondents see participation as an obligation (e.g. because I think I have to). Despite being

in Austria for two years and four months on average, almost two out of three respondents have not received a decision on asylum yet. About 27% were granted asylum or subsidiary protection; 10% received a negative decision. To sum up: For a sizeable part of the sample the prospects of staying in Austria are insecure and more than half of the respondents consider participation somehow difficult. Yet, despite the difficulties to measure the objective impact of the program, 75% of the respondents are very satisfied with it, with more than 60% reporting that participation turned out to be an opportunity for them to develop friendships with Austrians (for a more detailed overview see Annex). Further analysis indicates that perception of satisfaction with the program as well as the perceived difficulty mainly relate to (4.1) emotional barriers, (4.2) available resources and (4.3) social/relational conditions.

4.1. What is it like to study at an Austrian University? Experienced emotional barriers

The qualitative part of the research further highlights the distress of the participants. High insecurity, barriers to participate and a migrant skeptical setting take their toll. Not only influencing participation, but constantly causing emotional distress. This is a recurring theme, nut only mentioned by the students themselves, but also by the involved experts:

> "The main issue is that the process to gain asylum is lacking transpareny and their psychological situation is so troubled, that they have problems to focus on learning. These insecurities have a major impact on their chance for succeeding in their studies." (internal expert 2; quote translated from German)

> "In my situation […], as an asylum seeker, the question, if you can stay here is permanently on one's mind." (participant 6; quote translated from German)

Other existential needs play a role as well and refugee students are often reminded of their limited means:

> "I'm afraid of my financial situation. […] I desperately need to find work. […] When I was thinking about starting to study, I had no idea if I could afford it or not. That was a big question." (participant 4; quote translated from German)

Despite these emotional burdens and drawbacks, students manage – in most cases – to keep up a positive mindset. This is of interest as it provides insights into the complex dynamics of intrinsic reasons for participating. As one interviewed expert puts it:

> „What is common among them […], probably […] is their motivation, all of the [*MORE*] students have a very high motivation." (internal expert 1; quote translated from German)

Both, experts and participants, therefore value the *MORE* program, as it provides the refugees with some kind of stability and helps to migrate some of the emotional barriers and problems experienced. This ties to the fact that participating at e.g. university courses, doing homework or spending time on campus re-established a feeling of belonging. Here the solidarity offered

by the universities and the staff taking care of the *MORE* students are seen as a chance for normalization, a prerequisite for rejoining society after prolonged traumatic experiences and a form of reflective solidarity (Dean, 1995). However, this process is tied to structural and even societal issues.

4.2. Going beyond the university level? Resources and social structure

As seen in the quotes before, solidarity is a concept that works on the societal level and is tied to social structure as a whole. Solidarity is about cultural and live chances (Juul, 2013). For the refugees in *MORE*, this is evident when it comes to their social status. On the one hand interviewees refer to a perceived demand, that refugees and asylum seekers need to integrate – commonly meaning that they should adapt to local customs – into the Austrian society. On the other hand, they highlight structural and social barriers, that make this nearly impossible. They range from material deprivation to social and systemic exclusion:

> "Regarding lunch, I sometimes try to take a snack with me. I can't afford a sandwich at university. They are expensive. The cantina as well. If I take no snacks with me, I have to stay hungry, till I'm home." (participant 4; quote translated from German)

> "We ask ourselves how things are at refugee homes. If it is possible to study well […], when sharing quarters with other people. […] Those things must be difficult, compared to our [regular] students." (internal expert 3; quote translated from German)

> "When we [refugees] went to the playing field. […] To play soccer. The others [Austrians] left. I could not understand it." (participant 7; quote translated from German)

> "Until last year I tried to find some kind of activity, some volunteer work or whatever… But up to now I did not succeed or got an answer […]. To have no meaningful task is the main problem." (participant 2; quote translated from German)

This is further complicated by the fact that asylum seekers are already excluded from most opportunities to participate in society, e.g.: find regular employment or even rent a flat. In this context the importance of a program like *MORE* becomes evident: Asylum seekers, as well as refugees get the chance to participate at university and have a structured opportunity to engage with others, learn the local language and further their knowledge. Therefore, *MORE* provides them with chances to lessen the impact of missing resources, as it offers free German classes, finances public transportation and a welcoming community. This goes along with the chance of recognition of traits and competences (Honneth, 2001).

4.3. Rebuilding social relationships. Between understanding and prejudice

Fleeing from one's country goes along with abandoning most social relationships. Refugees and asylum seekers have to rebuild their social networks once they settle in a host country. They are cut off from emotional attention and support, the primary source of recognition

according to Honneth (2001). In this context interviewees not only stress that they are confronted with language barriers, but also with a high amount of skepticism:

> "And yes, I think people here hate refugees. Most of them anyway. If I see two people talking and they are looking in my direction I assume they are talking about me." (participant 3, quote translated from German)

> "If a refugee is doing something bad, all the people say that all the refugees are dangerous. This is really annoying." (participant 2, quote translated from German)

In this hostile environment building new relationships becomes a herculean task. Language barriers as well as structural barriers are hindering this process. Participants as well as experts stress this issue. *MORE* is described as a starting point for building up new social relations from where on other relationships may arise; a place where lecturers and organizational staff are aware of the problems the students experience regularly. This is accomplished by not offering only language and academic lectures, but also sports and group activities. However, the structure is limited in its efficiency.

5. Conclusion

Following our interview data, it can be stated that asylum seekers as well as refugees are in danger of not being recognized in Austrian society, while also having reduced opportunities for participation and gaining recognition. They describe their insecure asylum status causing emotional distress, as they are not knowing what the future holds. Therefore, it is hard for them to feel like equal members of society. Yet, some of the presented examples illustrate that the participants are willing to become part of the host society and are e.g. eager to study. However, existing barriers make it difficult to do so. Programs like *MORE* provide a partial solution to this. Participants stated that it helped establishing contacts between them and members of the Austrian host society and therefore provided a chance to gain recognition and get relevant insights into the underlying rules of the Austrian society, which were often seen as more formal than those found in their home countries. Additionally, university reestablishes a form of normality and it also integrates refugees and asylum seekers into an environment where solidarity – and not pity, to go back to Hannah Arendt (2006) – is seen as a suitable practice. Beyond that refugees are tasked with rebuilding meaningful social relationships. Concurrently they are experiencing prejudice, making this difficult as well. And here the limitations of the program become evident. Despite the fact that participants are stating that it helped them with their individual problems, systemic issues prevail. Overall, the interviewees are addressing a lack of solidarity also contradicting experiences are reported as well. *MORE* is perceived as an enabling chance, and therefore an example for reflective solidarity as stated by Dean (1995). It provides chances to recognize contributions of refugees to (a specific) community.

Link to full Annex:

https://www.jku.at/fileadmin/gruppen/119/AES/Lehre/Lehrforschung/BA/suplementary_material_PrandnerMoosbrugger_HigherEducationAndSolidarity.pdf

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An Investigation of the Role Programming Support Services Have for Mature Students

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Abstract

Programming support services for introductory programmers have seen a rise in popularity in recent years with third level institutions around the world providing "safe spaces" for students to practice their programming skills and get supports without the risk of being judged by anyone. These services appear in many different structures including Support Centres, Software Studios and help desks. The common trend however is that all the users of these services, in general, report that the service has helped them in their studies and garnered them with more confidence in their ability.

This paper examines the role which our Computer Science Centre played for students who attended the support service during an intensive higher diploma course. The intensive course is a 3-week course tailored to students who have previously completed a degree in a field not related to CS and covers CS1 and CS2 material. The structure and design of the support service is outlined in this paper along with the supports offered. A high-level survey was conducted to investigate the effect of the service on students programming self-efficacy. Study design and methodology are described in detail. Early findings suggest that the support services offered to these students improved their belief in their own programming ability which in turn improved their exam grade outcome. The findings provide valuable evidence to justify future research into the functions of support services with the computer science domain.

Keywords: *Support services, CS1, Self-efficacy, mature students.*

1. Motivation

First year computer science (CS) currently boasts one of the highest attrition rates in Ireland with about 25% dropping out, the highest among all higher education disciplines (Harmon & Erskine, 2017). While many possible causes exist, it is well known that first year computer science students generally have little to no formal exposure to CS prior to their CS1 course, which in turn leads to certain concepts in the CS1 course being difficult and hard to grasp (Connolly & Murphy, 2005). In addition to there being difficult concepts, the workload required by students to learn how to program competently can be significant. This workload coupled with the high workload of university, and the fact that CS is often taken as part of a Science or Arts degrees, could lead students to experience mental health issues such as stress, anxiety and depression which possibly could lead to dropout.

Another form of intervention offered to students in many third level institutions is that of a support centre. The role of a support centre is generally to assist students who are struggling with their coursework (or some aspect of it) without directly covering their current assignment. They aim to be supportive, judgement free and helpful towards students. Support centres such as these have been shown to have a particular benefit to at-risk students (Mac an Bhaird, Morgan, & O'Shea, 2009).

The prevalence of computer science and programming support centres across third level institutions in Ireland is encouraging, with almost all institutions offering some form of support structure. One of the first such centres in Ireland was that of Trinity College Dublin's

Science department (Stamouli, Doyle, & Huggard, 2005). Their initial findings were positive but did not look directly at what effect the centre had on grades. Since 2011, the Department of Computer Science at Maynooth university has offered a support service to students. The original Programming Support Centre (PSC) was set up to provide support for two first year modules. The pedagogical approach of the PSC was originally presented in 2015, which outlined how the PSC was set up in and provided recommendations on such (Nolan, Mooney, & Bergin, 2015). Since then the PSC has undergone radical change and has been rebranded as the "Computer Science Centre" (CSC).

Computer Science support centres often focus most of their resources on CS1 students. This focus on CS1 is largely due to the difficult nature of CS1. CS1 is the first formal module taken in Computer Science by students and given the worrying non-progression rates of CS1 there is a need to try and retain students (Connolly & Murphy, 2005). This is an important time to offer support as retaining of students from first to second year computer science has always been a difficult task (Quille, Bergin, & Mooney, 2015).

This paper will discuss the structure and practices of the Computer Science Centre in our university. In addition, a small study was carried out which will examine the self-reported

self-efficacy levels of Higher Diploma students at several intervals over the duration of a 3-week intensive CS1 course. These Higher Diploma students have previously earned a degree in a non-computing subject. We aim to determine if the reported levels of both change during the course, and if there are any notable differences between students who attend the CSC and those who don't. From there, determinations can be made about what interventions can be offered to students who are experiencing mental health or confidence issues.

2. Background and Related Work

Computer science in Ireland has become a state examined subject in 2020 meaning that some students entering third level in the future will have a formal exposure to computer science. However, the majority currently in third level don't have any formal exposure to CS. Going forward the provision of CS in second level is on a pilot basis and uptake within schools may be slow. This can present an issue in third level where students are taking modules in CS without the basic skills to cope with the demands being placed on them. This is a similar issue to the "Maths problem" which is not just an issue for students undertaking mathematics courses, but it is also considered an issue for students in science, technology and engineering, and has been shown to be a contributing factor to the low retention rates in these disciplines (Berry, Mac An Bhaird, & O'Shea, 2015). In response to the "Maths problem" the provision of Mathematics Learning Support is a regular addition in many HEIs worldwide.

Such Computer Science Learning Supports are not as commonplace, but they are appearing in more HEIs. Computer Science Centres are additional services to students on top of their lectures, tutorials and labs, and are never meant as a substitution for these. Students are always encouraged to engage fully with the course and carry out independent work before visiting a centre. Much of the work within these centres is on remedial supports but some centres support all students, irrespective of their performance in the subject, by providing advanced supports for stronger students.

2.1. Self-efficacy in Computer Science

The concept of self-efficacy has seen an increase in interest over the past 10 years. Conducting a search on the ACM Digital Library for "self-efficacy" returns 111,575 hits with the earliest being in 1954. Filtering this search down to since 2010 returns 73,458 and further filtering to 2018 returns 20,744 hits [Correct as of 01/04/2020].

Programming self-efficacy has been a topic of increased research in the area of computer science and particularly amongst first-year computer science students. Bandura defined perceived self-efficacy as "*people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances*" (Bandura, 1986). Self-efficacy mediates between an individual's knowledge and their actions. Therefore, somebody

may possess the knowledge or skills which are necessary to perform a particular task, however, they may not succeed due to their self-doubt or self-belief in their ability. Self-efficacy theory has emerged as an important means of understanding and predicting a person's performance.

Bergin showed that student's belief in their programming ability was the highest factor in predicting programming success (Bergin & Reilly, 2005, 2006). Quille et al., in a re-validation study found that programming self-efficacy was again found to be the main predictor of success in first-year computer science (Quille, Culligan, & Bergin, 2017). Research has shown that those with high programming self-efficacy are more likely to undertake tasks that are more challenging and demonstrate a want to learn and engage with material (Schunk, 1989). In addition to this, the success of a task will most likely increase the programming self-efficacy of the person involved (Schunk, 1989). In contrast, those with low programming self-efficacy tend to experience tasks that are easy or at least easier, as much more difficult than they are. This leads to the person experiencing stress or anxiety (Bandura, 1986). This would lead to the student not succeeding and further reduce their programming self-efficacy.

3. Computer Science Centre

The pedagogical approach at the CSC is based on peer-tutoring and at the heart of the model is the volunteer nature of this tutoring. There is no payment or credits provided for tutors, rather these are second- and third-year students who give their time freely, usually because they would like to experience this type of role or have a genuine desire in helping others. The tutors are proficient in the two introductory modules. The idea is that, having just recently finished the modules themselves, they are the closest to the material, and to the current student's age to have an effect on how they absorb the material. These tutors are trained in the first week of semester one, with a refresher session provided in semester two. Training involves guiding the tutors on how to talk to (and more importantly listen to) students, how to use the CSC systems and online support structures, and how to use good teaching methodologies to instil confidence in the students. Expectations of the tutors while working are also covered.

This approach, while sharing many philosophies with the Peer Assisted Study Session (PASS) (Geerlings, Cole, Batt, & Martin-Lynch, 2016) paradigm in promoting improved student comprehension, performance and retention, is different in that the number of students being tutored by an individual tutor at any time is small and these students may be working on different topics. Similarly, to PASS students are encouraged to work together in the CSC but it is not required, thereby allowing differentiation in student learning.

As the CSC is reliant on volunteers, there is a limited number of hours that the CSC is open to students. These hours are usually dictated by when 1) the students of first and second year can attend and 2) the volunteer tutors can attend. As such, the CSC is open for between 10-15 hours a week for drop-in services.

The CSC is coordinated by two academic staff tutors. Each session is managed by at least one of the tutors. Lecturers do not attend the CSC, a deliberate decision, to encourage a relaxed setting for learners.

Given the setup of the CSC, learners are enticed into the centre through the various services that are offered. With its re-branding the CSC offers additional supports such as; a) provide an induction session with new students, b) provide physical self-help sheets for all supporting modules, c) provide weekly programming competitions for both first- and second-year CS students and d) provide support for extra-curricular activities such as building robots and coding hardware boards such as Arduino, Raspberry PI and MicroBits.

If for some reason students cannot make one of the drop-in hours, the CSC tutors are available in an online environment through technologies such as online ticketing systems, social media technologies and Slack channels. Having this online presence, particularly through social media has increased the profile of the centre and has turned the centre from a traditional support service to more of a social setting where students collaborate on different CS topics.

The CSC has been in operation since the 2011with 3 of the founding members still involved in the running of the centre today. While no formal studies have been carried out in the centre, reports from the participating students indicate that the CSC has improved their programming ability which, in turn, has afforded them higher marks in both continuous assessments and final module exams. In the first semester of the 2019-2020 academic year, 49% of first-year students attended the CSC at least once in the semester, with 26% of these students attending at least once every week. The average CS1 exam mark of those who attended the CSC was 55.22%, compared to 49.95% for those who did not attend.

4. Early Indications

Given that no formal studies have been carried out on the CSC to date, this paper attempts to investigate if the centre has improved the programming self-efficacy of attending students.

4.1. Instruments

As part of this experiment, we included Bergin's Programming Self-efficacy questionnaire. The scale consists of 10 questions and has been shown to have generally inter-item and test-retest reliability (Bergin & Reilly, 2005, 2006). Each of the questions relate to programming

self-efficacy. For example, the first question is "At times I think that I am no good at all at programming" with responses on a Likert scale, "Not true of me" – "Very true of me".

4.2. Participants

The participants who took part in this study were all mature students (> 23 years of age) participating in an intense three-week course in Introduction to Programming taught through Java. The course covers aspects from system output to classes and objects and inheritance. In order to be eligible for the course, all students must retain a degree from a relevant university, however, the degree must not be in the area of computer science or software development.

Everyone in the course had the same lecture contact and lab contact. Attending the CSC was a voluntary choice the students made. The module assessment is carried out over the three weeks of the course. Each day there are two lab assessments. These lab assessments account for 20% of the final mark. On the Friday of each week, there was a written exam and from the first two of these exams, the best result is taken and is worth 40% of the final mark. The final exam on the last Friday is worth 40%. All grades were collected.

4.3. Data Collection

Microsoft forms were used to collect answers to the questions from the background questionnaire and self-efficacy surveys. The survey was conducted in multiple steps. On Day 1, participants took a demographic survey and the programming self-efficacy questionnaire. On Day 5, Day 8, Day 11 and Day 14 participants took only the programming self-efficacy questionnaire. Full ethical approval was obtained to carry out this research.

5. Results

5.1. Participant Profile

A total of 39 students participated in all 5 surveys. Table 1 shows the gender and age breakdown for those who attended and didn't attend the CSC.

Table 1 Gender and Average Age breakdown of all participating students.

	Gender	# Participants	Average Age
Attended	Male	11	31.2
	Female	6	29.6
Did Not Attend	Male	15	27.4
	Female	7	29.57

5.2. Programming Self-efficacy

Programming Self-efficacy was captured at five points across the three-weeks. Figure 1 shows the changes of programming self-efficacy in the participants of the CSC, those who didn't attend and the overall average change in programming self-efficacy during the three-week course. Initially, for the participants who didn't attend the CSC their programming self-efficacy was low. Following Survey 2 and Survey 3, there was a sharp increase in participants programming self-efficacy. Seeing this improvement in self-efficacy was positive. However, the sharp increase in self-efficacy is then followed by a decrease. This decrease is almost a self-correction of the student's appraisal of their programming ability. Examining those who did attend the CSC, their programming self-efficacy was low however their programming self-efficacy improved and ultimately finished at the same programming self-efficacy level as those who didn't attend the CSC. Table 2 shows the difference in programming self-efficacy between those who attended the CSC and those who did not.

Table 2 Difference in programming self-efficacy between those who attended the CSC and those who did not.

Survey Number	1	2	3	4	5	p-value
Did Not Attend	26.18182	28.81818	29.63636	29.09091	26.27273	0.017224
Attended	23.64706	24.29412	25.17647	24.94118	26.35294	0.722908
p-value	0.227536	0.019668	0.019489	0.022738	0.909608	

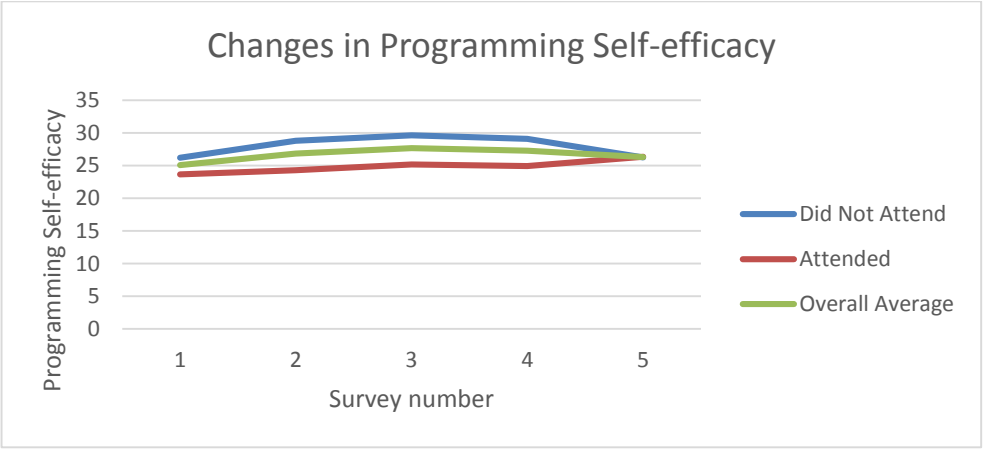

Figure 1. Graph of change of average programming self-efficacy over three weeks.

6. Future Work

While there was a decrease in self-efficacy between Survey 3 and Survey 5 overall, this decrease should not be looked on as a negative. The decrease is due to the participants self-correcting their appraisal of their ability. Overall, it appears that the CSC has improved the self-efficacy of the students that attended the CSC over the course of the three weeks. This is the beginning of a formal evaluation of the impact of the CSC and indicatively the CSC is making a positive impact on the students who avail of the services. A formal, longitudinal study is planned to evaluate if the CSC is making a difference to the performance and self-efficacy of the students using it.

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Good-bye email, welcome Slack

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Abstract

Email is the standard in communication with university students; as a one-to-one communication device, students repeat their doubts along multiple messages, multiplying the teacher's work and preventing the participation and learning of other students. The topic forums on virtual campuses allow better a management of doubts but require the active participation of all the students to achieve a final outcome. We propose to abandon the email and traditional forums of the campuses and enter tools with a higher professional profile to manage communication with the students. The results of this first experience, carried out with more than 90 postgraduate students, encourage its mass employment in both undergraduate and postgraduate. The survey conducted over 102 students in three different subjects of two different MSc shows how Slack, the tool we used, has been highly valued, with differences depending on the studies but neither on the gender nor on the intensity of use of the social networks.

Keywords: *Communication; social networks; email; Slack.*

1. Introduction

University teaching, both in degree and postgraduate, is evolving with the integration of new technologies. We cannot pretend that our students, with access to global information in near real time, will be satisfied with traditional communication, which has historically occurred in the classroom and, or, in the teacher's offices, at the planned tutoring hours. Information arises at anytime, anywhere, and the need to resolve doubts is growing in the face of the enormous volume of information available. However, while it is true that on many occasions the urgency is not such, in many others rapid intervention is required to solve doubts and problems that should be, in fact, solved sooner.

Technological evolution is undeniable, and the incorporation of the younger ones into them is getting faster and faster. According to Pew (2018), in the US the smartphone penetration rate has risen from 35% in the 1st half of 2011 to 81% in the first quarter of 2019. 96% for 18- to 29-year-olds own a smartphone, while only three out of four adults declare having a PC or laptop. Currently, the dependence of the smartphone has grown to important levels, with 22% of Americans between the ages of 18 and 29 reporting not having broadband at home but using a smartphone instead for their social and professional communications. The situation in Europe is similar. According to Eurostat (2019) 85% of European households would have access to the internet, up from 55% in 2007. It is interesting to note how the number of internet access in households with dependent children increases to 96%. In Spain, and always according to the same report, 90% of young people aged 18 to 29 access the Internet daily. More than 80% of young Europeans in that age range (more than 95% for Spain) access the internet via smartphone. As regards the use of email as a means of communication, more than 85% of young Europeans in the previous age range report to do so on a regular basis, according to Eurostat (2019).

Email is the communication tool *par excellence* between teachers and students. However, there are several problems in relation to their use and effectiveness. Thus, Ha et al (2017) examined the effect that excessive connectivity of students could have on the effectiveness of emails. Through face-to-face interviews and self-administered survey/quantitative data, they found that students' rejection of the reading of emails was not so much due to social media as to over-communications through this route. University departments, student organizations, and faculty advisors' e-mails were most likely to be avoided, and they recommend both university administrators and academic advisors "to reconsider the e-mail communication to students, target at the instant communicator social media users, and use Facebook to create a strong sense of community and campus involvement for their students." Almost 40% of students said they don't always read emails from academic advisers, and 54% of students said the same about emails from the university or from academic departments. Among all students, email use (12.1%) ranked behind social media (35.2%) and texting (50.2%), but ahead of phone calls (2.2%). The most important findings

of the study, in relation to the use of emails by students, were that 72% of students treat emails from student groups like spam, more than 50% of students don't always read emails from their institution or academic department, and nearly 40% of students don't always read emails from their advisors.

The privacy of life outside the classroom is one of the main challenges that lecturers face. Thus, Hillman et al (2019) maintain that it is unpredictable to handle in a different way the communication in real time with the students because, as the title of their paper graphically points out, "I have a life".

Dawkins (2019) reviewed 19 studies to confirm that academics are behind the industry when it comes to mass email evaluation and optimization strategies. He cites technological limitations of learning management systems (LMS) and the limited expertise of teaching staff as the main obstacles to more effective mass email at university.

Some other experiences have been set up to surpass email as a communication tool with the students.

López Zafra and de Paz (2014) showed how Twitter could be a powerful tool to communicate insights to students and engage them into the subject. As far as the second semester of 2010-2011 they started to communicate with the students in a course of Business Statistics in the Business Administration grade in a private school in Madrid, Spain. Twitter was seen as very powerful in motivating students in a field where they felt well. The latter observation in the line of what the CEO of Twitter Spain stated in the Talking About Twitter congress (Granada, Spain, June 22nd and 23rd), according to de Paz Cobo and López Zafra (2015); accessing Twitter is via mobile by 85% of young users. That is, by demographic target and usability it seems that Twitter can be a tool with which to connect with the students of the university.

Twitter is formed as a social network whose teaching use can be very productive. According to the experience of its use in the classroom over five years, always in subjects of the quantitative area and in different schools, De Paz Cobo et al (2017) found that students demand more and more alternative means of communication to the traditional ones. Access to sources of information in many different formats (text, audio, video) on the Internet, with the additional feature of the constant renewal of content, requires the use of a tool with the maximum accessibility, dissemination, immediacy and versatility, as well as the most important of them all: to be accepted almost natively by students

Of course, Facebook has also been widely evaluated both as a communication and learning tool. Walsh (2010) was one of the first in announcing the possibilities of the, then, increasing in importance network; he states a comment by Kristen Nicole Cardon, lecturer of a British Literary History course, where she describes the advantages of using Facebook

in the classroom, such as motivation, pointing at matters that really care and not wasting time in those already understood, the possibility of getting insights from those who generally don't participate in the discussion and the wider perspective coming from more and more students. Duncan and Barcyczk (2015) found that students in the Facebook-enhanced courses reported having more favorable attitudes toward the social media and a slight increase in their sense of classroom community compared to students in non-Facebook-enhanced courses.

The rise of Instagram (IG) has also been the subject of use in the classroom. Instagram, owned by Facebook, has 1 billion monthly and over 500 million daily active users; of those, 71% are under age 35, proving that Instagram is one of the most widely used social networks by young people, the target group of a college class. Time spent is nearly just 5 minutes behind the almost daily hour spent on Facebook. Byrd and Denney (2018) report the success of that social network in a journalism course. Results showed by Arceneaux and Dinu (2018) proved that information retention was most improved by visually based information published by professional news outlets, after an experimental design confronting Twitter to Instagram. De Paz Cobo and López Zafra (2020) have been using IG during the first semester of the 2019-2020 course, showing a higher engagement of the students and increase of the interactions regarding those in Twitter.

Anyway, it seems that email will continue to reign as in the top of the digital communication system. According to Becker (2016), it's going to be very difficult to substitute a tool that has been evolving over 30 years, with around 3 billion users in 2019, with an expectation of 319 billion emails sent in 2021 (Campaign Monitor, 2019), the third most influential source of information for B2B audiences, behind only colleague recommendations and industry-specific thought leaders (Finn, 2019). The main problem we have experienced as long-time users of Twitter and early adopters of Instagram is the difficulty in managing in a professional way the feedback of the students, their doubts and problems. In the search of improving the latter, trying to overcome email avoidance and engaging students in a two-sense communication system, we decided to enter Slack.

2. Slack in the classroom

As explained by Woodgate (2019), Slack is a workplace communication tool, "a single place for messaging, tools and files." This means Slack is an instant messaging system with lots of add-ins for other workplace tools. The add-ins aren't necessary to use Slack, though, because the main functionality is all about talking to other people. There are two methods of chat in Slack: channels (group chat), and direct message or DM (person-to-person chat). With over 12 million daily active users (Chan, 2019), Slack is close behind Microsoft Teams, its main competitor.

Being a slightly young communication tool (the first version was out during 2013 while Facebook was founded back in 2004, Twitter in 2006 and Instagram in 2010, and email in place since mid-seventies), and clearly leaning on the professional market, no so many experiences have been reported on the matter. Talbot (2015) is one of the early adopters of Slack in teaching, because of the artificiality of the discussion rooms in former LMS, the not-so-easy to share rich content such as videos in the LMS, and finally because the lack of efficiency when compared to email or SMS in the one-to-one communication. Talbot stresses the email-free possibilities of Slack as one of the motivating issues for adopting the tool, along with the increase in the amount of communication; students' perceptions were mostly favorable. Peck (2018) describes his first year as a professor as a terrible administration time, spending hours in checking, reading and answering often redundant emails. He chose Slack because of the possibility of shifting conversations out of the inbox, into a platform where they could be easily met any time during the semester, the possibility of answering once every issue and, a very important matter, the possibility of Teckchandani (2018) describes how Slack works, stating that the free version is enough for the classroom. Hussain et al (2018) compare the use of WhatsApp groups to Slack for classroom activity; although they expected undergraduate students would use Slack heavily, their usage habits suggested the application was not as effective as other research has shown it to be at the graduate level.

We decided to promote the effective use of Slack in four different postgrad classes in two different MSc, two into the Master's Program in Data Science for Finance (MDSF; courses in Reduction and Segmentation Techniques, on one hand, and Forecasting, on the other, with the same 21 students in each course) and another two in the Master's Program in Financial Markets (MMF; two different classes with a total of 60 students in a course in Quantitative Methods for Business). The scope of the master programs is different but both groups of courses share as a common feature the strong use of programming languages, in particular the R software. The page mdsf.slack.com was built to communicate with the students of the MDSF and the finanzascuantitativas.slack.com with those in the MMF. In every Slack page, four general threads were built: #general, for communication of whatever the issue in any course; #not_everything_is_somthg (where *somthg* stands for finance, in the case of the MMF, and data_science in the other case), a very popular thread among students where talking about anything, related or not to the course, was promoted; and a specific thread for each subject: #quantitative_finance in the MMF and #segmentation and #forecasting in the MDSF. The Direct Messaging possibilities of Slack were also used to solve particular problems.

Slack retrieved a quite heavy use of the platform, specifically among the MDSF students. As of January 23rd, and with days before the final exams, 3.129 messages out of the maximum 10.000 that the free version allows where crossed in the different channels of the

MDSF area. The weekly traffic (measured in terms of active users, those with at least an open channel) was intense, with all the students reading messages and the half publishing messages every week except during the Christmas period. #forecasting was the preferred thread, with 134 published messages, followed by #general with 76, #segmentation with 40 and ##not_everything_is_data_science with 9. The same statistics in the MMF showed 914 messages (so one third, for over three times the number of students), a quite lower weekly traffic, descending in terms of active users as the course was advancing, 179 messages published under the #quantitative_finance thread, 98 under the #not_everything_is_finance one, and 9 under the #general one.

We conducted a survey among the users for understanding both their behavior and the experience. 102 Students of the three different subjects were asked about different aspects of the use of Slack through a Google Form. 89 (87.25%) of them answered, 48 from the Quantitative Finance subject in the MMF and the remaining 41 in the subjects of Reduction and Segmentation Techniques and Forecasting in the MDSF. For 95% of them, it was their first experience with Slack in the classroom, and 77.3% of them heard about Slack for the first time in our subjects. A tiny 15% of them (20% among the MDSF students) had a Slack account prior to the present experience.

In a 5 point scale, where 1 means "totally disagree" and 5 "completely agree", the Slack global experience graded 3.78 points, but just 3.29 among those in the MMF for a 4.39 among those in the MDSF, showing possibly that Slack is better suited for those in technical studies; remember that the use of the tool among these students was quite heavier. The sentence "I love Slack" hit an average of 3.2 points but falling down to 2.71 among the students in the MMF and jumping up to 3.8 among those in the MDSF. No significant differences were found in terms of gender.

It's quite interesting the fact that the sentence "I think Slack is an interesting communication tool for the university" is valued with 4.1 out of 5 points (just 3.71 for those in the MMF, while the MDSF students increased the grade up to 4.55) and "Slack should be used by the remaining lecturers" get 3.98 points out of 5 (again, a lower value of 3.5 among those studying the MMF for a 4.55 among those in the MDSF studies).

In terms of use of social networks, all but one were WhatsApp users, 78.7% IG, 71% FB and 50% Twitter. 84.3% of them declared accessing their social networks more than once daily. The number of different social networks and the intensity of use didn't not cause any effect on the previous results.

3. Conclusion

Following previous experiences with Twitter and a parallel one with Instagram with undergraduate students, we decided to enroll four different classes in two master programs under the professional, workplace communication tool Slack. The results are different according to the profile of the programs. The those following the master's in data science were much more active and heavier users than their mates in the master's in finance, even if the different courses share the common feature of intense use of the R statistical software. As the survey proved, Slack was a good alternative to email and the usual forums in the LMS. The experience was enjoyed by the students, and as lecturers we were able to reduce the volume of emails along with the possibility of focusing the problems in a professional platform.

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Evaluation and Accreditation System of External Internship Tutors – SEATPE

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Abstract

The University of Valencia has implemented since 2012 an Evaluation and Accreditation System of External Internships Tutors (SEATPE) through its University-Company Foundation, ADEIT, under the direction of the Vice Chancellor for Employment and Formative Programs. The main objectives of this system are to improve the quality of tutoring of external internships implementing mechanisms to recognize the good work of the tutors and increase the commitment of companies and entities with the practical training of our students. It is aimed at the two profiles of tutors: academics and companies. The tutors who access the SEATPE obtain a "Quality Mention" in the case of the academic tutor and an "Accreditation" in the case of the company tutor. So far we have made five calls and 500 internship tutors have obtained their accreditation or mention of quality.

Keywords: *Quality; evaluation; tutor´s training; external internships; practicum; tutoring.*

1. Introduction

The University of Valencia has developed in recent years a series of actions and programs aimed at improving the quality of its external internships. In this context, during 2012 we designed the Evaluation and Accreditation System of External Internship Tutors (hereinafter SEATPE), funded by the Ministry of Education, Culture and Sports directed by the Vice Chancellor for Language Studies and Policy and which was promoted by its University-Company Foundation of Valencia (hereinafter ADEIT) as an organization responsible for the management of its external academic internships, with the objective of establishing a framework for improving the quality of external internship tutorials, implementing mechanisms to recognize the good work of the internship tutors and increase the commitment of companies and entities with the practical training of our students.

One of the pillars on which the system is based is the confluence in the formative actions of the two profiles of tutors, company or entity and academics. The program is taught in a personalized way and with a necessary face-to-face component, which is one of the elements most valued by the participants in all the editions celebrated. 7,500 people tutor each year: 6,300 belong to the company or entity and 1,200 are academics. A maximum of 150 people access each SEATPE call, so we are looking for alternatives to offer it to a greater number of tutors.

In general, the SEATPE is mainly aimed at people with experience in tutoring external university internships and it is structured in two phases. In the first, a training course on Teaching and management of external internship tutoring (level A) is taught following a quality model of the validated and proven tutoring. Once this has been completed, the workshop for the preparation of an external internship tutoring project (level B) in which the presentation of an individual internship tutoring project is evaluated is carried out in the second phase.

After passing both levels, an Accreditation is obtained, if you are a company or entity professional, or a Quality Mention if you are an academic teacher, which is issued jointly by ADEIT and the University of Valencia.

2. Quality model of external internship tutoring

We have defined six dimensions that make up the quality model of the internship tutoring: 1. Training program; 2. Tutorial´s Organization; 3. Human Resources; 4. Tutoring development; 5. Results and 6. Quality Assurance.

For each of the dimensions we have identified some criteria, as well as the most relevant aspects that define them and are necessary to consider and assess in order to achieve a quality external practice tutoring.

The dimensions and quality criteria that make up the model have been the result of a review and validation process by three groups of experts, both internal to the university institution itself, as professionals from various fields of the productive world and integrated into organizations with extensive experience in collaboration with the practices of the University of Valencia.

In the quality model of mentoring we have identified four essential moments of mentoring that have modeled the content of the two training actions contemplated in the SEATPE and they are described in the following section.

3. Internship Tutors´ Training

As we have commented previously, SEATPE contemplates the participation and overcoming of two training actions that correspond to two levels of competence and perform consecutively. In the first level, knowledge about the quality model of the tutoring is acquired and in the second level it is applied to a specific tutoring project.

To deliver the two training actions we have a teaching team consisting of ten people, half with an academic profile and the other half with a company or entity profile and who are experts and accredited by the system.

3.1. Level A Course "Teaching and Management of an External Internship Tutoring"

The objectives of this course are first of all to show the elements involved in external internships and the main functions performed by the academic tutor and the company tutor; secondly, to provide tools and documents that facilitate the performance of a good internship tutoring; and thirdly, to promote the exchange of experiences between the academic tutor and the Company tutor.

It lasts 20 hours and uses a blended methodology: 10 hours of online training (virtual classroom) and 10 hours of in-person lessons.

It is structured in five didactic units that correspond to an initial, external internships and tutorials, and four that respond to the four essential moments of the tutoring: *Tutoring Preparation; Student preparation; Internship Following-up and Internship Evaluation.*

Among the face-to-face actions, the holding of the two in-person workshops stands out. These workshops are held in the middle and end of the course and they study, through group dynamics, activities on the units treated.

3.2. Level B Course "Workshop for the elaboration of an external internships tutoring project"

The course is aimed at those tutors who have passed the level A course and consists of the design of an internship tutoring program, adjusted to the quality model addressed in course A. To this end, a guide for its preparation is provided, which It is completed with the follow-up and personalized attention carried out by the teaching team.

It is taught in the online mode with a duration of 30 hours, and in which the tutor prepares his individual tutoring project with a student or a group of students, as long as the internship is carried out in the same company or institution and with a single company tutor and a single academic tutor.

As a result, each tutor obtains a personalized quality tutoring project, which can serve as a framework for their tutorial work, either from the perspective of the company or from the academic.

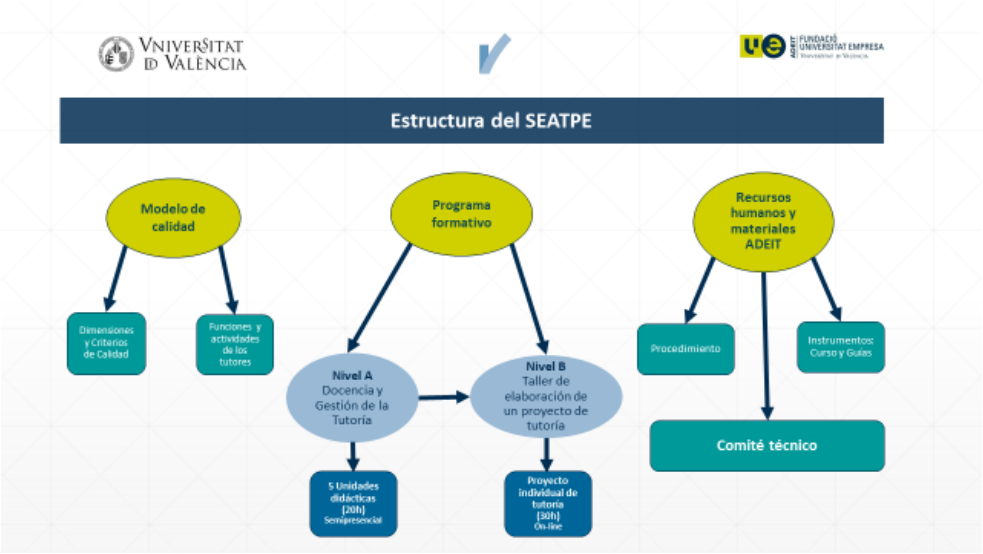

Figure 1. SEATPE general scheme.
Source: own elaboration (2020).

4. Results

This system of training and accreditation of tutors of the University of Valencia (SEATPE) promoted by its Foundation (ADEIT) has been applied in five calls in 2012, 2016, 2017, 2018 and 2019, and 499 tutors have obtained their accreditation or mention of quality internship: 266 company or entity tutors and 233 academic tutors.

Table 1. SEATPE participation evoluction.

AÑO	TA	TE	TOTAL
2012	57	47	**104**
2016-PI	51	44	**95**
2016-PII	13	10	**23**
2017	32	47	**79**
2018	36	40	**76**
2019	44	78	**122**
TOTAL	**233**	**266**	**499**

TE: Company or entity tutor; TA: academic tutor. Source: own elaboration (2020).

The degree of satisfaction with the program is very high, so we emphasize that, globally, 90% of the participants think that the training has been useful and 93% recommend it to other tutors.

Table 2. Satisfaction degree of the participants in the five editions.

Item	Average Rating about 7
Training process	6,1
Training materials	6,3
Teaching performance of teachers	6,5
Tutorials	6,6
Course Environment	5,4
Complementary services	6,4
Face-to-face sessions	6,4
Global	6,2

Source: elaboración propia (2020).

The program manifests itself as important and necessary to offer to our professionals and teachers who participate as tutors of external internships an instrument of communication, recognition, training and accreditation.

The next SEATPE call is scheduled for the second half of this year 2020.

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Class Discussion and Class Participation: Determination of Their Relationship

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Abstract

Generally regarded as important ways for students to engage in class, class discussion and class participation are placed at the heart of the classroom learning experiences. This paper aimed to determine the correlation between class discussion and class participation at Wenzhou Kean University in China. Convenience and purposive sampling of 105 undergraduates of which majority are English as a Second Language (ESL) learners participated in the online survey of this cross-sectional correlation study. Descriptive and inferential statistics have been used in the study to provide in-depth data analysis. Class discussion and class participation had a strong and positive significant relationship indicating that when there is enough time given for a group of three to five students to discuss general and creative topics on questions given by instructors before the discussion, students are more confident to actively participate in class. Finally, this paper gave relevant recommendations to the class instructors.

Keywords: *class discussion; class participation; length of discussion;structure of question, self –confidence, instructors' attitudes.*

1. Introduction

Many students are inactive in their class, which will make the teaching less effective. Class discussion is one of main techniques for educators to increase classroom participation and make more students get rid of shyness to immerse in the English environment. Class participation, on the other hand, given a figure that approximately 58% of first-year students in college indicated extremely when asked “to what degree are you the kind of person who participates in class” (Ahlfeldt et al., 2005). Therefore, examining the issue of class participation is important because class participation remains low in college classrooms. Examining the correlation between class participation and class discussion among the undergraduates is significant because it motivates instructors to comprehend the students’ attitude towards the class structure.

1.1. Literature review

Class discussion is defined as an invisible exchange between students and educators with the purpose of improving students’ learning and their skills (Witherspoon, et al., 2016). It is very useful when teachers want their students to exchange their ideas and show their understanding of the topic because accordingly class discussion can enhance student’ understanding by talking with other classmates, especially in lecture class (Smith et al., 2009). In Kornfield and Noack’s study (2017), speed-discussion was more effective and useful compared to slow-discussion because speed-discussion engaged students dynamically and students can remember the central ideas faster than those who does not participate class discussion. In slow-discussion, students can have enough time to extend their ideas and make everyone to join it. However, if time is tight, the discussion may not get enough time to implement.

Lambert (2015) reported "group size" types as to peer discussion (two students), large group (three to five students) and larger one (more than five students). Brooks and Koretsky (2011) reported that large group size (includes 3~5 students) makes students have more confidence that encourages students’ active involvement in class. Sawyer (2014) reported that creative topic can pique students' interest, have more chances to expand their minds because there are less limitations have engaged students further in the discussion. According to Dallimore, Hertenstein, and Platt’s study (2004), teacher’s guidance which can be seen the structure of class discussion, influences students’ attitudes. There are two main structures, one is putting forward question before the discussion, the other one is putting forward question after the discussion. Dallimore et al. reported that the former structure is more suitable for students because they can grasp the "central idea" of teachers so that the discussion will be more effective.

Anchored on the principles of constructivism that knowledge is socially constructed and learning is an active process (McLeod, 2019), class participation, is considered as an

important teaching strategy because the instructor holds that it increases students' ability of critical thinking. Class participation, according to Dancer and Kamvounias (2005), can be defined as the extent to which students participate or involve themselves in a class, course, etc. In particular, participation involves active student responding, which provides students with an opportunity to demonstrate skills learned in the course and allows instructors to provide useful feedback.

Three significant factors can influence students' class participation reported as openness and enthusiasm, attitudes and behaviors of students in class, and class formality (Roehling et al., 2013). Students were very reluctant to participate in the class when they perceived that the instructors were not open to their divergent opinions and ideas (Roehling et al.) Students' are willing to participate in the class when the class is less formal described as when instructors are warm when they are called in first name basis, rather than their last names (Roehling et al.). Kevin O'Conner (2013) reported that instructors have to show their teaching enthusiasm toward the students to promote class participation. Kevin O'Conner (2013) suggested ways to create a comfortable classroom atmosphere such as students work with teachers to establish the norm of class participation at the beginning of the semester.

1.2. Conceptual Framework

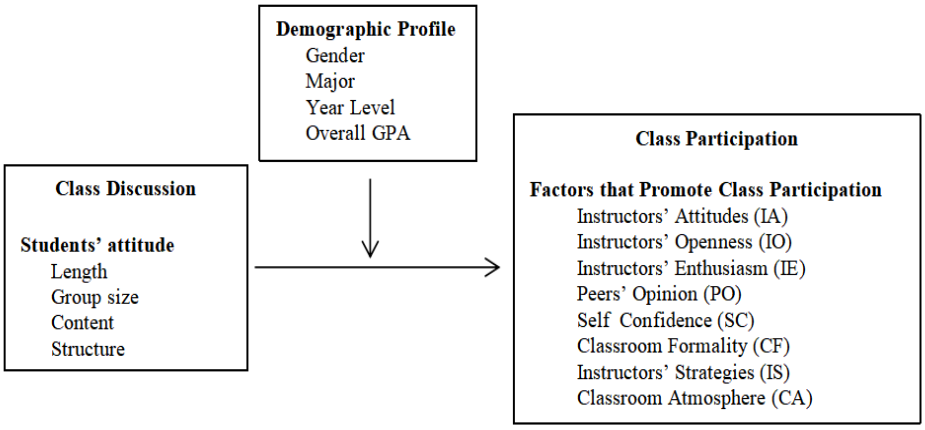

Figure 1. Conceptual Framework.

2. Methodology

Descriptive-correlational design was used in the study to determine the correlation between class discussion and class participation. The study was conducted at Wenzhou-Kean University (WKU) in China. Having the status of Chinese-American jointly established

higher education institution, English Immersion Program (EMI) is applied across curricular programs to adopt to the American educational system.

Convenience and purposive sampling composed of 105 respondents represented 4% of the study population. Online questionnaires posted through the survey website named Wenjuanxing and shared to QQ or WeChat was used in the study. Extensive review of the literature and peer critiquing was used to establish the validity and reliability of the research instrument. A four-point attitudinal Likert scale was applied to describe respondents' attitudes and their preferences. Numbers closer to 1 represented strong disagreement (SD) and numbers closer to 4 represented strong agreement (SA).

3. Results and Discussion

3.1. Students' attitude towards class discussion

Table 1 presents the students' attitude towards class discussion in the aspects of length, group size, content, and structure. For the length of class discussion, students prefer the long-discussion ($\overline{X}$= 2.51), but their answers fluctuate greatly. Results showed students preference as follows: for group size the 3~5 people in one group ranked first ($\overline{X}$= 2.51); for content the "general and creative content discussion" ranked first ($\overline{X}$= 2.97) and second ($\overline{X}$= 2.85) respectively. For the structure of discussion, students prefer to discuss when professors give questions before discussion ($\overline{X}$= 2.96).

Table 1 - Students' attitudes toward Class Discussion.

Item No.	Descriptive statements	Mean X	SD	Scaled Response
1.1	I prefer long-discussion. (enough time)	2.51	.983	Agree
1.2	I prefer short-discussion. (time is limited)	2.38	.897	Disagree
2.1	I prefer one on one discussion.	2.41	.886	Disagree
2.2	I prefer 3~5 people in one discussion.	2.51	.785	Agree
2.3	I prefer 5~10 person in one discussion.	2.20	.934	Disagree
3.1	I prefer academic discussion.	1.96	.842	Disagree
3.2	I prefer business discussion.	2.08	.749	Disagree
3.3	I prefer general discussion.	2.97	.859	Agree
3.4	I prefer technical discussion.	1.86	.789	Disagree
3.5	I prefer casual discussion.	1.96	.865	Disagree
3.6	I prefer creative discussion.	2.85	.917	Agree
4.1	I prefer professors to put forward questions after discussion.	2.05	.801	Disagree
4.2	I prefer professors give the questions before the discussion	2.96	.795	Agree
Students' attitudes toward class discussion		**2.51**	**.854**	**Agree**

The result on respondents' preference on long discussion does not support the study of Kornfield and Noack (2017) that reported students' preference for speed discussion. However, respondents' class discussion preferences on other indicators support the findings of Brooks and Koretsky (2011) large group size (3-5 students); Sawyer (2014) creative topics for discussion, and Dallimore et al. (2004) structuring of questions be given before the discussion.

3.2. The factors that influence the class participation

Table 2 presents the six indicators used to measure the factors that influence class participation as follows: "instructors' attitude", "instructors' openness", and "instructors' enthusiasm"; "peers' opinion", and "self-confidence"; and "class formality".

Table 2 - The Factors That Promote Class Participation.

Item No.	Descriptive statements	Mean X	SD	Scaled Response
1.1	I think instructors' attitude influence my class participation	3.20	.786	Agree
1.2	I think instructors' openness influences my class participation	3.16	.774	Agree
1.3	I think instructors' enthusiasm influences my class participation	3.10	.798	Agree
1.4	I think peers' opinion influences my class participation	2.95	.731	Agree
1.5	I think self-confidence influences my class participation	3.13	.784	Agree
1.6	I think class formality influences my class participation	3.19	.752	Agree
2.1	I think useful instructors' strategies can promote class participation.	3.13	.773	Agree
2.2	I think a comfortable classroom atmosphere can promote class participation.	3.19	.786	Agree
Factors that promote class participation		3.16	.780	Agree

Among the eight factors, the instructors' attitude is evaluated as the most significant one in shaping the undergraduates' participation ($\overline{X}$=3.20), while the factor of peers' opinion is the least important ($\overline{X}$= 2.95).

3.3. Class discussion and class participation Correlations and Practical Implications

To establish relationships of independent and dependent variables, researchers used Bivariate Correlational analysis as shown in Table 3. Findings showed that there is a strong positive correlation between the class discussion and class participation (r = .674) at the .05 level of significance.

Table 3 - Bivariate Correlation of all Variables

	Instructor's attitude	Instructor's openness	Instructor's enthusiasm	Peers opinion	Self-confidence	Class formality	Instructor's strategies	Comfortable classroom atmosphere	**Class participation**
	r	r	r	r	r	r	r	r	r
Length	0.671	0.603	0.617	0.640	0.707	0.601	0.668	0.642	**0.795***
Group Size	0.724	0.677	0.701	0.702	0.728	0.475	0.700	0.679	0.673*
Content	0.758	0.727	0.653	0.690	0.690	0.524	0.595	0.663	**0.663***
Structure	0.703	0.715	0.680	0.659	0.783	0.536	0.665	0.690	0.679*
Class discussion	0.714*	0.681*	0.663*	0.673*	**0.727***	**0.534***	0.657*	0.669*	**0.674***

* Correlation is significant at the 0.05 level.

When individual dimensions of class discussion and overall class participation were considered, length and class participation had the highest correlation (r = .795); whereas, when individual dimensions of class participation and overall class discussion were considered, self-confidence and class discussion had the highest correlation (r = .727).

When designing class discussion for WKU students who are English as a Second Language (ESL) learners, it is suggested that instructors consider students' preference for enough time to discuss, group composition of 3-5 students, and general and creative topic with questions be given before the class discussion. The incorporation of these conditions in organizing class discussion enhances students' self-confidence that encourages students' class participation.

It cannot be ignored that the area on course content (r = .663) and class formality (r = .534) ranked lowest in the correlation between class discussion and class participation. Top priority to address these shortcomings suggest that when students are engaged in general and creative topic discussions, the instructors need to manifest openness and enthusiasm. When students perceived that instructors are open and enthusiastic to students' divergent opinions and ideas, the students are more participative. Also, first name basis in calling students will make students feel more comfortable in a less formal classroom setting.

3.5. Conclusion and Recommendations

Since the relationship between class participation and class discussion is significantly positive, class participation improvement is dependent on the class discussion engagement. Students of three to five in a group when given enough time to discuss general and creative topics will likely enhance students' confidence that encourages active class participation.

Based on findings, the status quo of the Class Discussion and Class Participation is necessary to tailor fit instructors' efforts in class improvements. Armed with these data, whereby

strengths and areas that need improvements are identified, the instructors will better meet the students' learning needs. Since the primary goal is to improve class effectiveness, the following instructional strategies are thereby recommended: A. Provide enough time in class discussion; B. Give questions before class discussion; C. Organize group size composition of three to five students; D. Introduce more general and creative topic for class discussion; E. Instructors' manifest positive attitudes of openness and enthusiasm to create a more comfortable classroom atmosphere; F. Use first name basis in calling students to make the class less formal

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The Value of an Enterprise Postgraduate Research Programme for creating business start-ups in the UK

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Abstract

The Masters of Enterprise Programme is a postgraduate programme whereby a student attempts to start a business during the course of their studies. Established in 2001, we have analysed the success of the 59 companies created from the course and found that as expected the start-up rate is higher than the general population. We also found that ratio of male to female founders (70-30) was similar to start-ups from the general population; however, the survival rate of ventures created from the programme was significantly higher. Also, a higher rate of the businesses were employing more than just the founder, implying they are what could be considered "Entrepreneurial" businesses rather than simply someone self-employed as might be normal in some careers. Despite many overseas students completing the course, only 3 of the businesses were founded outside the UK, suggesting the UK economy is benefitting from the ventures created. We also discuss other outcomes from the course such as these entrepreneurial students are often recruited by top corporates. We further discuss what we believe are the contributing pedagogic factors to its success.

Keywords: *Entrepreneurship and Enterprise Education, Employability, Start-ups, UK economy.*

1. Introduction

Along with employability, enterprise is a key area for UK universities in ensuring work-ready graduates and the government has recommended all students have some form of enterprise education (QAA, 2018; AdvanceHE, 2019).

In UK there are a number of universities delivering entrepreneurial programmes at undergraduate and taught postgraduate level. According to Matlay and Carey (2007) however, each university uses their own description of what establishes an entrepreneurship education. Though measuring the outcomes and value of entrepreneurship education in the UK is still unclear. There is a debate on the impact of entrepreneurship education upon the UK economy (Maresch *et al*., 2016; Matlay and Carey, 2007; Gibb, 2008). One of those efforts to measure an outcome for a particular programme; the Master of Enterprise Programme (M.Ent.), a postgraduate research programme whereby a student attempts to start a business during the course of their studies. Alumni entrepreneurs at The University of Manchester have often participated in a number of enterprise activities whilst at University (Phillips, 2018) and a range exist from on curricular courses such as modules within other subject areas to extra-curricular activities such as business plan competitions, boot camps, accelerator programmes and inspirational speaker events (Papadopoulou and Phillips, 2019; Phillips, 2010). There is also a considerable amount of practical support to student entrepreneurs at many institutions.

"Functional" or "system-level" theories view entrepreneurship as a series of actions or a process, than a result such as registering a start-up company, since they highlight the entrepreneur's unique function in the economic system of the market economy (Klein and McCaffrey, 2019). Such theories are a centre of the activity-based, processual research trend in entrepreneurship studies. Many different types of actions have been used to define the entrepreneurial function, including small-business management, imagination or creativity, innovation, alertness to opportunities, the ability to adapt to change, leadership, and judgment (Klein and McCaffrey, 2019).

Looking in general, besides academia within UK, the number of various programmes has grown rapidly over the last few years, a total of 205 incubators and 163 accelerators are currently located in the country, this growth has been facilitated by £20-30 million per year of public funding from UK and EU and is being spent (Bone *et al.*, 2019). Within the UK economy the number of UK registrations was 381,885 and graduate start-ups were 4,024 (including social enterprises) in 2017, and they account for roughly 1% of all UK business launches between 2014 and 2017 (HESA, 2019; ONS, 2019).

The authors believe that university activities can boost student entrepreneurship in four ways; 1) improving self-efficacy, 2) inspiring students to think about entrepreneurship as a

career, 3) providing skills training to allow students to take advantage of current or future opportunities and 4) provide practical help for the nascent business.

1.1. Aims and Programme Background

The University of Manchester has a range of activities run by its Enterprise Centre that lead to student start-ups, the one that is studied and analysed in this paper is the M.Ent. with its motto "*Developing the next generation of entrepreneurs*". The aim of this paper is to focus on the 59 start-ups founded by M.Ent. graduates and asses their contribution in terms of business start-ups and the effectiveness and value of this research programme in terms of survival rates and compare it to the official statistical data of business start-ups mainly to the UK start-ups, linking to the pedagogy of the course where possible.

The M.Ent. aims to stimulate enterprise combined with various disciplines including number of subjects such as business, engineering, materials, computer science etc. This postgraduate research degree (PGR) has been designed to train and support students in developing business ideas from postgraduate research. It is integrated in its enterprise and discipline subject with four taught units and a one-year-long enterprise project as seen in figure 1. The taught component provides the individual with both skills in enterprise and a depth of specialist knowledge that is directly applicable to their enterprise project. The flexibility for the student is to choose elective subjects for example if they want to carry on studying in the M.Ent. their previous bachelor degree area in a business content, or they want to develop completely different skillsets in a completely different area which they did not have the opportunity to study in their Bachelor degree. The one-year-long project comprising of two parts to the research dissertation: a "Subject" theoretical part focusing on researching a key aspect of the proposed business concept and its implementation and "Enterprise" which is essentially a comprehensive business plan for the proposed business venture. The programme's objectives are to extend the student's understanding and knowledge in their chosen field of entrepreneurial work, to teach business, management and enterprise skills and understanding of the business processes applicable to the development of knowledge based enterprises and to expose students to the processes involved in starting up and running a business (The University of Manchester, 2019). The M.Ent. researchers, apart from the programme's content, have other business start-up support opportunities available to them such as extra-curricular activities including competitions, workshops and conferences which are part of the University's enterprise ecosystem, this programme is linked closely to the theories as stated earlier by Klein and McCaffrey (2019).

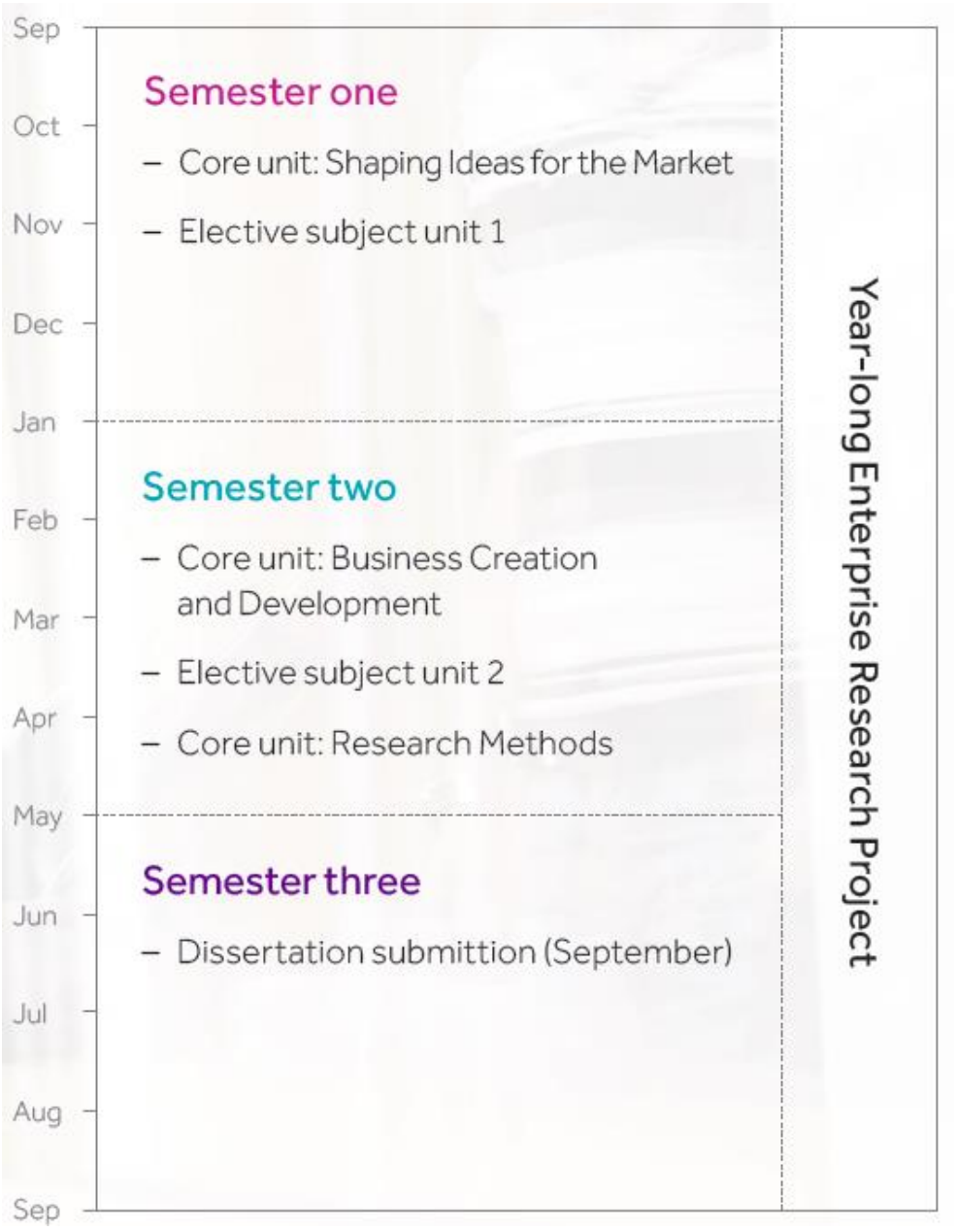

Figure 1. Master of Enterprise 12-month research programme structure. The University of Manchester (2019).

2. Methodology

Secondary data was used from the University's enterprise database (Papadopoulou and Phillips, 2019) for student start-ups - all known student businesses were identified e.g. linked to postgraduate study, business plan competitions, boot camps or any other activities that they may have taken part in and only individuals that studied on the M.Ent. were selected. The M.Ent. programme, first run in 2001, with the first students graduating in 2002 and the database includes information between the 2002 and 2019 which is a period of 17 years. The database includes 59 M.Ent. start-up companies, in total approximately 1/3 of all the M.Ent. students start a business. This database was used to compare survival rates in UK using the Global Entrepreneurship Monitor (GEM) (Hart *et al*., 2018) which includes data from 2002 to 2018 a period of 16 years. Both databases have: a similar time range, similar time length and geographical location making them very relevant for a comparison study. It should be noted that the M.Ent. students have business intentions hence they are self-selecting this programme and in this study the focus is on practical aspects.

3. Results and Discussion

The main results show the percentage of start-ups, gender of founders, the employment (jobs) created and survival rates of start-ups three and five years from their registrations. Table 1 summarises the main results from the analysis of the M.Ent. database and comparison with the UK data from various national data sources that are discussed in this section.

Table 1. Comparison of M.Ent. and UK economy data.

Activity	M.Ent.	UK data (GEM, APPG, SBA, ONS)
Setting up a start-up company (start-up rate)	33%	8% (GEM)
Gender of business founders ratio (Male/Female)	73/27	70/30 (GEM)
Businesses created that employed more than just the founder	69.5%	10% (APPG)
Start-up Survival Rates 3-year	83%	50% at 2-year (SBA)
Start-up Survival Rates 5-year	86%	43.2% (ONS)

3.1. Setting up a start-up company

From the M.Ent. course, approximately 33% of students start a business during the programme or after graduation. According to GEM data, in the 18-25 year old group in the UK general population, start-up rate is approximately 8% (Germany is 4% and France 2%) (Hart *et al*., 2018), whilst from the university as a whole, those starting a business (including professions where it is normal to be self-employed) on graduation is approximately 5% (APPG Report, 2018). Furthermore, approximately only 10% of these (i.e. 0.5% of total university graduates) are what we might consider an entrepreneurial start-up rather than in a career where it is normal to be self-employed. Hence this shows a much higher percentage for the M.Ent., although as mentioned the students are self-selecting this programme.

3.2. Gender of business founders

The M.Ent. has 59 businesses in the database, 43 of them founded by men and 16 by women, hence male founders are more than double of the female (around 2.7 times), (73% men, 27% women). There were 36 individual male founders and 13 individual female, indicating additionally that more male than female had multiple businesses. This compares to GEM data which shows that in the general population female start-up rate was 5.2% and for male founders was 10.5% (Hart *et al.,* 2018). Therefore male founders are approximately double that of female founders. This gender gap is roughly the same for different stages of business as well. France and Germany also show that female start up rate is about 50% of male, however the US shows that female start up rate is about 75% of male.

3.3. Employment created

From the database the total employment created by the M.Ent. in the last 17 years is 349, which is an average of 5.92 people per business, including the founder and an average of 20.5 jobs created per year due to M.Ent. (1.7 jobs created per month). Breaking this down by the founders gender, the total employment created by male founders is 282 (including the founder), each male founded business employs on average 6.56 people (including the founder). The total jobs created by female founders 67 (including the founder), each female founded business employs on average 4.19 people (including the founder). Male founded businesses employed more people on average, however, the percentage of male and female founders who were employing others were similar. Looking further into the growth of the startups, 41 of the 59 start-ups employed more than just the founder (69.5%). Breaking this down in gender, 30 of the 43 male founded businesses employed more than just the founder (70%), and 11 of the 16 female founded businesses employed more than just the founder (69%). With a large percentage of the businesses were employing others at 69.5%, this suggests that a significant number of the businesses are “high growth, entrepreneurial

companies" rather than simply self-employed lifestyle businesses. Data from the 2019 APPG report suggests that graduates starting what might be considered an "entrepreneurial start-up" business is as low as 0.5%, whilst approximately another 4.5% of graduates are self-employed. This is a strong indication that the M.Ent. creates a higher percentage of high growth businesses.

3.4. Start-up Survival Rates in UK

Of the 59 companies created, 49 were still active as of January 2019, i.e. a survival rate of 83%, which is a strong survival rate. Looking at the 47 businesses created between 2002 and 2016 i.e. those that had survived 3 or more years, 39 were still active, indicating a rate of 83% for a 3-year survival rate. Of 36 businesses started between 2002 and 2014, i.e. those that had survived 5 or more years, 31 were still active with a rate of 86% for a 5-year survival rate. This compares very favourably to The Small Business Association (SBA) (2019) data which states that 30% of new businesses fail during the first two years of being open, 50% during the first five years and 66% during the first 10 (3-year survival data not available). In addition, ONS data in UK indicated the 5-year survival rate for businesses born in 2012 and still active in 2017 was 43.2% (ONS, 2017) with regional variations of 39-45%. This shows that the M.Ent. is not only generating start-ups at a significant rate, but the skills gained is allowing those businesses a better chance of survival compared to UK norms. Comparing this with the survival rate of the non-academic programmes in UK, according to Bone *et al.* (2019) most UK startups consider the contribution of the incubator/accelerator they attended have been significant or even vital to their success. Start-ups' participation in accelerators is positively correlated with higher survival rates, increased growth in employee numbers and higher amounts of funds raised, though specific numbers are not available, those who attended an incubator (73%) are likely to report it as significant or vital to their success and those that attended an accelerator (64%) report it as significant or vital (Bone *et al.*, 2019). In terms of non-UK businesses, only three of the 59 businesses were registered outside the UK despite having a significant number of overseas students on the course, so the UK economy is benefiting from students who have chosen to remain in the UK to advance their business.

4. Conclusions

The M.Ent. research programme is proving to be an effective programme. The M.Ent. business creation rate is much above the general population average and the average for recent graduates, although the ratio of male to female founders is just as low as that found in the general population. A key benefit seems to be that the survival rate is between 83% and 86% which is very high in comparison to general UK data and is analogous with incubators and accelerators. It provides evidence of sustained development of start-ups and

entrepreneurial skills rather than just setting up one company. The uniqueness of this programme is that provides an education with a mix of academic knowledge and practical knowledge, offering constant interventions (e.g. assignments, business plan feedback, competitions) to develop their idea. It forces individuals to do primary research and test ideas as part of their dissertation and develop a strong tested/verified business plan and knowledge transfer, which might aid survival rates. It provides students time to think critically, apply the skills taught in the classroom, and assess the validity of their business idea and supportive network of the University's ecosystem hence improving the quality of their work, and equipping them with entrepreneurial and transferable skills. In some cases, graduates that choose not to set-up a start-up immediately upon their graduation, benefited from the M.Ent. programme by finding employment in companies such PWC, Deloitte and The Hut Group. Further work is proposed in identifying the type and discipline of business created, including social enterprises, the background of the students degree prior to joining the M.Ent. and other activities they might have benefitted from whilst at University.

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Relationships Between External Factors and University Students' Attitudes towards Academic Research

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Abstract

Research is an important part of an academic career, yet it is not always frequently practiced by most students. This descriptive-correlational research aimed to find out the external factors that influence students' attitudes toward research. The researchers sampled 201 undergraduates at Wenzhou-Kean University and analyzed their responses to the questionnaire in order to determine the relationship between possible factors and their attitudes. The results revealed that the external factor of the training environment has a moderate positive influence on research attitude, while support from the university has a strong positive influence on research attitude. Specifically, factors of faculty support, curriculum design, on-campus academic activities, library service, and financial support all moderately influence students' attitudes towards research in a positive way. The most salient influential factor of all is faculty support. The results suggested that to improve students' attitudes towards research, sufficient support is vital, especially academic and financial support. Therefore, to externally encourage students to conduct academic research, faculty and university could give more consideration to support provision.

Keywords: *Academic research; research attitude; research training environment; university support.*

1. Introduction

Research conduct is one significant part of society's academic advancement, which also plays an essential role in the personal academic career. Specifically, for undergraduates, it is a necessary skill to learn, for it prepares them to produce academic outcomes, which will influence their admission to graduate schools. Moreover, research benefits students by assisting them in attaining knowledge on a much deeper scale and inspiring them to learn confidently, independently, and proactively with better communication skills, retention, and persistence. (Stanford et al., 2017). Therefore, academic research should not be overlooked in undergraduate education.

However, studies have discovered that among undergraduates, only a small percentage holds a positive attitude toward academic research. In general, there is no research culture cultivated in universities. (Van der Linden et al., 2015). For various reasons, students lack information, exposure, or merely interests in academic research, resulting in unawareness of the value of academic research, as well as little participation in research.

To have a better understanding of why the above phenomenon exists, this study aimed to explore and describe external factors that influence students' attitudes toward academic research. The study mainly focused on the research training environment and support from the university, using analysis of survey responses from students at Wenzhou-Kean University (WKU). Connections between these two factors and students' attitudes may provide educators and instructors with possible directions to inspire students to view academic research more positively.

1.1. Literature Review

1.1.1. Attitudes Towards Academic Research

Students' attitudes towards research are variable. The results from previous researches revealed that the majority of students held positive attitudes towards research study. Only a minority of them were interested in conducting their own research projects at the same time (Kozlova & Atamanova, 2013). Thus, shaping attitudes became a priority in high educational settings. Various elements could be evaluated and discussed in this topic. Accordingly, there were two aspects to infer students' research attitudes: research knowledge and personal research experience. Research knowledge is used as a criterion to examine students' research output. "Acquiring deep and sound knowledge" was one of the major motives for students towards academic research (Kozlova & Atamanova, 2013). Undergraduates' performances in academic research were affected by their early research experiences (Stanford et al., 2017).

1.1.2. Research Training Environment

The research training environment is referred to as an overall atmosphere that relates to academic research. The past researches had suggested that the audiences of research skills include all university graduates, regardless of their future career path (Murtonen et al., 2008). In the context of the WKU campus, the training system consists of a research curriculum and faculty support. A case study in Russia revealed that a research-related curriculum aims at developing students' motivations and shaping their positive attitudes towards academic research (Kozlova & Atamanova, 2012). What to be offered in curriculums have a great influence on students' research attitude. Faculty support here is generally referred to as the instruction and help coming from faculty. In the past surveys, "Being respected by tutors and approved by other people" and "Following tutor's requirements and setting a good example for peers" are listed on the motives for a research study (Kozlova & Atamanova, 2013).

1.1.3. Support from the University

University-level support is noticeably powerful in encouraging research conduct. A study reported that on-campus academic activities could increase students' confidence and appreciation of research, leading to postgraduate study (John & Creighton, 2011). Furthermore, Xi et al. (2019) discovered that more reputable universities with stronger academic backgrounds have relatively better reference services of libraries. This correlation suggests library service's impact on research attitudes. According to Evans (2010), financial support from the university is another essential factor for a positive outcome of undergraduate research. More student participation ensues from increased university financial support (Stanford et al., 2017). It should also be considered that a sufficient amount of funds directly impacts the feasibility of the research in terms of necessary equipment and other costs.

1.2. Conceptual Framework

1.2.1. Operational definition of the terms

Attitudes towards Academic Research: The perceptions of academic research and willingness to participate in academic research. Specific indicators include students' research knowledge and research experience.

Research Training Environment: The academic research atmosphere in university considering the cultivation of students' research ability. This is indicated by the design of the research curriculum and faculty support.

Support from the University: The provision made by the university, from which faculty and students benefit. Indicators are on-campus academic activities, library services, and financial support provided by the university.

1.2.2. Conceptual Framework Graph

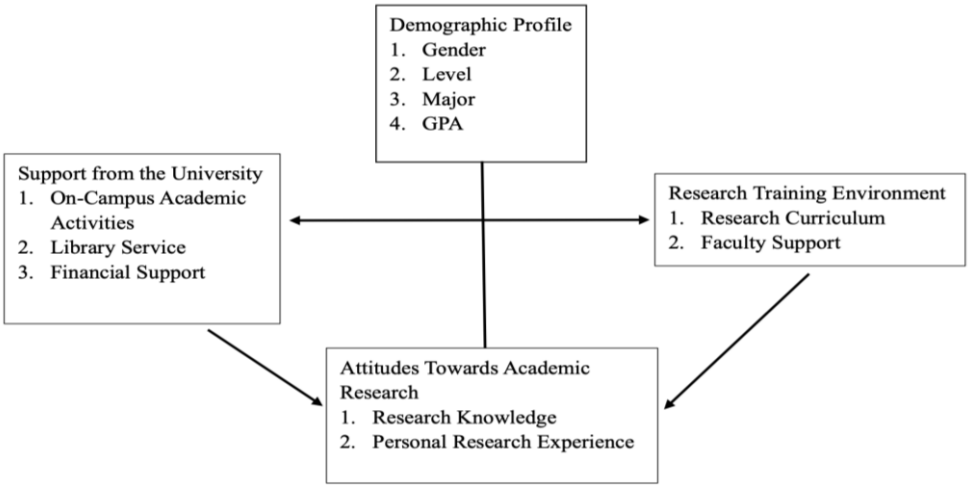

Figure 1. Conceptual Framework

2. Methodology

Descriptive-correlational and cross-sectional designs were used in the study, serving to determine the correlation between external factors and students' attitudes towards academic research. The research was conducted at Wenzhou-Kean University which is an institution that is collaborated between China and the United States. The current undergraduate programs in WKU adopt the American education system.

Two hundred and one responses were collected as research samples, which were nearly 10% of the total student population at WKU. All the responses were proved to be complete and valid. The data came from all four colleges across four grades in WKU, during the Fall Semester of 2019, which freshly reflected the current academic research situation at Wenzhou-Kean University.

Peer critiquing was used to establish the validity and reliability of research instruments. This study used a quantitative approach by means of an online survey administered via WeChat in an open and closed-ended questionnaire. A four-point Likert scale was used to measure the respondents' attitudes towards academic research, support from the university and research training environment. In the scale, number 4 represented strongly agree (SA), while number 1 represented strongly disagree (SD).

3. Results and Discussion

3.1. Research Training Environment and Students' Research Attitudes Relationship

Faculty support in the research training environment was observed to have a moderate positive impact on students' research attitude (***R***=.553). What was noteworthy about the statistics was, all descriptive indicators' coefficients were lower than the overall coefficient, among which the highest was (***R***=.*526*,) the lowest was (***R***=.451). This suggested that when all independent indicators were combined and taken into consideration together, there was an extra positive impact on students' interests in research. Table 1 presents the statistics of *faculty support's impact.*

Table 1. Relationship between faculty support and students' research attitudes

Indicators	**Academic research attitudes**
	R
▪ Programs like Students Partnership with Faculty (SpF) and Students Partnership with Staff (SpS).	.526
▪ After class one-on-one instruction from faculty	.469
▪ The teaching style of faculty	.451
Overall Faculty Support	**.553**

* Correlation is significant at the 0.05 level

Regarding research curriculum design in the research training environment, both conditions of existing research courses (***R***=.393) and extra training opportunities (***R***=.354) had a weak positive impact on research interests. The correlation coefficient (***R***=.476) of helpful feedback from faculty ranked the highest among all the indicators related to research curriculum design, followed by the correlation coefficient (***R***=.468) of students' satisfaction in current courses. Same as faculty support, overall considerations of research curriculum design showed more positive results than each independent indicator. In general, the relationship between research curriculum design and students' academic research interests was moderate positive. Table 2 presents the statistics of the relationship between research curriculum design and students' research attitudes.

Table 2. Relationship between research curriculum design and students' research attitudes

Indicators	**Academic research attitudes**
	R
▪ Existing research courses in a four-year plan	.393
▪ Extra training opportunities (lecture/workshop/competition)	.354
▪ Students satisfaction on current courses	.468
▪ Helpful feedback from faculty	.476
Overall Research Curriculum Design	**.528**

* Correlation is significant at the 0.05 level

3.2. Support from the University and Student's Research Attitudes Relationship

The results reported that WKU students generally recognized the helpfulness of the support from the University, which overall had a strong positive impact on their attitudes toward research. Among all the indicators which were considered moderate positive, financial support ranked the highest (***R***=.466), followed by library service (***R***=.452), library resources of related materials (***R***=.444), and on-campus academic activities (***R***=.271). Similar to previous statistics but with a more noticeable leap, once combined all independent indicators, the relationship between research attitudes and support from the University becomes strongly positive. Table 3 presents the statistics of support from the University.

Table 3. Relationship between support from the university and Student's Research Attitudes

Indicators	**Academic research attitudes**
	R
▪ On-campus academic activities	.271
▪ Library service	.452
▪ Library's offer on related materials	.444
▪ Financial support	.466
Overall Support from the University	**.720**

* Correlation is significant at the 0.05 level

Results revealed that there is a significant positive relationship between WKU students' attitudes towards academic research and external factors. Both major factors, support from the university and research training environment, have a moderate positive impact on

students' research attitudes. This result was in accordance with several past studies about academic research from John and Creighton (2011), Xi et al. (2019), Stanford et al. (2017), Evans (2010), Murtonen et al. (2008), Kozlova and Atamanova (2012, 2013), and David (2003). As for the highlights of this research, it combined independent factors studied in previous researches and did an overall evaluation of undergraduates' academic research situation, specifically at Wenzhou-Kean University, a typical Sino-foreign university.

3.3. Support students expect to receive from the university

Findings of the open-ended question reported other support students expect to receive. Among 201 responses, 109 answers were valid, of which 73 (67%) respondents gave suggestions concerning academic aspects. The 36 (33%) respondents provided suggestions concerning non-academic aspects. In general, students anticipate more academic improvement from the University, including opportunities to be exposed to research (21%), professional instructions (38%), and others (8%) considering academic issues. Another noteworthy indicator was financial support for academic research, proposed by 32 (29%) respondents. Table 4 presents the detailed responses provided by respondents.

Table 4. Support students expect to receive from the University.

(Non-) Academic	Category	Subcategory	Number	Note
Academic **Total: 73**	**Opportunity** (exposure to research)	Library	3	retrieve and learn from other research
		Research recruitment	4	join research
		conferences	15	publish research and learn from others
		Publication platform	1	publish research
	Instructions (preparation for research)	Course	8	/
		Workshops	18	including game, case sharing, and other activities
		Professor	15	/
	Others	Credit replacement	1	/
		Not specified	8	/
Non-academic **Total: 36**	**Finance**	From school	31	/
		Social scholarship	1	/
	Time	Enough time	2	/
	Reward	Certificate	2	/

Students' expectations of university support mostly expressed were concerns related to academic aid and financial support. Based on ranking, the highest demands were 1) financial aid from the school, 2) research-related workshops, 3) conference opportunities, 4) professors' instructions, 5) modified curriculum.

3.4. Practical Implications

For faculty support to help students better prepare themselves for conducting research, it is suggested that more research-oriented activities such as SpF and SpS programs be appropriately granted, thereby anticipating an increase in students' participation in experiential research learning. Likewise, stepping up of after class mentoring and instructions is recommended. These conditions will likely cultivate students' positive attitudes towards academic research since students enjoy being immersed in a positive training environment.

For curriculum designers, to be able to expand students' research knowledge, hone students' research skills, and develop students' research potentials, researchers propose to enhance the four-year plan to incorporate more discipline-based research courses. Thus, students are more likely to equip themselves with fundamental skills tailored fit to their field of specialization. In addition, the inclusion of research related training activities and opportunities such as institutional based or interuniversity conferences and workshops is being recommended. Students' exposure to these activities will enhance students' current course satisfaction.

For school administrators, it is expected to provide students with more financial support on research, including awarding scholarships and reimbursing related fees.

Researchers believe these implications are applicable to similar educational environments and encourage the associated part to take measurements in providing relative support to their students.

3.5. Conclusions

A significantly positive and moderate correlation of external factors and students' attitude towards academic research was established for Chinese students learning in an EMI context. Students' research attitudes are shaped by both the support from the university and the research training environment. There are some additional support students expect to receive from the university. Top priorities are financial support from the school, research-related workshops, conference opportunities, professors' instructions, and modified curriculum.

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Creativity and Innovation Skills in University STEM Education: The CHET Project Approach

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Abstract

Creativity and innovation are crucial skills to face challenges in economy, environment and social context today, especially next decade with 2030 Agenda for Sustainable Development adopted by all United Nations Member States. European Higher Education System considers STEM studies play a key role to lead the global labor market and address our economic system towards more sustainability and equality model.

Innovative educational projects developed at the Universidad Politécinca de Madrid have identified lack of students skills in creativity and innovation to apply challenge based-learning and others methodologies in classrooms.

Hovewer Higher Education institutions need a whole approach to include creativity in university curricula (graduate and postgraduate programs), at the same time, professors claim support to embebed innovative methodologies in their subjects.

CHET Project is designed as a solid strategy aimed at developing an innovative process to modernization of Higher Education System in Europe. Step by step, the project begins by defining the learning environment, then developing creativity techniques and tools, and finally validating methodologies and processes. All this supported by free access online platform.

Keywords: *creativity; innovation; STEM; learning environment.*

1. Introduction

The importance of creativity and innovation in addressing the economic, environmental and social crises has been recognized in Europe. Recent policies call for the strengthening of Europe's innovative capacity and the development of a creative and knowledge-intensive economy and society.

De Bono (1970), in "Lateral thinking", stresses the importance of the use of creativity and innovation in the classroom, and considers these key in giving their students the skills to face and solve complex problems.

On top of that, the last decade has seen a paradigm change in the characteristics of Higher Education (HE) students, the economic and other pressures and demands of the labour market, are generating career changes or the need for additional education in later life. At the same time the age of students entering university after secondary education has been slowly decreasing. Diversity among students has also been increasing. All the above poses a challenge on HE teachers, which have to deal with students from a variety of backgrounds and skills levels.

This has generated a challenge for HE teachers to be more effective in teaching and to make teaching and learning relevant, for society, for the labour market and for the students themselves. Experiences have shown that using creativity techniques and innovation increase the problem-solving and innovative capacity of their students, while at the same time increasing their motivation (Rodriguez-Chueca et al., 2019).

This is confirmed by "Innovating Learning: Key Elements for Developing Creative Classrooms in Europe", a EU Joint Research Centre study (2012), which highlights that HE institutions need to emphasize the importance of creativity and innovation for modernising education, it also identifies as one of the main improvement areas the training and education of HE teachers.

From a job perspective, as outlined in the conclusions of the "Annual Report on Labor Flexibility and Employment" by Randstad Research (2016), STEM (Science, Technology, Engineering and Mathematics) jobs offer higher levels of productivity growth through the introduction of new technologies and innovations. To achieve this, it is necessary to convince teachers about the necessity of the renewal of teaching methodologies to further promote the competences in creative skills of students (Shernoff et al., 2017).

HE institutions an important role in this, as they have to provide their students with an education that will enable them to adapt to an increasingly globalised, competitive, diversified and complex environment (Csikszentmihalyi & Wolfe, 2014) in which creativity, the ability to innovate, a sense of initiative, entrepreneurship and a commitment to continue learning are just as important as the specific knowledge of a given subject. Current

educational systems do not answer the demands of the labour market for professionals with innovative, problem-solving and entrepreneurial capacities.

When teachers finish their university degrees, they have no problems with contents they have to impart; through practice they acquire the necessary skills to became good teachers; However, what they neither learn at university nor through practice are the skills that make them "innovative and creative teaching professionals".

By providing HE teachers will skills and competences to integrate creativity and innovation in their teaching activities, they will contribute to a better preparation of their students and are better placed to provide an answer to the needs of the varied classrooms (EUA, 2007). The HE institutions recognise that preparing and motivating students is key and that they are part of the solution, as their teachers are pivotal in fostering and developing students creative and innovative capacities.

2. CHET Project background and objetives

Since the beginning 2016-17 course, a Universidad Politécnica de Madrid (UPM, Spain) professor´s team has develop successive innovative education research projects, address to engage students and improve learning process integrated innovative methodologies (Flipped classroom, Challenge-base learning, ...).

One of the most important result was students has serious difficult to apply creativity and innovative solutions in solving real problems or situation proposed during the semester. From this point of view, we worked on a desing project that would provide a whole vision of learning creativity in Higher Education. This challenge needed an more complete approach and collaboration with other european universities.

Finally a consortium group was formed with six partners, four universities: Universidad Politécnica de Madrid (Spain), University of Southern Denmark (Denmark), Vilnius Gediminas Technical University (Lithuania), Ege University (Turkey), joined together with two methodology support and technology companies: Avaca Technologies Consulting, Informatics AE (Greece) and EOLAS S.L. (Spain).

In this context the CHET (Creativity for Higher Education Teachers) project emerged, supported by Erasmus+ (Key Action 2) focusses on STEM High Education teachers. On the one hand, because the participating HE institutions indicate that it is in these type of studies where they see the take up of innovative teaching activities is slower. On the other, because Europe needs professionals trained in these subjects. Bringing about a change in the way education is approached, addressing better the needs of the labour market and the challenges of a varied classroom, will increase the attractiveness of these studies and reduce drop-out rates. In this framework, creativity definition is understood like as outcome of a process and

has four main characteristics: originality, appropriateness, future orientation and problem-solving ability (EUA, 2007)

CHET addresses these challenges by providing STEM HE teachers, with the skills and pedagogical competences to embed innovation and creativity in their their teaching activities. To make this happen the project will develop e-learning materials and content, based upon the needs of STEM HE teachers, delivered through the CHET learning environment, which will allow them to implement learner-centred learning approaches which foment creativity and innovation among their students and provide them knowledge and insights on how to increase the interactive learning of students with teachers and peers.

Tackling a challenge which is present across European Union (EU) countries and educational systems, is only possible on a European level, through intense cooperation of relevant players. The transnationality is vital to learn from each other experiences in how different national educational systems address the issues and to detect good practices across different countries. Knowledge from different EU regions will be combined and integrated into the Intellectual Outputs. Current European landscape on implementation of creativity techniques and innovation in HE STEM studies has not been mapped, and there are no guidelines on which approaches or techniques are better suited for a specific STEM context, CHET aims to provide these.

3. Methodology: step by step

First, for the learning approach to be robust it needs to be based upon a set of solid findings and contrasted with the targeted learners (i.e. STEM HE teachers). Secondly, the design of the learning environment will aware easy access to a set of creativity techniques, and finally all this will be validated in practice with teachrs and students.

3.1. Baseline studies and curricula design

It will take as a starting point the findings from the desk research and analysis of existing activities applied among participant universities. These research results will lead to an initial list of factors that are considered as key elements for creativity and innovation in STEM HE education, such as the needs of the STEM HE teachers, the challenges for practical implementation and the sources for knowledge on the topic.

These initial results and list will be presented in a focus group approach to STEM HE teachers will be executed in 4 project countries and possibly covering more countries through the existing networks of the partners. The focus groups will provide insight into the current state of skills, knowledge and attitudes among the teachers and their institutions, allows to lay the baseline for the determination of the curriculum, which will describe the specific skills,

knowledge and attitudes that both the STEM HE teachers and the HE institutions need to have to be able to fully embed creativity and innovation in the teaching.

As a result the overall learning approach for CHET will become evident, the overall results of the preliminary research focus groups and curriculum will be basis on which to define in detail the CHET learning approach, which consists of a description of the learning objectives; the learning process; the learning content (i.e. the curriculum) and the assessment methodology.

3.2. Defining the learning approach

The first activity will be the identification of those creativity techniques that are relevant for the target public, these will then be mapped against the existing materials and knowledge from the partners so as to identify those materials already existing and which can be adapted to the needs of the target public. By building upon existing materials and knowledge the consortium can include with the same effort a larger amount of techniques and experiences, thus generating a sufficient critical mass of content, within the limits of the project and its resources. The map will also identify those areas of knowledge and/or techniques for which no existing material exist (or not of sufficient quality) and thus requires new development.

The CHET learning content will cover two aspects:

- Understanding and knowledge of the specific creativity techniques, and the underlying processes of educational innovation in teaching activities.
- Understanding and knowledge on when and how to apply a particular creativity technique, depending on the learning contexts and circumstances.

The first aspect focuses on the more theoretical aspects of creativity techniques. A selected set of most relevant creativity techniques will be explored and described in more detail, based upon the recommendations from the learning approach section. Each of the identified techniques will be defined using a set of common descriptors, introducing the technique and the underlying educational innovation processes to the learner. The techniques are classified as per a defined ontology and semantics (theme, type, etc), so as to ensure their seamless integration in the app and their alignment with the app´s search engine and options. The underlying materials and content related to creativity and the educational innovation processes developed and will be made available through the e-learning platform so as to allow for more profound exploration of a specific topic, aspect or technique.

For each of the selected creativity techniques the second aspect will explore for which type of learning contexts and circumstances the techniques is most effective, (e.g. size of the student group, subject, topic etc), resulting in a second level semantics and ontology. For each of the techniques, experiences, best practices and examples are mapped, and those

considered most relevant these are described, including tips and tricks on how to implement them in practice.

3.3. Content elaboration and CHET learning environment

The contents for the e-learning platform consists of:

- Theoretical descriptor of the creativity technique
- Tips and tricks on the practical implementation (including references to circumstances under which it has been more effective)
- Examples (including best practices and short case studies) of their use by peer STEM HE teachers.

The e-learning platform will allow easy access to a set of creativity techniques with theory and practice (examples, best practices, tips and hints) represented in a user-friendly way, and adapted for mobile platforms (type to be determined based upon the preferences of the HE STEM teachers). The e-learning platform will provide the space for the participants to drill deeper into the skills, knowledge and attitudes identified by the research activities and developed in the content of CHET learning content, it is also the place for knowledge sharing.

The CHET e-learning platform will also include the development and implementation of the assessment methodology, based on the content of the training programme, the learning objectives and needs.

3.4. Testing and validation

Within this task, the most suitable pilot testing and validation methodology will be established and statistical and qualitative analysis techniques will be selected. Objectives of the pilot validation need to be clearly defined and be common to all as they are detrimental to the execution of the pilot test.

The pilot testing will take place on 2 levels:

- Transational learning activity in which the participating teachers receive training on how to embed creativity techniques, into their teaching activities, share knowledge and gain insight into how to use the CHET tools for this.
- Pilot testing in which a selected sample of teachers will use the CHET learning environment and a specific set of them will implement a selected technique in a classroom.

Students will play an important role in the validation of the second level, as after the implementation of the selected technique they will assess the interest of this kind of educational innovation.

4. Expected results and impact

CHET will already generate a turnaround in the perception of creativity and innovation in the higher educational system and by the teachers. CHET foresees a study and solid analysis to define the 'ideal' skillset for creativity and innovation in the teaching activities of HE STEM teachers, as well as the most pressing needs in terms of its implementation. The result is relevant not only for the present project, but for any activities in the field of educational innovation and creativity in other areas of study, as well as in other types of education.

CHET Erasmus + project will bringing together a comprehensive set of creativity and innovation techniques, specifically for the HE STEM areas, with guidelines, tip and tricks and examples/testimonies of their use in a real teaching activity. Teachers get easy access to very concrete skills, tools and embed creativity techniques and innovation in their teaching activities in practice.

Results and impact are aligned with these direct and indirect target groups:

- **STEM HE teachers:** focus on the need for acquiring skills and competences to integrate and embed creativity and innovation in teaching activities, and how the CHET outputs and results can help them to do so
- **STEM HE institutions and their training bodies:** to communicate the need for innovating in the teaching methods and integrate creativity and innovation skills into the educational curriculum (for teachers and students) and how CHET outputs and results will help them in this process.
- **Policy makers and public authorities with competences in the field of education,** to convey how CHET can help them to modernize the educational policies and system to the demands for of labour market and society and include creativity and innovation as an integral part of the education system and curriculum;
- **Educational and/or creativity experts** on the importance increased cooperation, and how CHET can provide guidance on how to change the educational environment and approaches

To ensure facilitate the uptake of the CHET outputs and results by the different target groups and stakeholders a set of guides and a policy brief are elaborated, which will describe the CHET e-learning platform, explain the benefits and provide examples of their implementation.

5. Conclusions

Creativity and innovation are skills required by the labour market and a competitive economy, by embedding these type of techniques in the way subjects are taught and designed, will better prepare HE students for the challenges of both work as private life, and increasing labour market relevance of learning provision and qualifications.

Creativity must be understand how an horizontal skill in universitary studies, and it is a necessary abillity to apply others innovative education methodologies like Challenge and Project Based Learning, design thinking, collaborative learning, gamification, among others.

For this reason, it is necesary developing a new approach to embed creativity and innovation techniques and methodologies into HE teaching activities. It thus, introduces a set of skills which allow them to deliver high quality teaching in their subjects, and to address the need for educational approaches which are more adapted to the challenges and current demands.

CHET project promotes take-up of innovative practices in STEM HE by providing teachers with the skills and competence to support personalised learning approaches, collaborative learning and critical thinking. In this way, students can learn different subjects while using and achieving creativity skills.

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Combined Use of Problem-Based Learning and Flipped Learning in Turbomachinery

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Abstract

Several methodologies are available to promote active learning processes. This is especially important under the creation of the European Higher Education Area, which has contributed to enhance university teaching through the use of new teaching tools. The aim of this paper is to present results about the use of Problem-Based Learning combined with Flipped Learning methodology for teaching turbomachinery, with a group of 50 undergraduate students. This experience was implemented in the Industrial Engineering School at the University of Castilla- La Mancha (Albacete, Spain). The aim of this study was to implement innovative tools to avoid conventional classes at the university. Moreover, it can be useful to increase motivation, because students participate in class, interacting with other students.

Both methodologies resulted in a very positive learning experience, with most of the students (89%) participating in the task, which is not commonly achieved in a conventional class. The majority of students considered this type of activity to be useful for the subject although they thought it necessary to devote more time to it for the methodology to function properly.

Keywords: *Problem-based learning; flipped learning; university, turbomachinery.*

1. Introduction

Several methodologies are available to promote active learning processes. This is especially important under the creation of the European Higher Education Area, which has contributed to enhance University teaching through the use of new teaching tools. These tools include Problem-Based Learning (PBL) (Bouhuijs, 2011; Labra *et al.*, 2011; Castaño, 2015) and Flipped Learning (FL)(Garza, 2004; Findlay *et al*., 2004). Problem Based Learning can be defined as an instructional learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem (Savery, 2006). Flipped Learning is a pedagogical approach that allows teachers to create an interactive learning environment, promoting dynamic activities in class (Pierce and Fox, 2012).

The aim of this paper is to present results on the use of Problem-Based Learning methodology combined with Flipped Learning in the teaching of turbomachinery, with a group of 50 undergraduate students. This experience was implemented in the Industrial Engineering School at the University of Castilla- La Mancha (Albacete, Spain). The aim of using these methodologies was to increase motivation, and provide students with a different way to learn course content, avoiding the deductive approaches used in conventional classes.

2. Methodology

2.1. Proposed Case

The main case study proposed was based on a previous experience carried out by the authors (Córcoles and Martínez-Romero, 2019), developing Problem-Based Learning methodology, where the students had to solve a problem in class to detect the main deficiencies in an urban water network. Hence, the students had some previous experience in the use of Problem-Based Learning tools but had never used Flipped Learning methodology. In the case mentioned, undergraduates studying turbomachinery have to identify the main problem in a village, the urban water network of which does not guarantee enough pressure and flow rate to the hydrants. To solve this problem, the students have general information about the case, and have to read a text explaining the main problem of the network.

In the proposed case, the urban distribution network consists of 75 km of pipelines and more than 300 connections, and supplies a population of 2500 inhabitants, which increases by 30% at different times of the year, when the problem is further aggravated. The network has a regulation-storage tank that supplies water by gravity. The tank is filled with a submersible water pump (located at a distance of 1 km) that extracts water from the aquifer. This pump usually works in hours of reduced energy cost, following the electricity tariffs chosen by the local council.

2.2. Methodological procedure

To carry out this PBL activity, students are divided in small groups (approximately 8 students per group). In this task, students ask the teacher, who plays the role of technician and user of the network, questions about the system. After the question session, they have to identify the problem.

In this problem, the students will detect that the pumping system does not work properly, and hence they need to check how the pump is working. To carry this out, a second activity is proposed, based on Flipped Learning, where students, rather than being given a conventional class on pumps, have to obtain the information for themselves.

With this aim, once they have analysed the previously proposed case, the students have to search for information related to a pump characteristic curve (White, 2016). This information is important to understand how a pump works and is needed to solve the proposed problem. In this regard, the students have just a general idea about a pump characteristic curve but have no previous information related to this. Once they have the information, they will be able to understand and resolve the proposed case, which draws on Problem-Based Learning.

Thus, using Flipped Learning methodology, the students need to carry out the following tasks:

Search for information on the characteristic curves of a centrifugal pump. Describe the most important aspects of the curves.

Drawing on the results obtained, answer the following question. Can a pump work under different conditions? That is, can a change in water demand in the network modify the flow supplied?

Represent the curve of minimum resistance of an installation in a reference system (coordinate axis) H (m) vs. Q (l/h) and select a pump (motor curve H (m) vs. Q (l/h)).

As additional information, the students can understand better how to determine a pump characteristic curve because they have an installation in the laboratory that reproduces the operation of a pumping system (Fig. 1) as well as devices to measure pressure and flow rate (Fig. 2).

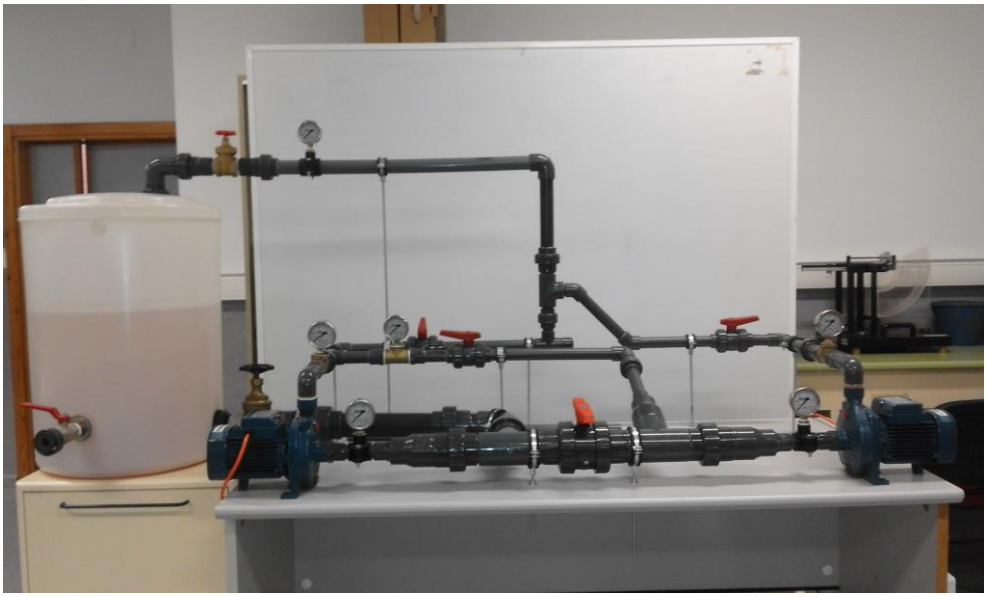

Figure 1. Experimental set-up

Figure 2. Ultrasound flow meter

When they finish this activity, as a methodological instrument, the students have to complete a short survey including the following questions:

Table 1. Proposed questions.

Question	Options
1. How much new knowledge does this activity provide you with?	1. None 2. A little 3. Some 4. A lot 5. All the knowledge is new
2. How is content assimilated compared to a conventional class?	1. The content is not understood 2. Worse 3. The same 4. Better 5. A lot better
3. How applicable is the activity to the world of work?	1. Not at all 2. Not very applicable 3. Moderately applicable 4. Reasonably applicable 5. Very applicable
4. How would you define the difficulty of the activity?	1. Low 2. Medium 3. High 4. Very high 5. Impossible
5. Is it interesting to include activities of this type in the subject?	1. No 2. Yes, but devoting less time to them 3. Yes, but devoting more time 4. Yes, but devoting a lot of time
6. Indicate to what extent the aims were clear	1. Not at all clear 2. Partly understood 3. Partly understood with the lecturer's help 4. Completely understood with the lecturer's help 4. Completely understood without the lecturer's help

3. Results and Discussion

The following section presents the results of the experience carried out. It has been divided into 2 sections: 1) ranking of the questions proposed by the professor, and, 2) pupils' responses to the learning and satisfaction surveys.

First of all, it is important to note that 89% of the students enrolled completed the activity, compared to 79% who normally attend class.

3.1. Ranking of the questions proposed by professor

The activity is assessable, and, as well as the high level of participation (89%), student engagement was high. The average student grade was 8.34 (out of 10). No student failed. These grades are markedly higher than those achieved by the same students on different tests during the academic year, where the mean score was 6.54 and 28.6% of students failed (below 5 out of 10).

3.2. Learning and satisfaction surveys

In Figure 3, the main results for questions 1 to 6 (Table 1) (related to the evaluation of the activity in the students' training and its importance in the subject) are shown.

In this regard, approximately 97% of the students considered that the activity provides new knowledge (question 1) and 70% of them say they understand it better than in a typical class (question 2). In addition, about 97% find it interesting to include activities of this type in the subject, but more time should be devoted to them (question 5). Only 3% of students think that the activity is not applicable to real life (question 3) and 30% that is it not very directly applicable, but is applicable in terms of problem-solving processes. On the other hand, 67% think that it is really applicable. For most students (76%) the activity involves certain difficulty (question 4). The objectives of the activity were clear, as 48% of the students say that they fully understood the objectives of the activity (question 6), and 42%, although they understood, needed the support of the teacher.

The students rated the activity with a score of 7.6 out of 10, and 82% scored 7 or more. Only 3% rated it below 5.

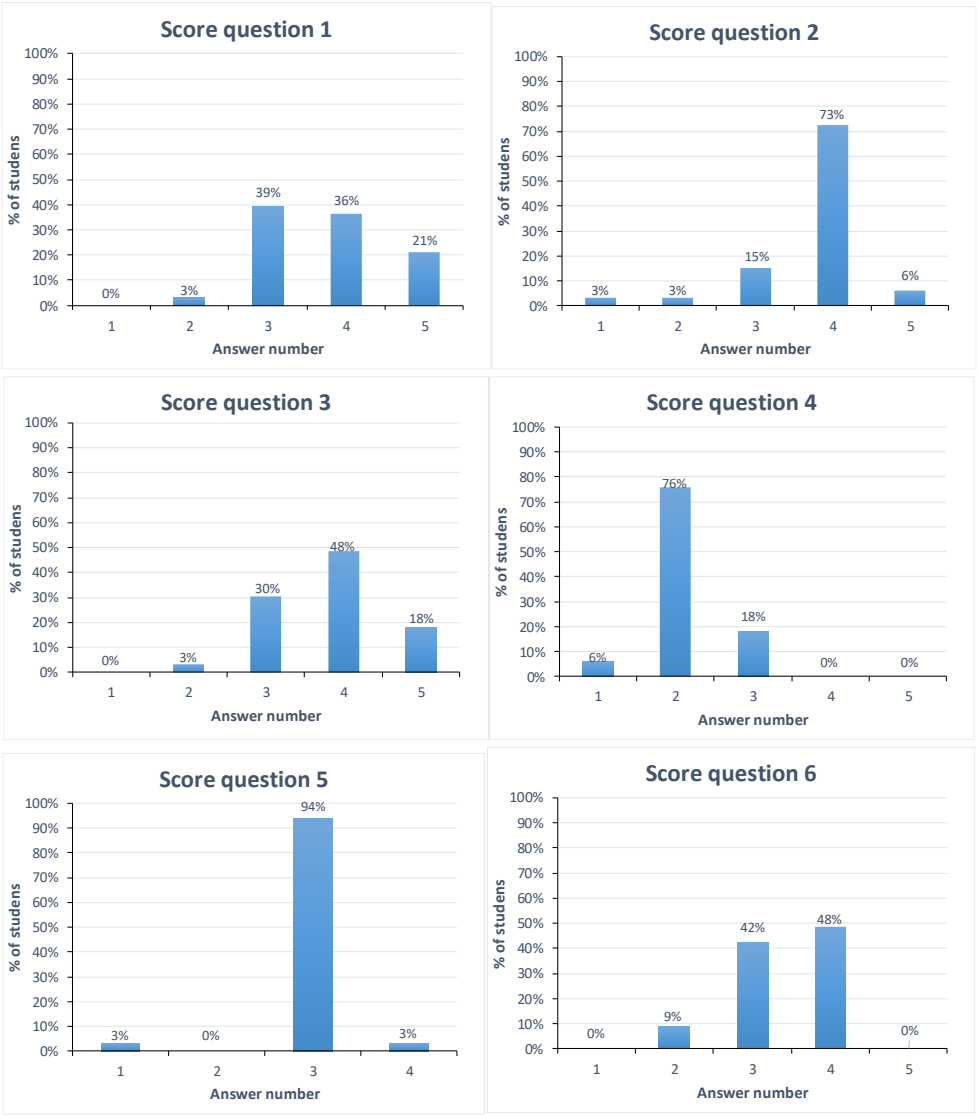

Figure 3. Score distribution for Questions 1 to 6.

4. Conclusions

This paper presents a combined study of Problem-Based Learning with Flipped Learning methodologies, the aim of which is to implement innovative tools to avoid conventional classes at university. Moreover, it can be useful to increase motivation, because students participate in class, interacting with other students.

The majority of students considered this type of activity to be useful in the subject although they think it necessary to devote more time to it for the methodology to function properly.

Both methodologies resulted in a highly positive learning experience, given that most of the students participated in the task, which is not commonly achieved in a conventional class. The main problem of these methodologies is that they are difficult to apply with a large number of students, which can be considered the principal limitation. Our experience suggests that the most noteworthy benefit of these methodologies is the high degree of student motivation, with most participants seeking to find a reasonable answer to the problem.

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U-Behavior: Visual-Form Learning Analytics to Enhance Teaching and Learning

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Abstract

Learning analytics have great potential to support students' learning process and instructors' learning design, specially when presented as a visualization, visual-form LA, designed in conjunction with student reflections. This presentation represents a multi-year mixed-methods study that collected students learning analytics from participation in retrieval practice activities, low-stake quizzes, and presented this data as visual-from LA to help students to be cognizant of and reflect on their learning practices in order to improve retention and recall by implementing high impact learning practices. Quantitative and qualitative data was collected, analyzed, and integrated to generate insights regarding the impact of the design on students' study behaviors and students' self-awareness of these behaviors. Findings suggest that the integration is successful in developing autonomous learners that more often recognize and implement effective learning behaviors.

Keywords: *Learning analytics; spaced retrieval practice; visual-form learning analytics; reflection.*

1. Introduction

There is considerable empirical evidence that provides students with guidance on the most productive way to spend study time. Zimmerman's self-regulated learning model is a three-phase cyclical process that encourages students to regulate their study behavior and time by monitoring time including planning (forethought), practice (performance), and self-reflection (Zimmerman, 2000). Additionally, the testing effect, which is the power of retrieval as a learning tool (Brown, Roediger, & McDaniel, 2014), requires students to retrieve information through self-quizzing, planning their retrieval of content over time and mixing up their practice. This effect is strongest (i.e. has the biggest impact on student performance) when students practice retrieval with time at the center of their strategy (Brown, Roediger, & McDaniel, 2014). Although these well-established learning techniques provide students with guidance on how to spend their time, students often behave in less-productive ways (Karpicke, 2009).

This research paper describes a multi-year study that aims to use visual-form learning analytics (LA) to help students to be aware of and reflect on their study behaviors as well as to persuade learners to change their learning strategies. Visual-form LA consist of representing learner data as a visualization (Authors, 2019). To produce the visual-form LA, the researchers developed U-Behavior.

The study was conducted with a primary objective of teaching well-established learning strategies, such as retrieval, spacing, and interleaving, and apply those strategies in course assignments. U-Beehavior is a method that uses retrieval practice activities (RPAs), implemented in a learning management system (LMS) as low stakes self-regulated quizzes. The intention of the RPAs was to create an opportunity for students to implement the various learning strategies they were discussing in the course and to observe their own study behaviors after learning about retrieval, spacing, and interleaving. The aim of the study was to determine if learners can be persuaded to implement more productive and beneficial learning behaviors through reflection and self-regulation.

2. Literature Review

This section presents the literature used to support the study. A review of the current literature related to the use of learning strategies, particularly low-stakes quizzing, to improve retention and recall is highlighted. In addition, the concepts of visual-form LA to bolster learning is discussed.

The behavior of testing one's knowledge is a highly effective way of learning and retaining information (Bjork & Bjork, 2011; Larsen, 2018). Specific behaviors such as active retrieval of information through testing, spacing out one’s testing practice, and interleaving (mixing

up) subjects and content that is tested, are supported by decades of empirical research that reinforces the positive effects of these learning behaviors (Brown, Roediger, & McDaniel, 2014). Furthermore, empirical evidence suggests that these effects translate into the acquisition and retention of conceptual, procedural, and metacognitive skills (Roediger & Karpicke, 2006; Kornell, & Bjork, 2007; Bjork & Bjork, 2011).

To be considered a high impact learning practice, testing, or quizzing, must be understood as a learning strategy instead of an assessment tool (Brown, Roediger, & McDaniel, 2014). As a learning strategy testing boasts several benefits for learning such as: retrieval aids later retention; helps to identify gaps in knowledge; increased learning in subsequent study episodes; produces better organization of knowledge; improves transfer of knowledge to new contexts; can facilitate retrieval of material that was not tested; improves metacognition monitoring; prevents interference from prior material when learning new material; provides feedback to instructors; and encourages students to study (Roediger, Putman, & Smith, 2011). Studies have shown that low-stakes quizzes that allow multiple attempts, with or without feedback, removes the anxiety of high-stakes quizzes/exams, encourages the learner to focus on the material instead of on a grade, and helps students to perform better and achieve long-term learning (Brown, Roediger, & McDaniel, 2014; Trail-Constant, 2018).

Learning analytics are an effective tool for supporting students and informing instructional design (Gasevic, Jovanovic, Pardo, & Dawson, 2017). One way of helping students to make use of learning strategies that will contribute to their long-term learning is to show students their LA as a tool for supporting and improving their study behaviors. Presenting these LA as a visualization, visual-form LA, provide insight into how students are engaging with the activites instructors and designers are creating for them (Ellis and Goodyear, 2010) and is one way to provide students with clear feedback regarding their learning behaviors (Authors, 2019). Ware (2004) questioned how the visual representation of digital products could change users' behaviors by supporting their optimal decision-making process.

3. Methods

During Fall 2017, learners were given the opportunity to complete eight RPAs introduced as learning-based quizzes which they had the option to take up to ten times and retain their highest score. After the final retrieval practice activity (RPA) was offered, learners were presented with visual-form LA, in the form of a personalized RPA graph depicting their RPA attempt data, and prompted with reflection questions about the RPA graph and thus their learning behaviors. Based on the high score focus of the learners and their desire to compare their study behaviors with their classmates as well as the desire of the instructor to see learners engaging in the beneficial learning strategies presented in the course, an intervention reflective activity was incorporated in the Fall 2018 design. The intervention was introduced

one month into the course, allowing students the opportunity to start building their knowledge regarding the content in the course. This intervention consisted of presenting RPA graphs from Fall 2017 and asking the students to reflect on them. At this time they were also told that they would be provided their own RPA graphs containinng personalized data of their RPA usage behavior near the end of the course and were prompted to forecast how they would like their RPA graph to look at the end of the course.

The researchers hypothesized that with this shift in expectation by the instructor, that students' RPA graphs would reflect effective learning strategies due to the presentation of exemplar RPA graphs and the understanding that the instructor and each individual student would actually see their personalized study behavior presented in visual-form as an RPA graph at the end of the semester.

The remainder of this paper will focus on describing the second phase (Fall 2018) of this research study, its findings, and how those compare with the findings from phase one conducted in Fall 2017.

This study used a mixed methods approach in which the investigators collected and analyzed both qualitative and quantitative data, integrated the findings, and then drew inferences using both qualitative and quantitative methods to provide a better understanding of the research problem (Tashakkori & Creswell, 2007; Creswell & Plano Clark, 2018). Prior to the first day of class, students were asked to complete the Study and Learning Behavior Pre-Survey. Once the course started, one RPA was offered each week in the form of a low-stakes quiz. After a month of classes, students were asked to complete the intervention reflection activity. After the eighth and final RPA was completed, researchers used the U-Behavior application to collect RPA attempt data and generated the current students' RPA graphs. Each student received their individual RPA graph and instructions to complete the reflection activity on their own RPA data. Lastly, at the end of the semester, students were asked to complete the Study and Learning Behavior Post-Survey.

This project was initialized in an online graduate level education course. Twenty-four adult learners were registered for the course with 19 consenting to be included in the research. The content of the course emphasizes research supported learning strategies, such as retrieval, spacing, and interleaving, and then creates opportunities for the students to apply the strategies when completing RPAs.

Overall this multiphase sequential study addressed the following mixed methods research questions: 1. What are students' perceptions of study and learning behaviors at the beginning of the course? 2. How do visual-form LA impact students' awareness of their study habits? 3. How do visual-form LA persuade students to change their study and learning behaviors?

3.3. Data Collection

The quantitative data was collected using web-based surveys and web-based retrieval practice activities. The pre and post surveys had seven multiple choice questions related to student's study and learning behaviors and were based on Kornell and Bjork (2007) studies. The U-Behavior application was developed by the researchers using Python and extracted the necessary data (quiz-log file) from the Canvas LMS. From this data, an RPA graph was generated for each student including the date and time of the attempt and the score received for each attempt. Each attempt is represented by a colored node and each of the RPAs offered during the course is identified by a particular color. Trend lines connect the RPAs taken in chronological succession. A single node not connected using trend lines represents either a single attempt of an RPA or interleaved attempts.

Qualitative data was collected through two web-based reflection activities. The first intervention reflection activity presented RPA graphs from the previous semester (fall 2017) and asked students to reflect on it considering the learning strategies and theories presented in the course. In the second personal reflection activity, students were prompted with a series of reflective questions based on their personal learning behaviors represented in their RPA graph. The reflection activity also included questions regarding the visual-form LA presented as an RPA graph so the researchers could collect feedback for future improvements to the RPA graph.

3.4. Data Analysis

Quantitative data analysis included descriptive statistics about the RPAs. RPA attempt data and learning strategy data (spacing, interleaving) identified in the RPA graph was also analyzed. Finally, comparison of data from pre and post web-based surveys to detect possible changes in students' study and learning behaviors after acquiring and practicing the various learning strategies studied throughout the semester was also quantitatively analyzed.

Qualitative data analysis of the students' RPA graph and reflections were analyzed and coded for the emergence of visual and written themes. The coding process was steered by one researcher and was conducted using Discourse Textual Analysis (DTA) (Moraes & Galiazzi, 2007). The DTA approach consists of building units of analysis from the corpus and identifying categories and themes from the previous units of analysis identified. It used the inductive method to look at categories that emerged from the units of analysis. The inductive method uses analytical induction (Lincoln & Guba, 1985) to identify categories, kinds of elements that have something in common. In order to ensure the trustworthiness of the findings, a second researcher reviewed the qualitative data and the categories. The two researchers conducted a social moderation process where they discussed the codes and categories until they came to agreement (Schaffer, 2017).

4. Findings

The primary difference between the two phases of research, Fall 2017 and Fall 2018, was the design in Fall 2018 which introduced the intervention reflection activity in an attempt to modify students' study behaviors. The researchers wanted to know if they were able to improve study habits by motivating students to incorporate various learning strategies based on the presentation and reflection of the exemplar RPA graphs from Fall 2017.

4.1. Retrieval Practice Activities

In order to determine any changes in study behaviors, the RPA graphs of each student were analyzed prior to the intervention reflection activity and post intervention. From that analysis two groups emerged: No Change Group – Students who did not change their behaviors after the intervention activity. Change Group – Students who did change their behaviors after the intervention activity.

Of the 19 students, 11, or 58% did not change their behaviors after the intervention activity. Of the 11 students, 36% (four students) practiced spacing and retaking prior to the intervention activity. They were categorized in the No Change Group, identified as not having changed their behavior, because they did not start to interleave after the intervention. So, even though they did not change their behavior, they already had used some of the learning strategies. In contrast, 64% (seven students) just retook the RPA , but did not space or interleave their practices. These students were focused on getting the highest score on each RPA, they are identified as high score oriented students.

Eight students, representing 42% of the total students, did change their behaviors after the intervention. Of those, one student started to space after the intervention, but did not interleave at all. Seven students, 37%, were already practicing spacing and retaking before the intervention and started to practice interleaving post intervention.

The data indicates that interleaving is the least practiced strategy utilized by students. Most of the students (63%, 11 from the No Change Group and one from the Change Group) did not interleave at all. The students who did interleave (37%, seven from the Change Group) only did so after the intervention.

The RPA graphs were analyzed to observe if students retook the RPAs after they had achieved the maximum score possible. Of the 19 students, only 26% (five students) retook an RPA after having achieved the maximum score. All five students were from the Change Group.

4.2. Personal Reflections

In coding the personal reflection activity, the themes identified from the Fall 2017 study (high impact learning practice, intentions versus engrained practices, high score orientation, and desire to compare) were used apriori themes. In addition, the researchers attempted to remain open to identifying emergent themes. The additon of a new theme regarding learning strategy application emerged in the Fall 2018 study.

From the No Change Group (students who did not change their behavior after the intervention activity), it was observed that the same themes from Fall 2017 were present and the presence of a new theme was identified, the application of learning strategies (AoLS) theme. The high impact learning practice (HILP) theme involves initial categories and units of analysis where students described the learning strategies they studied and how they identify them and understand them in relation to the RPA graphs. This differs from Fall 2017 where students mentioned a variety of learning strategies, students in the No Change Group from 2018 focused on spacing and retaking. The intentions versus engrained practices (IVEP) theme included commentss on study behaviors they applied during the semester, reflections about their learning behaviors, and reflections about the benefit of using RPAs. For example, Student N states that the RPA graph showed them falling into old study habits rather than applying the learning strategies presented in the course.

The High-score orientation (HSO) theme included students' description about how they focused on grades in spite of the low stakes nature of the RPAs and how they fixated on receiving the highest score possible. The desire to compare (DTC) theme involves students' desire to compare their performance with others. The application of learning strategies (AoLS) theme involves initial categories and units of analysis that demonstrate how students are applying the content they have learned from the course to other situations.

The analysis of Change Group students (students who did change their behavior after the intervention activity) included all of the same themes, however the high-score orientation theme was only present in one student's reflection. The HILP theme emerged in the change groups' reflections, and it extended beyond the No Change Group who primarily focused on spacing. In addition to discusing spacing the change group included pedagogical practices, such as interleaving, retrieval, and reflection. The IVEP theme for the Change Group was notable. Unlike studetns from the No Change Group, it was not surprising that this group discussed their shift away from engrained practices and how they actually changed their behaviors. The DTC theme was present for the Change Group, but fewer students mentioned their desire to compare their performance with their classmates as seen with the No Chanage Group students. The additional theme to emerge in 2018, AoLS theme, included the following reflections by students in the Change Goup: *Yes. Once I learned more about forgetting and the power of retrieval, I started to utilize the RPAs as a learning tool more often. Even if I aced the RPA, I would keep going back to it each week. (Student B) I tried to*

interleave what I was learning in course with the work I was doing for my job. In addition, I frequently shared what I learned (which required retrieval and elaboration) to my team members who've always explained an interest in what I'm learning. (Student I)

5. Conclusion

The inclusion of persuasive design that incorporated an intervention illustrating the utilization or lack of utilization of various beneficial learning strategies along with the opportunity to reflect on this data created an opportunity to change student' behavior. This intervention had an apparent positive effect in student behaviors when comparing the Fall 2017 study with Fall 2018 study. The intervention resulted in more students integrating spacing, retaking, and interleaving. This study supports what is presented by Brown, Roediger, & McDaniel (2014), that testing, spacing, interleaving and varying practice, are perceived as less productive by students because they are harder to do than rereading and their effects are not immediately perceived. However, with this intervention the researchers were effective in changing the behaviors of some students. Quantitative and qualitative data provided evidence that after the intervention, students started to space and interleave their studies, using learning strategies that have been shown to contribute to long-term retention and performance. However, as identified by Karpicke (2009) some students persist in using less-productive strategies, thus the necessity of continuing to work on strategies that persuade students that testing, spacing, interleaving and varying practice are learning strategies that are valuable for long-term learning.

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Correlation between students' workload and attendance as related towards final grades: A case of study on Statistics for first-year Engineering students

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Abstract

Are students' workload and attendance related to final grades? In this work, a monitoring experience of student workload and attendance is presented. During four academic years, first-year students of the Engineering School of Toledo (Universidad de Castilla-La Mancha, UCLM, Spain) have been asked, three times a week, to estimate their autonomous workload devoted to the Statistics subject. The monitoring strategy has been anonymous, open and voluntary and has shown a high ratio of participation: 407 students out of 433. This information has been combined with attending to classroom-based lectures records and final grades. Along this work nonparametric tests haven been used. The concept of "average student" is widely questioned in the literature and therefore instead of comparing mean values comparisons between the distributions are preferred. Results indicate that declared student's workload hardly reaches the 90 hours of autonomous work established in the ECTS ratio of the university. The strong significant differences between the distributions of percentage of attendance for different grading groups as well as the significant differences between the distribution of the percentage of workload monitorization show that attending and participating in the classroom-based lectures has a positive influence on grades.

Keywords: *workload, attendance, first-year, ECTS, engineering.*

1. Introduction

Since the implementation of the Bologna Process and the European Credit Transfer System (ECTS), European Commision (2015), the estimation of the students' workload has been approached by countless works (Pogacnik *et al.*, 2004; Molina et al., 2007; Cañas Belmar & García Escamilla, 2012; Ceballos Aranda et al., 2015; García Martín & García-León, 2017; Souto-Iglesias & Baeza-Romero, 2018). Standards in higher education systems establish that a full-time student needs to complete 60 ECTS per academic year, about 1500 to 1800 hours of work. This leads to the equivalence of 25-30 hours per ECTS. Then each university has different ratios between classroom-based teaching and autonomous study.

A ratio of 40-60% for presential-autonomous work has been established by the university. Therefore, a 6 ECTS subject requires 150 hours of work, divided into 60 hours of classroom-based lectures and 90 hours of autonomous work (1 ECTS = 25 hours). A 6 ECTS subject is usually designed to be taught in a semester and scheduled on 15 weeks, that are slightly affected by local holydays scattered along the semester.

For the teacher, designing a subject implies to arrange these 150 hours of work and then teach 60 hours of classroom-based lectures along these 15 weeks. These hours include theoretical lectures, laboratory and tutoring sessions and include exams sessions. Then each student should organize himself to arrange 90 hours of autonomous work into his workday (Rivadeneyra Sicila, 2015).

Classroom-based lectures are easily recorded on the teacher's schedule, but estimating the workload of autonomous work of each student is an open problem that has been widely addressed (Andreu Martí, 2014).

On the other hand, attendance to classroom-based lectures, especially on first year students, has a noticeable effect on study success (Bevitt et al., 2010; Bijsmans & Schakel, 2018). Attendance is usually non compulsory and its monitorization is usually seen as a surveilling strategy.

2. Methodology

During four academic years: 2015/16-2018/19 all the students enrolled in the first year subject Statistics (6 ECTS, second semester), have been offered to participate in a monitoring study in order to estimate students' workload (433 students). The study was presented in the very first classroom-based lecture and the information has been shared with the students through the online teaching platform following an open data strategy.

At each theoretical lecture (three times a week), the student has been asked to voluntarily answer the question: "Since the last time that you answered to this questionnaire: How many

hours of autonomous work have you devoted to the subject?". This question has been answered on a paper sheet that is handed to the students at the beginning of the theoretical lecture and collected at the end. On the paper sheet they can find their three last characters of their identity card (this is enough to identify uniquely each student) and an empty cell for the answer. This strategy allows a continuous and anonymous process of data collection. In order to stimulate their participation in the study, the full data are weekly updated on the online teaching platform. Each student can then check the amount of workload declared and compare himself with their classmates. This strategy has achieved a high participation ratio, only 26 students (from the 433) refused participating in the study at all. Table 1 shows how the 407 students that participated in the study are distributed.

Table 1. Distribution of the students by academic year, sex and grade.

	Sex\ Grade	**No performance**	**Fail**	**Pass**	**With merit**	**Sum**
15/16	male	12	21	23	18	74
	female	4	4	5	3	16
	Sum	**16**	**25**	**28**	**21**	**90**
16/17	male	17	23	31	22	93
	female	0	7	4	4	15
	Sum	**17**	**30**	**35**	**26**	**108**
17/18	male	17	28	31	16	92
	female	1	0	4	3	8
	Sum	**18**	**28**	**35**	**19**	**100**
18/19	male	23	29	32	13	97
	female	3	2	4	3	12
	Sum	**26**	**31**	**36**	**16**	**109**
Sum	male	69	101	117	69	356
	female	8	13	17	13	51
	Sum	**77**	**114**	**134**	**82**	**407**

At the beginning of the final exam the monitoring paper sheet was also handed out for the students to declare the amount of autonomous work since the classroom-based lectures ended. Therefore, the students were asked to estimate their workload almost continuously along the semester.

On the other hand, attendance was monitored with the help of the Bologna continuous assessment strategy. At the end of each theoretical classroom-based lecture a grading question was offered to the students through the online teaching platform. Also, at each laboratory classroom-based lecture grading questionnaires were offered. Only those that attended the classroom-based lectures could answer these questions. Classroom-based lectures grading had a 20% weight on the final subject grade.

The numerical final grade, ranging from 0-10, has been categorized in: "Fail" for grades under 5, "Pass" for grades greater or equal than 5 and lower than 7, and "With merit" for grades greater or equal than 7. Those that didn't attend to a minum of evaluation events have been categorized as "No performance".

3. Results

The mean attendance of the 407 students to the classroom-based lectures is of 76.3% while the mean participation in the workload monitorization is of 67.9%. This is a measure of how the students are involved within the workload monitorization. Students have been encouraged to understand the differences between a missing data and "0 hours" of autonomous work in the workload monitorization. Obviously, higher attendance implies higher workload declared: there exists a strong linear correlation between them, Pearson correlation coefficient is significant and up to 0.89.

Students that have attended to a percentage of classroom-based lectures greater than the mean (76.3%) and participated in the workload monitorization less than the mean (67.9%) have been identified: 24 out of 407. These students seem to drop from the monitorization while keep attending the classroom-based lectures. After analyzing these records, neither gender nor grade differences explain this behavior.

To try to answer the question: "Are students' workload and attendance related to final grades?" nonparametric tests have been performed to detect significant differences between percentage of workload declared or grading categories. Nonparametric tests compare the distributions instead of comparing means and this is suitable for this situation were the concept of "average student" is widely questioned in the literature (García Martín & García-León, 2017).

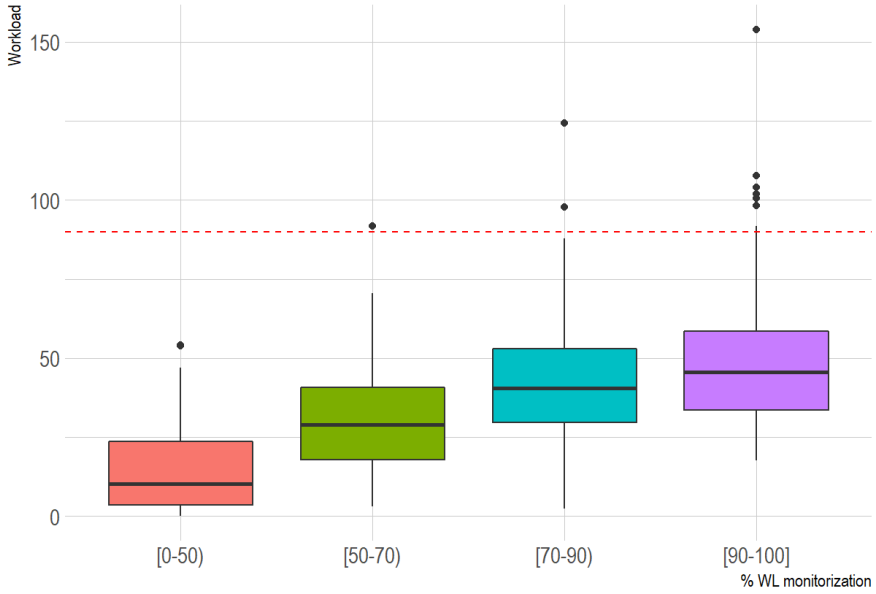

Figure 1 Workload vs. Percentage of Workload Monitorization.

Firstly, whether the students achieve the 90 hours of expected autonomous work is checked. Figure 1 shows the distribution of autonomous workload declared by the students for different percentages of workload monitorization. The 90 hours are only exceeded by 10 students. And the mean workload out of the 407 students is of 35.6 hours. Mean value should be taken with caution due to the great dispersion of the number of autonomous hours declared, ranging from 0 to more than 150 hours.

The percentage of workload monitored, %WL, has been discretized into four groups, Table 2 shows the workload for each of these groups. The first category [0,50) are students that filled the monitoring paper sheet in less than half of the occasions while the last category [90,100] are students that did it in almost all the occasions: filling the monitoring sheet was voluntary.

Table 2: Workload declared for the four groups of percentage of workload monitored, %WL.

	Workload declared in hours:						
% WL	Min.	1stQu.	Median	Mean	3rdQu.	Max	N
[0-50)	0.0	3.5	10.3	**14.7**	23.5	54.0	**99**
[50-70)	2.9	17.9	28.9	**31.0**	40.6	91.7	**64**
[70-90)	2.3	29.6	40.5	**42.3**	52.9	124.3	**134**
[90-100)	17.7	33.6	45.4	**49.1**	58.6	154.0	**110**

A Kruskal-Wallis test has been performed to compare the distribution of workload between these four groups, the test rejects the null hypothesis of equally distributed workloads for the four groups (p-value = 0). Then the Dunn test, with Bonferroni correction, of multiple pairwise comparisons finds significant differences between all the comparison except for the [70%-90%) and [90%-100%] (p-value = 0.39). All the significant differences between the distribution of workload declared by the students in each group are quite strong, all of them with p-values less than $\alpha = 0.01$.

In a second stage, a comparison between percentage of workload monitored, %WL, and the grade achieved by the student has been performed. Figure 2 shows the distribution of grade achieved in the subject (in numerical scale 0-10) for different percentages of workload monitorization. Graphically it can observed that those students that have been monitored at most of the classroom-based lectures tend to obtain higher grades.

The Kruskal-Wallis test rejects the equally distributed null hypothesis and therefore finds significant differences between at least two %WL groups (p-value = 0). The multiple comparisons performed by the Dunn test, with Bonferroni correction, show that all the comparisons are significant except for [0%-50%) and [50%-70%) (p-value = 0.51). Again, all the significant differences between the distribution of grades achieved by the students in each group are quite strong, even for significance levels less than $\alpha = 0.01$. Mean values of workload for each %WL group are highlighted in Table 2.

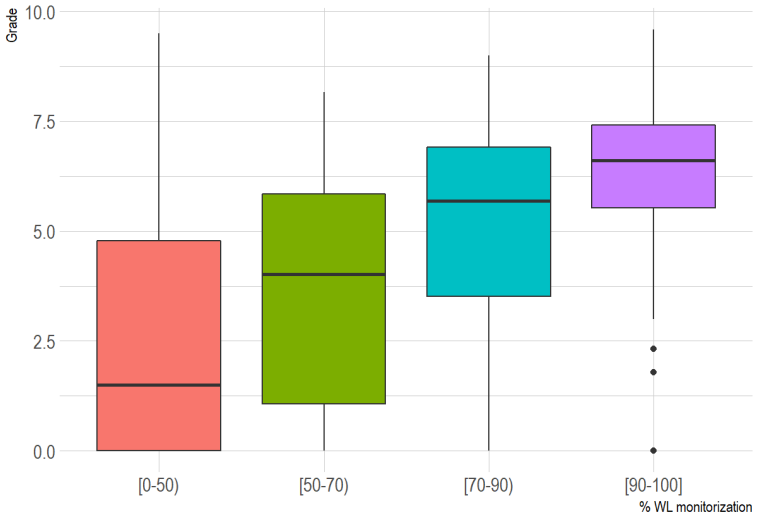

Figure 2. Grade vs Percentage of Workload Monitorization.

Finally, the distribution of percentage of attendance to classroom-based lectures between the four grading groups have been compared (Figure 3). Graphically it can be seen that students with higher grades tend to attend to higher percentages of classroom-based lectures.

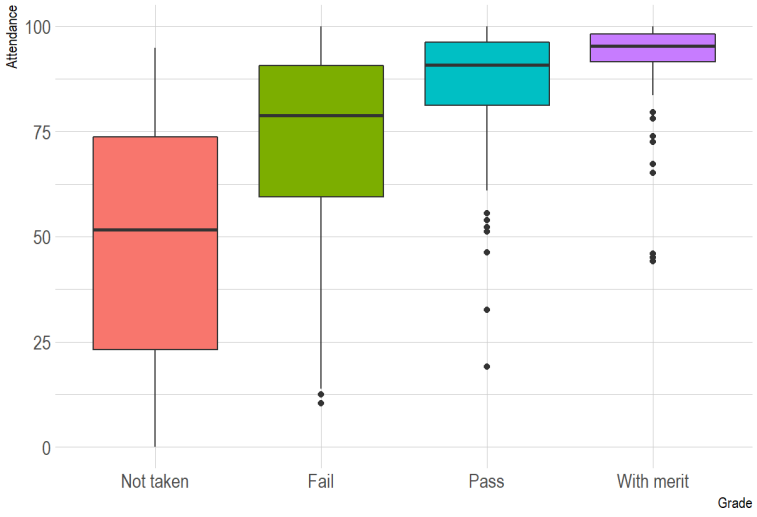

Figure 3. Attendance vs Grade.

The Kruskal-Wallis test finds significant differences and rejects the equally distributed null hypothesis (p-value = 0). The Dunn test, with Bonferroni correction, of multiple pairwise comparison finds strong significant differences between all the comparisons, all of them with p-values less than $\alpha = 0.01$.

Table 3 shows the percentage of attendance for each of the grading groups, mean percentage of attendance is highlighted. Again, large dispersion is observed and the concept of "average student" is questioned. This is the main reason why nonparametric tests have been used to compare distributions instead of comparing means.

Table 3: Percentage of attendance for the four grading groups.

Grade	Min.	1stQu.	Median	Mean	3rdQu.	Max	N
No Performance	0	23	52	**48**	74	95	**77**
Fail	10	59	79	**72**	91	100	**114**
Pass	19	81	91	**86**	96	100	**134**
With merit	44	92	95	**92**	98	100	**82**

4. Discussion and Conclusions

In order to find an answer to the initial question: "Are students' workload and attendance related to final grades?" the strategy of paper handout and daily monitorization of students' autonomous work has proved itself as a useful tool to estimate students' workload. The participation of 407 out of 433 students and the strong correlation between workload monitorization and attendance are proofs of it.

The fact that the declared students' workload hardly reaches the 90 hours of autonomous work established in the ECTS ratio of the UCLM is widely shared in the literature (Pogacnik *et al.*, 2004; Molina *et al.*, 2007; Cañas Belmar & García Escamilla, 2012; Ceballos Aranda *et al.*, 2015; Rivadeneyra Sicila, 2015; Souto-Iglesias & Baeza-Romero, 2018). This experience shows proofs of an overestimation of nominal hours for each ECTS credit and these are more than enough evidences urging to reconsider, after more than 10 years of ECTS experiences, realistic and desirable schedules for students. Also notice that large differences usually appear between different subjects that are being taught at the same time.

It is striking to compare over Table 2 the disjoint interquartile ranges (Q1-Q3) of workload for those with less than 50% and those with 90-100% of workload monitorized: 3.5-23.5 vs. 33.6-58.6 hours. Also, disjoint interquartile ranges are found on Table 3 while comparing percentages of attendance for those that "Failed" or passed the subject "With merit": 59-91% vs. 92-98%. Nonparametric statistical procedures in this work have only been used to

quantify, in terms of probability, differences that graphs and tables clearly show. The strong significant differences between the distributions of percentage of attendance for the grading groups as well as the significant differences between the distribution of the percentage of workload monitorization show that attending and participating in the classroom-based lectures has a positive influence on grades.

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Project-based learning: A practical approach to implementing *Memsource* in the classroom

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Abstract

Information technology has long become an integral part of today's professional reality and given rise to new job profiles, in response to the changing requirements in many industries. Hence, the knowledge of languages for specific purposes as well as the acquisition of practical competences through project-based learning (PBL) have gained growing significance. Specialized communication skills, coupled with a multilingual professional competence, are a means to address the demands of our today's complex reality. Institutions of higher education more and more feel the urge to prepare their students to new professional challenges and a wide range of employment opportunities. This paper presents a PBL approach by implementing the Computer Aided Translation Tool Memsource in foreign language classes of the Master's course "Languages and Business Relations" at the University of Aveiro. This innovative approach seeks to provide students with a multidisciplinary competence, increase their linguistic proficiency and actively involve them in the decision-making and problem-solving process.

Keywords: *higher education, Project-based learning (PBL), Computer Aided Translation Tool, Language teaching for specific purposes.*

1. Introduction

Information technology has long become an integral part of today's professional reality and given rise to new job profiles, in response to the changing requirements in many industries. Hence, many Institutes of Higher Education have long felt the urge to react to these new dynamic work environments by implementing project-based learning (PBL) into the standard curriculum of their courses. The idea of PBL is to offer students a real-life work environment, providing them with a more dynamic and motivating learning setting. This paper proposes a PBL approach by using the Translation Management System Memsource in the first year Master's course "Languages and Business Relations" at the University of Aveiro. PBL is implemented in the discipline "Applied Project German" that allows the adoption of innovative learning methodologies. We propose to explore how PBL can enhance students' professional skills and in which way the work with Memsource can add value to language learning.

2. Project-based learning: theoretical framework

There has been extensive study on the implementation of PBL in a higher education setting. The term centers on student-driven project work, which helps students gain methodological competences in different areas, such as project management, teamwork and problem solving (Dahms, 2014). PBL came up in a response to an imbalance between challenges of today's work environment and students' lack in dealing with such challenges. Higher education institutions have to meet these changing needs, as stated by Uden & Beaumont (2006): "University education should, ideally, provide students with the necessary skills, values, and attitudes that are essential to cope with the dynamic complexities of the modern world. […] there is a lack of deep learning about the complex issues and problems that graduates have to face in the real world" (p. 26). Due to a lack of terminological consensus, PBL is herein used in a broad sense, functioning as an umbrella term for a set of innovative teaching activities that focus on the implementation of project work in the classroom.

3. Memsource and language learning

Due to the importance of specialized communication skills in our today's information society, in a previous classroom experience students were challenged with small projects on web site localization, which aimed at enabling them to combine linguistic as well as cultural competences with technical skills (Herget, 2018). As shown in this first approach to PBL in the context of localization, Master's students were given the task to localize a company's website from English into their mother tongue Portuguese. However, the approach proposed for this paper goes beyond the localization practice described at an

earlier stage. The idea behind the implementation of Memsource into language learning was to actively involve students into project work and aimed at preparing them for new professional requirements and changing job profiles within the language industry, such as project managers, localizers, technical writers, etc. The implementation of the CAT tool Memsource into the language learning classroom allows to confront students with a different area of study other than the one they are specializing in. The discovery of such a new area gives them the chance to acquire transversal skills, which are crucial for employability. "Despite their usefulness for translation, CAT tools are seldom used in the context of learning a language, since a good command of a language is usually needed before starting to translate" (Fernández-Parra, 2016, p. 386). The author proposes to expand the usage focus of CAT tools and explore its application in a wider context, i.e. in foreign language classes. From our point of view, the implementation of Memsource through PBL for non-translators represents an interesting methodology, challenging students with a set of hands-on language learning activities.

4. Memsource – a brief insight into basic functionalities

Memsource is a cloud-based translation management system, which was developed in the Czech Republic in 2010. It integrates translation memory (TM) technology, machine translation as well as terminology management tools. Memsource, hence, combines all the features of a computer-aided translation tool (so-called CAT tools) that renders translation more efficient. In the specialized translation context, CAT tools are widely used, since the TM feature allows to recycle repetitive text patterns that are typical of specialized texts with domain-specific terminologies. Such systems divide the source text into smaller segments, which are individually displayed and provided with a previous translation during the translation process. TM systems are, thus, databases that store source segments with its translation equivalents for reuse.

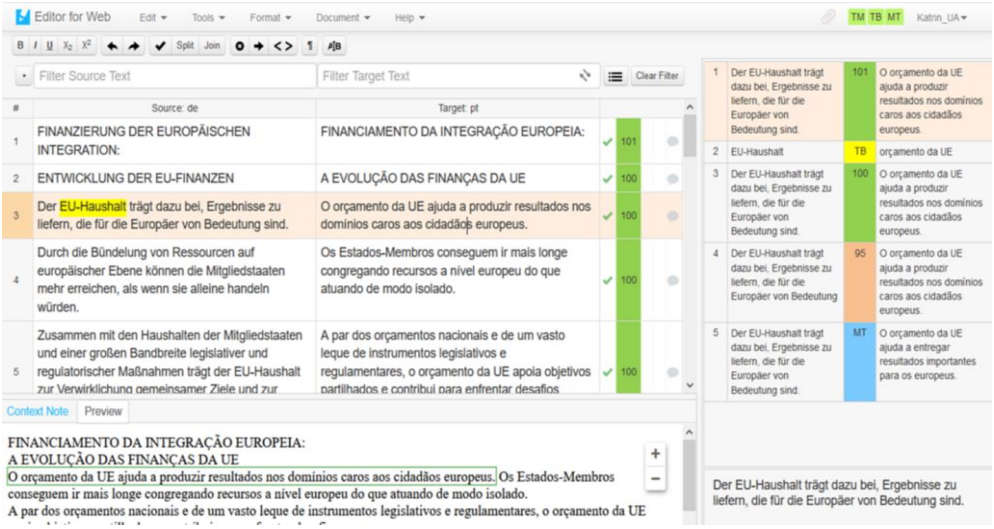

Figure 1. Editor Panel in Memsource

In combination with term recognition tools, alignment of corpora, autosuggest features, integrated term bases, project management, quality assurance, etc., CAT tools are efficient, speed up the translation process and save the translator a lot of time. Particularly important is the fact that Memsource has implemented the latest machine translation advances in its Translate feature, supporting more than 30 machine translation engines and guaranteeing a high quality translation output. These latest technological advances offer new challenges and methodologies for language learning through PBL that have yet to be explored.

5. The case study

Due to Memsource's combination of different functionalities and its intuitive interface, it is a very interesting tool to be used in the language classroom, offering a series of practical activities for project learning. In the following, we give a brief description of the PBL experience gained with first year Master's students.

5.1. Project Management

In a first approach, students assume the role of project managers without having prior experience in project management. Since project management is considered an emerging profession, having a notion of creating a methodology or a project workflow is crucial for today's work environment. Students can design their own hierarchical workflow structure in Memsource, such as translation, editing, proofreading, and assign a specific person (linguist) for each step. This means that they learn to work in teams and assume responsibility when defining project resources and setting due dates for project activities.

They also have to dwell on the number of resources assigned to each step, since this may have consequences on the project's success. Memsource allows to create 15 different workflow steps, which is very useful for a precise definition of a project. In a second approach it is possible to enhance group work, where only one student assumes the role of a project manager, whereas the other group members work as linguists or take on other roles. As soon as a task is assigned, the student is notified by e-mail. The project manager can also decide if the same TM is used for all workflow steps or if it is necessary to edit the attributes of a TM. Once the linguist has access to the job, Memsource – as all commercially available CAT tools – provides a statistical analysis of segments, words or characters that are to be translated. Such analysis is fundamental for project planning, since it gives all stakeholders a notion of the amount of work. It lists all information concerning repetitions in the source text, translatable elements as well as fuzzy matches from the TM and machine translation (see Fig. 2).

File: Finanzen_DE.doc

	Segments	Pages	Words	Characters	%
All	27	1.58	377	2488	100
Repetitions	0	0	0	0	0
101%	7	0.53	121	833	32.1
+ 100%	11	0.38	100	596	26.5
+ 95%–99%	0	0	0	0	0
+ 85%–94%	0	0	0	0	0
+ 75%–84%	0	0	0	0	0
50%–74%	1	0.13	31	208	8.2
0%–49%	8	0.54	125	851	33.2

Figure 2. Project analysis in Memsource

According to the project volume, students can then set a quote, indicating all the costs involved in the project. This part is particularly interesting, since it means that they get a notion on how to calculate the price of a specific workflow step. The calculated cost can then be mailed to the client and only after its final approval, the linguistic work starts. By writing formal emails to potential German clients, students learn to enhance their written communication skills and also acquire an intercultural competence in the field of business communication. The students responsible for the linguistic part then translate the document and send it to the reviewer in charge, who makes the final changes. In accordance with students' foreign language competences, the teacher may introduce a number of different work flow steps, which aim at combining the application of linguistic as well as project management skills. Memsource provides an ideal work environment for practical project management activities, since all project's stakeholders have the possibility to interact

during a project life cycle. The carrying out of project management activities gives students the opportunity to gain work experience by carrying out a set of hands-on exercises.

5.2. Datafication and information recycling

The alignment feature is of particular interest for language learning, since it allows the creation of bilingual (or multilingual) text corpora that are stored in a TM. In times of datafication, in which all kind of data is computerized, the web turns out to be a primary and important source for terminology extraction and corpus building. There is a huge amount of bilingual and multilingual text corpora freely accessible on the web that can be very useful for language learning. Specialized text corpora play an important role in the teaching of languages for specific purposes, since they provide terminological knowledge in a specific domain and a better conceptual understanding of a given area of study. At the beginning of the alignment task, students were provided with a bilingual text in German and Portuguese from the area of Social Policy. The students then were introduced into the work with Memsource's alignment function, which automatically aligns corresponding text segments. Whereas the original text (Portuguese) was presented without any alterations, the translation was modified beforehand in such a sense as that some parts of it where left out. With the creation of such cloze passages, the teacher can test students' linguistic skills, such as lexical and grammatical structures. In the context of TM implementation for language learning, Fernández-Parra (2016, p. 389) suggests "a variety of exercises, ranging from substitution and gap-filling exercises to all kinds of text manipulation exercises, such as partial or complete text reconstruction, reordering words in a sentence, unscrambling, etc.".

FINANZIERUNG DER EUROPÄISCHEN INTEGRATION:	FINANCIAMENTO DA INTEGRAÇÃO EUROPEIA:	Finanzen_PT.doc
ENTWICKLUNG DER EU-FINANZEN	A EVOLUÇÃO DAS FINANÇAS DA UE	Finanzen_PT.doc
Der EU-Haushalt trägt dazu bei, Ergebnisse zu liefern, die für die Europäer von Bedeutung sind.	O orçamento da UE ajuda a produzir resultados nos domínios caros aos cidadãos europeus.	Finanzen_PT.doc
Durch die Bündelung von Ressourcen auf europäischer Ebene können die Mitgliedstaaten mehr erreichen, als wenn sie alleine handeln würden.	Os Estados-Membros conseguem ir mais longe congregando recursos a nível europeu do que atuando de modo isolado.	Finanzen_PT.doc
Zusammen mit den Haushalten der Mitgliedstaaten und einer großen Bandbreite legislativer und regulatorischer Maßnahmen trägt der EU-Haushalt zur Verwirklichung gemeinsamer Ziele und zur Bewältigung gemeinsamer Herausforderungen bei.	A par dos orçamentos nacionais e de um vasto leque de instrumentos legislativos e regulamentares, o orçamento da UE apoia objetivos partilhados e contribui para enfrentar desafios comuns.	Finanzen_PT.doc
Von den Sechzigerjahren, in denen erstmals eine gemeinsame Politik in einem wichtigen Bereich – der Landwirtschaft – eingeführt wurde, bis zum heutigen Tag hat sich der EU-Haushalt parallel zum Aufbau der Europäischen Union sukzessive weiterentwickelt.	Desde a primeira grande política comum – a política agrícola – na década de 1960 até aos dias de hoje, o orçamento da UE evoluiu progressivamente e em paralelo com a construção da União Europeia.	Finanzen_PT.doc

Figure 3. Aligned documents in Memsource

5.3. Quality Assurance – improving linguistic skills

Given the already mentioned advances in machine translation technology, activities related to machine output evaluation constitute another component that helps to increase students' language proficiency. What is more, in the era of neural machine translation and Deep Learning methods that imitate neural network architectures, post-editing has become a mainstream concern in the professional environment with companies striving to optimize their documentation quality. With that in mind, students were introduced to the Quality Assurance (QA) process carried out in Memsource. The QA feature detects translation errors and terminological inconsistencies in source and target segments by comparing these segments with term base entries, carries out spell checks and identifies wrong formatting and missing tags, etc. Thus, it provides learners of a foreign language with a whole set of attributes that contribute to the improving of text production quality and also increases students' awareness towards the importance of post-editing in today's professional environment.

6. Conclusions

This paper explored the implementation of Memsource in the language classroom and aimed at identifying project activities that can be carried out in the foreign language learning when working with a CAT tool. We also wanted to show to what extent the suggested PBL methodology can add value to language learning and prepare students for professional practice. The implementation of Memsource in the Master's course "Languages and Business Relations" offered problem-solving as well as collaborative strategies in real-world scenarios, providing students with new knowledge in a different area of study and promoting the creation of transversal competences. The classroom experience revealed that students with no previous knowledge of CAT tools showed no difficulty in understanding Memsource's basic features and applying them in the professional context. Given the importance of adopting PBL methodologies in higher education settings, the exploration on how Translation Management Systems, such as Memsource, can be used in the language classroom to raise linguistic proficiency of students, constitutes an interesting research question.

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Stakeholder Management: Formulating a Primer for Practitioners

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Abstract

Stakeholder management is the act of balancing the competing preferences or claims of company stakeholders for the sake of competing, collaborating, and succeeding. The present manuscript structures a primer, in the shape of a pedagogical proposal about the topic of stakeholder management. For this purpose, it introduces the reader to terms and concepts that are necessary to understand stakeholder management as an alternative way to manage organizations in both utilitarian and ethical manner. It also offers sufficient grounding in the field that enables the reader to interpret the insights of stakeholder management as a dynamic and cross-functional concept. The present work addresses practitioners, students, scholars and instructors in any topic of the business administration domain, which desires to validate alternatives to the traditional view of a shareholder-oriented way to manage.

Keywords: *Stakeholders; Stakeholder management; Executive education; Value creation.*

1. Introduction

According to scholars like Argandoña (2011), both the theory and practice of corporate social responsibility (CSR) fluctuates between two extremes. On the one hand, a linear approach that reduces the businesses' responsibility to the procurement of the highest possible profit for its shareholders (e.g., Jensen, 2000). On the other hand, a direct approach that extends the businesses' responsibility to include a wide range of actors with an interest or "stake" in the business, called the stakeholders (e.g., Donaldson & Preston, 1995; Freeman, 1984). It is evident that for both cases, the ultimate goal of the theory of CSR is the welfare of society. However, for the second approach the concept of "value" is subject to further explanations.

By acknowledging the duality mentioned above, this manuscript attempts to outline a pedagogical proposal for a module in stakeholder management (SM). This proposal is oriented singularly to enhance either an executive diploma program or a focused Masters program. For this purpose, this manuscript introduces the reader to terms and concepts that are necessary to understand SM and their application to modern organizations. Furthermore, it suggests a module structure that helps instructors to address the topic of SM as a fundamental part of management-oriented topics like strategy, marketing, supply chain, and HRM.

In the first instance, it is crucial to present the objective and learning outcomes projected for an archetypal SM module. Worth to mention, for a course in SM within executive education programs, students are expected to have followed undergraduate (or graduate) courses in management or organizational behavior, marketing, and business strategy.

1.1. SM Module Objective

In essence, the purpose of a module in SM is to provide prospective students with a conceptual framework for understanding how an organization's management can identify its stakeholders and manage its relationships with them. In the long run, this module will help students to recognize how to optimize the triple bottom line – economic, social, and environmental sustainability – through a successful CSR strategy.

1.2. SM Module Intended Learning Outcomes

By the end of a module of SM, students will be able to: 1) Critically evaluate the main theoretical and conceptual approaches to SM; 2) Evaluate how a company identifies its stakeholders and assess its relationships with them; 3) Consider the strategic opportunities provided by SM within the different areas of the business management body of knowledge; and 4) Apply the concepts of SM to formulate recommendations at the managerial level.

2. Conceptual Framework

Sustainable Development is defined as the enhancement of existing human living standards without compromising those of future generations (UN, 1987). A **Stake** is conceived as any interest or share in an undertaking. A stake can also be a claim or demand (Buchholtz & Carroll, 2012). "The idea of a stake can range from simply an interest in an undertaking at one extreme to a legal claim of ownership at the other" (Buchholtz & Carroll, 2012; p.63). For its part, the concept of **Stakeholder** was originally defined as any group that the firm relies upon: "those groups without whose support, the organization would fail to exist" (Ackoff, 1974). However, in a widely accepted definition, stakeholders were conceived by Freeman (1984) as "any group or individual who can affect or is affected by the achievement of a business' objectives" (p.46). Converserly, **Legitimacy** is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions (Suchman, 1995). Finally, **Value** is broadly defined as anything that has the potential to be of worth to Stakeholders. The term "utility" will be understood to reflect the value a stakeholder receives that actually has merit in the eyes of the stakeholder (Harrison & Wicks, 2013).

3. Justification, Theory, and Foundations

The stakeholder theory (ST) is essentially about organizational management and ethics (Phillips, Freeman, & Wicks, 2005). From that lens, ST is also about how business works at its best, and how it could work. It is descriptive, prescriptive, and instrumental at the same time (Donaldson & Preston, 1995), and is about value creation and trade and how to manage a business effectively. "Effective" can be seen as "create as much value as possible." Furthermore, their body of knowledge suggests that if we adopt as a unit of analysis the relationship between a business and its stakeholders, then we have a better chance to deal with other problems. For instance, the one of value creation and trade, or one of the ethics of capitalism; and iii) the one of managerial mindset (Freeman, Harrison, & Wicks, 2007). Finally, ST attempts to articulate a central question in a systematic way: which groups are stakeholders deserving or requiring management attention, and which are not? In other words: who is a stakeholder (stakeholder identification), and what is at stake? (Mitchell, Agle, & Wood, 1997).

Since its introduction in 1984, this theory has been an essential cornerstone in the study of the concept of management at every level (Freeman, 1984). It arrived to counterbalance the traditional view of financial value maximization, or what Jensen (2000) labelled "the manager's oath." Some scholars claim that the ST has been proposed as an alternative to shareholder theory. This idea means that the dynamics of both value creation and value

appropriation experimented profound changes so as they are conceived and applied. Consequently, by this moment, stakeholders ought to be taken into account for these kinds of "strategic" assessments (Coff, 2010). Understanding this phenomenon in complex contexts represents a research opportunity that could lead us to exciting contributions.

Complementarily, according to Freeman (2010), the stakeholder approach (SA) is an idea about synergism, and about how a business works. This approach suggests that for any business to be successful, it has to create value for costumers, suppliers, employers, communities, and financiers (mainly shareholders and banks). It says that a manager can not look at any one of those stakes in isolation. Their interests have to go together. And the job of a manager is to figure out how those interests go in the same direction.

Therefore, the SA is the idea that each one of these groups is important to the success of a business; and figuring out how their interests can go in the same direction is what the managerial task is all about. The SA indicates that if a manager just focuses on financiers, the manager misses what makes capitalism tick, which is that all stakeholders can together create something that no one can create alone.

3.1. Stakeholder Identification

In today's hypercompetitive, global business environment, any individuals and groups are business stakeholders. However, from the business point of view, specific individuals and groups have more *legitimacy* in the eyes of the management; that is, they have a legitimate, direct interest in, or claim on the operations of the firm. And while the most obvious of these groups are shareholders, employees, and customers, from a highly pluralistic society, stakeholders include not only these groups but other groups as well. These other groups include the community, competitors, suppliers, trade associations, the media, and society, or the public at large (Buchholtz & Carroll, 2012).

In a first instance, Freeman (1984) stated that stakeholders were divided into two types: internal (owners, customers, employees, and suppliers) and external (governments, competitors, consumer advocates, environmentalists, special interest groups, citizens, and the media). However, further developments took place in this matter, and new typologies arose, especially in terms of their nature and interests. Fehr and Falk (2002) built on this and suggested that stakeholders can be categorized into two main types: self-regarding and reciprocal. The former type concerns a stakeholder who only cares about a personal "tangible" retribution, while the latter type uses to value fairness in a business relationship.

Nevertheless, an important question that has been addressed is to which groups do managers pay attention? Mitchell et al. (1997) developed a model of stakeholder identification and salience based on stakeholders possessing one or more of the attributes of power, legitimacy, and urgency. Later, Magness (2008) confirmed that the three attributes

do lead to salience. Thus, we might anticipate that firms would pay the most attention to those legitimate stakeholder groups who have power and urgency. In practice, this might mean that firms with problems over employee retention would attend to employee issues, and those in consumer markets would have regard to matters that affect reputation. Stakeholder groups may also become more or less urgent, so environmental groups and issues became more urgent to oil firms following the Exxon Valdez oil spill example (Patten, 1992).

3.2. Managing Stakeholders

The nature of ST is managerial in the broad sense of that term. It does not merely describe existing situations or predict cause-effect relationships; it also recommends attitudes, structures, and practices that, taken together, constitute SM. This requires, as its key attribute, simultaneous attention to the legitimate interests of all appropriate stakeholders, both in the establishment of organizational structures and general policies and in case-by-case decision making (Donaldson & Preston, 1995).

The fundamental idea of SM is that business can be understood as a set of relationships among groups, which have a stake in the activities that make up the business. Business is about how costumers, suppliers, employees, financiers (shareholders, bondholders, and banks, among others), communities, and managers interact and create value. To understand a business is to know how these relationships work. And the executive's or entrepreneur's job is to manage and shape these relationships (Freeman, 2010).

In this vein, SM is defined as the action of balancing the competing preferences or claims of the stakeholders (Reynolds, Schultz, & Hekman, 2006). Also, more practically and accurately, it can be conceived as the management of expectations of parties involved designed to fulfill the various interests at stake (Manetti & Toccafondi, 2012). Consequently, the height of the SM process is known as stakeholder engagement, which is understood as a process with mutual benefits for companies and stakeholders that draws on a cooperative scheme called a "mutually beneficial and just scheme of cooperation."

4. Classroom Activity

Cases based on real crisis incidents can work as an exercise in order to collectively assess what the key stakeholders are in a critical situation. At the same time, they can work for teaching how to desig a stakeholder communication plan in order to deal properly with a crisis. The activity described by Contreras-Pacheco, Talero-Sarmiento, & Escobar-Rodríguez (2020) is a vivid example of the latter. The book written by Coombs (2019) is full of such examples, together with their corresponding instructor notes and feedbacks.

4.1. Understanding the Stakeholder's View of the Firm

Lately, from the management perspective, it has widely argued that "for sustainable development to become a reality, the SA offers the best opportunity" (Buchholtz & Carroll, 2012; p.63). In that sense, it has also been argued that SM is an outcome of the Value Creation & Appropriation Approach (Brandenburger & Stuart, 1996). See figure 1.

The ST for its part, is introduced as an evolution of a purely rational approach based on the self-interesting of actors in an economic relation. It primarily claims that organizations should be managed in the interest of all their constituents, not only in the interest of shareholders (Laplume, Sonpar, & Litz, 2008). Furthermore, true sustained value creation is achieved when a company has a purpose and when decisions are made on the basis of a set of authentic values (Harrison & Wicks, 2013). In other words, adequate distribution of the created value into different stakeholders becomes a long-term source of sustained value creation. Later, this became the primary input of a powerful and practical idea, which Porter & Kramer (2011) labeled as "Shared Value Creation."

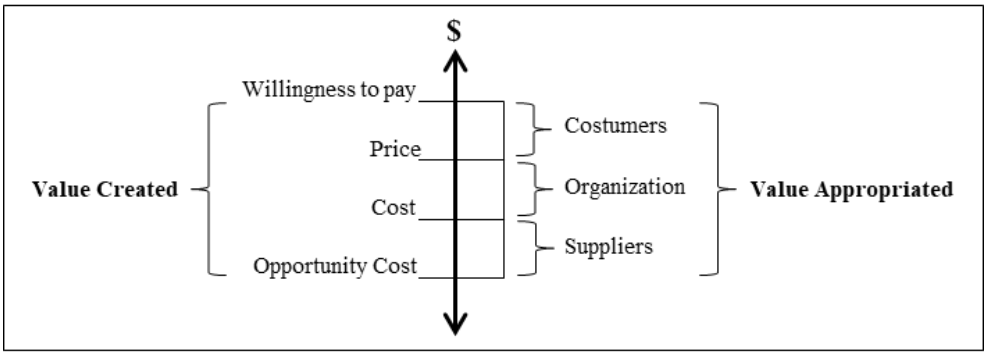

Figure 1. Value Creation – Appropriation Model (Brandenburger & Stuart, 1996)

However, one of the keys of this last idea is the way to obtain the "adequacy" in the distribution of value between participant stakeholders. Assessing this process can be confusing but necessary. In this sense, different scenarios appear to diagnose reality in this matter. One valid approach is the one named "Stakeholder value appropriation trade-offs" (Stakeholder VA Taxonomy), which was recently proposed by García-Castro & Aguilera (2015). They developed a useful categorization model that addresses the relationship between the value appropriated by stakeholders and the total value created in a period by a conventional stakeholder interaction.

García-Castro and Aguilera's (2015) proposal explains, in 7 generic scenarios, how the value created in a specific period is distributed into two stakeholders who are part of a conventional stakeholder relationship. First, the value creation of this interaction can be identified as one of three possibilities: 1) positive-sum game (there is value creation); 2)

negative-sum game (there is value destruction); and 3) zero-sum game (there is neither creation or destruction of value). At the same time, it is needed to identify the value appropriation "equilibrium" of each stakeholder during the interaction. First, it can be a balanced appropriation, when the proportion of either creation or destruction is the same for both stakeholders; second, it is possible to find a scenario where value-creation (or value-destruction) of one stakeholder implies no value-modification for the other stakeholder; this means neutrality. Finally, it is possible to note that under an unbalanced output, one stakeholder can capture value at the expense of the other. See Figure 2.

		Balanced	**Neutal**	**Unbalanced**
Value Creation	**Positive**	*1. Sharing value*	*2. Stakeholder neutrality (gains absorption)*	*3. Over-appropiation of value*
	Negative	*4. Sharing losses*	*5. Stakeholder neutrality (loss absorption)*	*6. Over-appropiation of remains*
	Zero	*7. Zero-sum*		

Figure 2. Stakeholder VA Taxonomy (García-Castro, Aguilera, 2015)

5. Questions for testing and for future developing

How important are for SM to have a truthful purpose and values?; What is the relationship between stakeholder power and stakeholder interest?; How should a manager communicate with the company's stakeholders?; What is the relationship between SM and firm financial performance?; What is the relationship between SM and corporate social performance?; What are other organizational outcomes affected by SM?

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Challenges in Higher Education Teaching Collaborations – a CAGE distance framework analysis

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Abstract

Transnational teaching collaborations have many advantages, but also create challenges. Many challenges relate to distances between partner countries. The CAGE (cultural, administrative, geographic, economic) framework helps to assess and classify the impact of various distances. The framework was initially developed for a business context. We test the usability of the CAGE model in a higher education institution (HEI) context by relying on insights from an EU-teaching collaboration project. Within the project, students and lecturers from different HEIs consult real-life firms in going abroad. Teams from the home and the host country of the firms work together in these collaborations. We conclude that the framework is helpful for HEIs. Administrative distances seem to be the most crucial aspect in selecting the right partners for teaching collaborations, whereas geographic and economic distances are manageable. Cultural distances had less of an impact in our setting, but we expect a stronger impact for other projects. The teaching community can learn from the insights of the illustrated collaborations to avoid specific challenges and successfully set up cross-country teaching collaborations.

Keywords: *HEI; Collaboration; internationalisation; co-teaching; CAGE; distance.*

1. Introduction

The benefits of transnational teaching collaborations at higher education institutions (HEI) are well known. Students develop their intercultural skills, practice their foreign languages, and learn to interact in global settings (Altbach & Knight, 2007). They also develop their ability to contribute to innovation creating processes through individual, inter-personal, and networking skills (Saulich & Lehmann, 2017). These abilities increase their employability and have an indirect positive effect on future employers (Kinash, et al. 2016). The internationalisation of teaching activities is also beneficial for the teaching staff. Besides the learning opportunities that also applies to students, lecturers can develop their networks, tap complementary knowledge, and get inspired through the exposure to different teaching methods across countries (Wohlgemuth, Saulich, & Lehmann, 2019).

Although, the benefits of transnational teaching collaborations are well established, we rarely see them in practice or only in rudimentary forms. „Traditional approaches such as mobilities are a start, but do not go far enough, in that they have a limited audience and little institutional impact" (Nilsson, 2000, p.40). A potential reason might be the challenges that are related to the internationalisation process. Distances between countries can complicate relationships. To classify and address those challenges, Ghemawat (2001, 2007) developed the CAGE framework and postulated that the decisive distances are cultural (C), administrative (A), geographic (G), and economic (E). We therefore ask: *Which CAGE Factors are the most relevant when establishing HEI teaching collaborations?* To answer our research question, we rely on insights of the EU-funded transnational collaboration project INTENSE (INTernational ENtrepreneurship Skills Europe).

We briefly introduce the INTENSE project in section two, before we detail on the CAGE framework and its influences on our HEI collaboration in section three. Section four concludes. We provide the following contributions: First, the CAGE framework was developed for a business setting. We test the usability of the CAGE framework, in an academic setting. Second, we illustrate how to select partner countries for successful international collaborations, based on the CAGE model, by describing challenges that occurred in the INTENSE project. We can show, based on our case, that administrative distance seems to play the largest role in international HEI collaborations, This might create an awareness and other cross-country collaboration projects can learn to avoid them.

2. The INTENSE Teaching Collaboration

The aim of INTENSE (intense.efos.hr) is to develop and implement a cross-country teaching module (15 ECTS) in the field of international management. After completing the module, students should be able to guide small and medium-sized enterprises (SMEs) through the process of going abroad in the form of a transnational consultancy project.

In joint workshops that involved five partner HEIs from different EU countries (Belgium, Croatia, Finland, Germany, and the Netherlands) the content structure and teaching methods were developed. Each institute contributed to developing teaching material that corresponded to its specific field of expertise. Overall, the implementation of the module (September 2016-August 2019) involved staff trainings, development of teaching materials, pilot runs in every HEI, revisions based on lecturer feedback, and the final implementation.

The module is taught in parallel at all HEIs that participate. Some components are taught in regular national setting, with standardised content across countries. However, the capstone of the module is a real-life transnational consultancy project that requires cross-country co-teaching. Figure 1 illustrates the general idea of the cooperation.

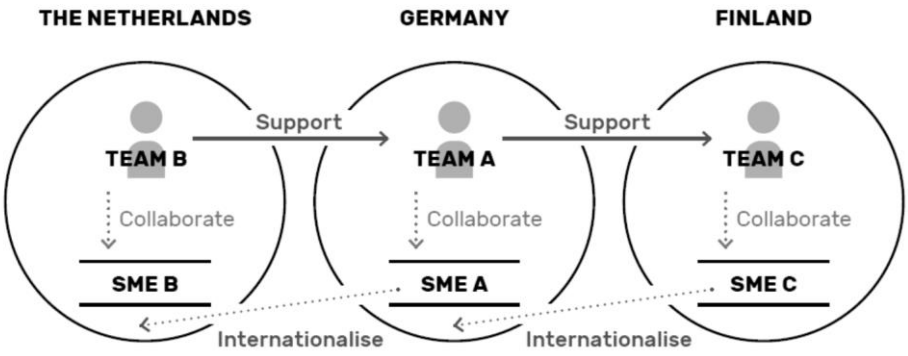

Figure 1. Transnational Student Consultancy. Source: Adapted from Lehmann, Saulich and Wohlgemuth (2018)

The transnational student consultancy has been explained in Lehmann et al. (2018) and Ammeraal (2019). Basically, student team A in Germany consults the German SME A, who wants to internationalise to the Netherlands. The Dutch student team B supports team A with relevant knowledge of the Dutch market. At the same time, team A provides specific German market information to team C from Finland (Lehmann et al., 2018; Ammeraal, 2019).

In addition to development of the module and its contents, this system of providing and receiving support to and from other student teams at different HEIs is the core collaboration component. The HEIs and the involved lecturers need to constantly work together to make this system work. This continuous interaction and preparation involves several challenges.

3. Challenges in Implementing the Collaboration

3.1. The CAGE Framework

The Uppsala-model of internationalisation (Johanson & Vahlne, 1977) postulates that it is easier to engage in host countries that are proximate to the home country. Ghemawat (2001, 2007) developed this further by specifying proximity. He developed the CAGE-framework to identify and assess the impact of cultural, administrative, geographic, and economic distances between countries on internationalisation endeavours. Some distances have stronger impact, depending on the industry and type of internationalisation (Beugelsdijk et al., 2018). The framework should help managers to decide which country to expand to. While the framework was developed for a business context, it might also be useful to assess the likelihood of successful HEI collaborations between countries. Thomas and Ghemawat (2008) use the CAGE-framework to analyse potentials to include globalisation in curricular, but do not discuss HEI collaborations. We assess the impact of the distances on the INTENSE project below.

3.2. Cultural Distance

Attributes that create cultural distance are different languages, different ethnicities, religions social networks, and social norms (Ghemawat, 2001, 2007). These create different interpretations on how to structure relationships.

Within the INTENSE project, cultural distances did not have such a strong impact on the collaborations. This has different reasons. First, students and staff specialise in the field of international management, that directly addresses these challenges and thus, probably prevented some. Furthermore, all participants are fluent in the transfer language English.

This does not mean that we did not have cultural conflicts. We did encounter the standard intercultural challenges such as miscommunication and different approaches to schedules and deadlines (Hall, 1989). A further cultural distance we could identify, was the general connection between HEIs and SMEs. In some countries, strong ties between HEIs and the business community are the norm. Other countries struggled to convince SMEs of the fruitful relationship as lecturers had little experience with working in a real-life consultancy project.

However, we felt that the overall impact of cultural distances was smaller than expected, given the international management literature (Taras, Steel & Kirkman, 2010).

3.3. Administrative Distance

Reasons for administrative distances are the absence of colonial ties, the absence of shared monetary or political associations, political hostility, and institutional weakness (Ghemawat, 2001, 2007). Since all countries of INTENSE are EU-members, we initially assumed that

administrative distances will not be a decisive factor. However, this seems to be the most crucial distance that should be considered before setting up relations.

Like teachers before (Minett-Smith & Davis, 2019) we realised that intrinsic motivation and like-mindedness of the faculty is not found everywhere. Some lecturers minimised collaboration as it was perceived as too time demanding and difficult. We attribute this mainly to administrative distances, as incentives for lecturer to participate in cross-country collaborations varied. Some lecturers did not receive any time- or financial compensation.

Furthermore, academic calendars and course requirements across universities varied greatly, which made the scheduling of work phases and team meetings difficult. Another challenge was steering the enrolment for the consultancy project. In Germany for instance, lecturers did not know how many students would participate in the course and what their background knowledge was until the first class meeting. Furthermore, students were entitled to disenroll from the course throughout the first three weeks of the course, which is difficult a for real-life consultancy project. In the Netherlands, the project was also open to incoming exchange students meaning that e.g. an Irish student was working on the project and had to interview Dutch wholesalers. For students not speaking the native language this was quite a challenge.

Although, the European credit transfer system (ECTS) aims to ensure a comparable workload for students, the workload expectations differed substantially across countries. Resolving those situations early on and discussing the progress of both teams and the quality of their work regularly is crucial to avoid misunderstandings (Wohlgemuth et al., 2019).

Administrative distances seem to be the most crucial challenge in setting up collaborations. Since the EU Bologna-process aims to harmonize higher education across the EU, we assume that this distance has an even stronger impact on collaborations between countries that are not part of a political or economic union.

3.4. Geographic Distance

Geographic distance between countries is assumed with a lack of a common border, physical remoteness, as well as weak transportation and communication links. Particularly with the need to communicate often this distance becomes important (Ghemawat, 2001).

Three partners had a rather low distance with joint borders, whereas two partners had a larger geographic distance. Hence, the distances between countries of the INTENSE project did not allow for much face-to-face communication, due to cost reasons and environmental concerns that result from traveling. Therefore, cross-country team communication relied mainly on virtual tools. Various channels, such as e-mails, text messenger services, video-conferencing, phones, file sharing services etc. were used. No specific medium is superior in all cases, but the diversity creates additional value (Tenzer & Pudelko, 2016). Nevertheless, we tried to ensure regular face-to-face meetings at least twice per year during 2-3 days project meetings.

Our experiences show that a combination of virtual communication and face-to-face contact is beneficial. Less distance would allow for more personal contact, which would be better. However, while virtual communication is not perfect, it was sufficient for our purposes. Therefore, we conclude that geographic proximity is beneficial, but not crucial in this setting.

3.5. Economic Distance

Economic distance between countries refers to differences in consumer income as well as differences in the costs and quality of inputs and infrastructure. This distance is the most important attribute for most businesses (Ghemawat, 2001). However, for HEI collaborations, it seems to have less influence.

The partner countries of INTENSE are all EU members. Therefore, the distances are not too high. The partner country with the lowest per capita GDP and the highest economic distance to other project partners is Croatia (Miloloža, 2015). Accordingly, the financial compensation for participation in the project was also the lowest in absolute (€) values. While the EU-funding intends to create comparable relative compensation (based on the countries income levels), this sometimes creates some frustration for the involved lecturers.

We could observe that the SMEs we consulted were usually interested in entering the economically and geographically largest market (Germany). This created some imbalance between outgoing and incoming firms from and to Germany. As Figure 1 illustrates, a balance is very desirable for the project. Interestingly, it seems that SMEs do not chose their target country based on the economic distance between home and host country as suggested by Ghemawat (2001), but by the economic strength of the host country.

Otherwise, the HEI collaboration was less affected by economic distances. However, the INTENSE HEIs are all state-owned non-profit organisations and are not exposed to the same market mechanisms as businesses or profit-oriented private HEIs,.

4. Conclusion

The CAGE framework was developed for a business context. We contributed by testing its usability in a HEI context. Ghemawat (2001) suggests that the distances are not equally important for all industries. We conclude that economic distance is not that important for state-owned non-profit HEIs. However, it might the decisive for profit-oriented HEIs.

Our second contribution is an illustration of criteria that help to select partner countries for successful international collaborations based on the CAGE model. We considered administrative distances to be the most crucial aspect to look for. Particularly harmonised academic calendars, harmonised workload expectations, and student selection criteria played a role in our setting. The international management literature suggests that cultural distances

create a lot of frustration (Taras, Steel & Kirkman, 2010). Since all our involved lecturers and students are from that field of expertise and are well prepared to address them, we did not observe a lot of challenges that relate to international culture. However, we expect a stronger impact on lecturers and students that are not prepared in this regard. Geographic distance forced us to rely a lot on virtual collaboration. This is not ideal, but sufficient. Therefore, we consider geographic distance to be manageable in a HEI context. Table 1 summarizes our findings for our project of five state-owned HEIs within the EU.

Table 1. Summarizing CAGE distances in the INTENSE project.

CAGE Distance	Challenges experienced in INTENSE	Potential mitigation strategies
Cultural distance	Miscommunication + different approaches to schedules	Common language
	Differences in HEI-SME connections	Intercultural sensitivity training
Administrative distance	Differing incentive structures for teachers	Teambuilding among lecturers + aligning incentives
	Varying academic calendars	
	Varying course requirements, workload expectations and enrolment regulations	Developing joint rules and structures beforehand
Geographic distance	Limited possibilities for face-to-face meetings	Virtual collaboration (Based on teambuilding among lecturers)
Economic distance	Differences in financial compensation for participation	Align incentives

With the help of the CAGE framework, we describe challenges that occurred in the INTENSE project. Many of them are probably not idiosyncratic to the INTENSE project and will occur in a similar way in other projects. They can learn from us and avoid these challenges, e.g. through a CAGE framework-based partner selection.

Additionally, while this paper discussed many challenges that come with cross-country collaborations, none of the challenges we faced is that severe that it should stop us from engaging in collaborations. We were able to master all of them and hope to motivate the community to engage in future transnational HEI collaborations.

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Design of a gamified tool for the development of citizenship competencies

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Abstract

The DidacTIC project emerges as a proposal in face of high levels of desertion in virtual education, and the latent need to develop citizen competencies in the Colombian context. It consists in the joint development of a platform that will extract information from the Learning Management Systems and a motivational didactics tool based on gamification principles, designed to reinforce the teaching and learning process in the subject of citizen competencies. This document evidences the methodology applied to the design of the gamified tool. The methodology used was based on the "player-centered design", so, various information collection tools were used to gather and categorize the main characteristics of users (motivations, sociodemographic and behavioral data) and design the game accordingly . From this, the findings show that users have a high impact, such that, the graphical interface and content present a close relationship with real-life situations.

Keywords: *Gamification; citizenship competencies; machine learning; artificial intelligence; education; ICT.*

1. Introduction

Virtual education in Colombia has had a rattling growth in recent years, according to data from "*Ministerio de Educación de Colombia*" (2018). Also, in recent years, the growth in the number of enrollments in the virtual mode of higher education was 98.9%, manifesting thus the importance to undertake processes of continuous improvement over this teaching modality, to ensure the quality of education.

A big challenge for virtual education is the motivation of both teachers and students. Teachers, who seek to create emotions in their students with the encouragement to raise awareness towards learning, and students, who sometimes are not aware of the purpose or goal of a particular academic activity. Motivation is fundamental in every educational modality, since without it, hardly anyone would undertake a personal or academic level work effort towards competencies development (Romero & Pérez, 2009). Besides, motivation becomes more relevant in online training courses because distance, solitude and special requirements for student autonomy are factors that influence their permanence/attendance.

Thus, if learning is understood as a continuous process, it can be intuited that it requires permanent motivation, both for undertaking it as to prolong it until it reaches the proposed objectives, and that is precisely one of the greatest efforts in virtual classrooms. Although students may have a notable will at the beginning of every course, usually it is going to decay over time as topics advance and the training course reaches more complexity. In this context, there are excellent alternatives like the design and application of participative or interactive activities, such as recreational activities or formal games. These, framed in a gamified ambiance, contrast in some/a major way with the more passive and regular activities within the virtual classroom. In the face of these requirements from the virtual educational model, the DidacTIC project seeks to take advantage of gaming, artificial intelligence and machine learning to design a didactic tool based on gamification that will be found in the Learning Management Systems (LMS) of virtual training courses. This tool will focus on the development and strengthening of citizenship competencies in students, enabling them a proper posture and interaction within society.

Being so, this project seeks to answer the needs observed in different studies, which have considered the development of citizenship competencies from diverse educational perspectives (Castro Annicchiarico, 2014). Particularly, in the Colombian context, it increases the relevance of these competencies due to the governmental efforts to find alternatives to resolve social issues (social exclusion, corruption perception index, violence, among others) (ICFES, 2018a), and the obtained results in "*Pruebas Saber*" where it became evident that 49% of young people accept violence in any of its manifestations and 41% of young people accept disobeying the law (Schulz et al., 2016).

So being, it is justified the need for citizenship competencies appropriation in every educational setting when using innovative and attractive resources for the students, such as Information and communications technology (ICT) tools. In this way, the objective of the present study is to design a gamified tool to motivate and develop citizenship competencies in virtual education students; it should be noted that this research is part of the DidacTIC project.

2. Theoretical framework

This research is based on the concepts of gamification and citizenship skills, as they g**a**ve rise to the DidacTIC project. On one hand, gamification is the use of typical elements of games in non-gaming contexts" (Llorens-Largo et al., 2016) and it is considered as a promising educational approach to the extent that it can motivate, increase commitment, strengthen knowledge and at the same time it entertains (Katsaounidou et al., 2019). Various researches have studied the impact of gamification on the development of citizenship competencies, these are considered as the set of knowledge, cognitive, emotional and communicative skills that, together, make it possible or an individual to act in a constructive and productive way within society (ICFES, 2018b). A good example related to this research is the European Union's project: WeAreEurope, an online game created to educate 6-10 year-old students in citizenship competencies through gamification (Bratitsis et al., 2017).

Within this context, the DidacTIC project uses moral dilemmas, which are brief stories in which a character faces a complex moral situation, and, in that context, each user must decide about their future actions, limited to various alternatives, each one with positive and negative implications. Moral dilemmas allow the development of cognitive skills, referring to fundamental mental abilities to exercise citizenship competencies, since questions and insights related to these situations are supposed to increase civic knowledge. On the other hand, emotional skills are increased to the extent that moral questioning makes it possible to develop empathy for the characters, increasing the recognition of their own emotions and identifying the appropriate attitudes and behavior**,** finetuning their Emotional Inteligence. Finally, communication skills are improved since discussions that arise from dilemmas help develop the skills required to establish a constructive dialogue.

3. Methodology

The methodology used in this project comes from the Player-Centered Design proposed by Kumar & Herger, (2013), based at the same time in the User-Centered Design (UCD), an iterative process in which designers focus on the users and their needs in every phase of the project. This method suggests a five-step process for the design of an effective gamification

experience, which represents the phases of this investigation. Each of them is described below along with the tools used in the data collection process.

(1) Recognition of user profiles for the definition of their most important characteristics: age, skills, and abilities; these factors were obtained from surveys, interviews and similar studies found in the literature. (2) Identification of the mission and the learning objectives, determined by a Factor weighting method. (3) Understanding the intrinsic and extrinsic motivations of the user through the construction of empathy maps and journey maps. (4) Definition of the mechanics, in other words, the history, characters, missions, levels, points, badges, leaderboards, and other elements to use within the tool. (5) Administration, monitoring, and mediation of every advance of the tool, to validate and improve it according to the user`s opinions obtained through proof of concept.

4. Results

4.1. User Profiles

Initially, to recognize the users' main features, a literature review was conducted about the students and teachers from the academic courses in virtual mode. In this review, sociodemographic and behavioral data was identified (Acevedo et al., 2015; Facundo Díaz, 2009; Rodríguez Albor et al., 2014), from which, three preliminary profiles of students and teachers were created.

Afterwards, to verify the designed pre-profiles, polls were created and conducted to 132 students and 52 teachers of virtual education; also, four particular teachers from this modality were interviewed. The information obtained generated four student profiles and three teacher profiles, summarized in Table 1.

4.2. Learning objectives

Afterward, a factor weighting method based on the Delphi method was used to determine which of the seven types of citizenship competencies recognized by the Colombian Ministry of National Education, would be the most relevant. As a result, and based on a quartile analysis, it was found that written communication and cognitive skills, associated with knowledge about citizenship education, will be the central theme of the gamified tool.

4.3. User's intrinsic and extrinsic motivations

Additionally, to comprehend user motivation, empathy maps and journey maps were created for the "Newly graduated student" profile. In this study it was found that, the largest number of students fit in this profile. The results indicate that the main intrinsic and extrinsic student motivation is the teacher permanent monitoring and the constant teacher-student communication, as well as development and implementation of innovative activities for their learning.

Table 1. User profiles

Profile	Features
Ghost student	Their objective within the course is to steal content and charge to do activities for other students.
Working student	Age between 30 and 60 years old, with a stable job, they have the ability to focus easily, they are competitive, and they have difficulties dealing with frustration.
Newly graduated student	Age between 20 and 30 years old, just graduated from high school, they have team work skills and communicate easily, they have difficulty focusing and acquiring/attaining discipline.
The student with personal challenges	Over 60 years old, with lots of free time, they have the skills to organize themselves, they are proactive and love challenges. However, they have difficulties using current technology.
Empathetic teacher	Age between 30 and 50 years old, face-to-face and online teachers, they are very aware of their students dinamics and frequently implement activities to motivate them.
Normative teacher	Age between 30 and 50 years old, face-to-face and online teacher, fulfill their job and tasks, they struggle to do activities that motivate their students.
Active teacher	Age between 30 and 50 years, online teacher, fulfill their job, tasks and sometimes they do activities to motivate their students.

4.4. Mechanics of the game

For the definition of the mechanics, the elements proposed by Knautz (2015), were considered. The following is a brief description of each one:

1. Story: the story takes place in 2120 in Didactic-City, a city where chaos, discourtesy and individualism prevail over the common good, affecting the happiness of the citizens. For this reason, the scientific community decides to develop an artificial intelligence called OSMO that helps making decisions on how to optimize the use of public resources. However, this is considered not to be enough for the necessary improvements, so it is decided to sign up for a new Mayor for the city. The mayor will be represented by the student using the tool, who will face complex decision making to save his city. The city has buildings the user will be able to improve, as well as a power plant, food suppliers and water treatment plants, in which the Mayor must keep high indicators to avoid citizens moving out to another city.

2. Characters: the tool will have a Mayor (avatar selected by user) and an assistant, OSMO, who will be represented by the avatar of a robot.

3. Missions: the missions will be contained in interaction bubbles with multiple choice questions, moral dilemmas and problem situations, which must be solved by the user to get rewards. Moral dilemmas are short stories in which a character faces a complex situation and must decide on his future actions limited to two alternatives with positive and negative implications each. On the other hand, problem situations are related questions from the perspective of three characters, so the player must make decisions taking into account different points of view. The implementation of these strategies contributes to the appropriation of knowledge about citizenship education. Also, the emotional competences increase as the moral questions will allow developing empathy for the characters and the identification of the appropriate attitudes and behavior towards them. Finally, communication skills are improved because at the time the user writes the arguments of his responses to moral dilemmas, the student will be presented with feedback regarding orthographic, grammatical and linguistic aspects; this evaluation will be generated thanks to artificial intelligence that will be anchored to the game

4. Levels: the tool will have eight levels that must be overcome sequentially by the user. Inside each level, the student must solve 20 missions with multiple choice questions, 6 missions with moral dilemmas, and 1 mission with a problem situation; as well as keeping high indicators in water, food, electricity supply and number of citizens. As the player progresses in the levels, the city area will increase also, which will increase the number of buildings, as well as improve their living conditions, resulting in a more modern city.

5. Points: The tool will grant the user points and coins for overcoming missions. With the coins, the student can build and improve buildings and increase the key indicators of the city (see water, electricity, and food).

6. Leaderboards: A public leaderboard of 10 positions will be generated according to the user scores. Besides, each student can know their position privately.

4.5. Monitoring and measurement of the progress

Finally, for the validation of the design, a concept test was conducted to evaluate the tool mechanics and dynamics, that is to say, the rules, limitations and actions done by the user, as well as rewards, missions, levels, characters and story. The test was done in a focus group with online students structured in two parts. Students in the first section learned the concept of the tool and simulated some of its phases, generating general appreciations in the group; during the second stage, the students answered individually an acceptability questionnaire according to their perceptions and opinions. Regarding the contents of the tool, the test results indicate that users expect that moral dilemmas and problem situations have complex real-life issues, also that inside the gamified system there must be some fundamental information granted about the citizenship competencies before the execution of the mission; these considerations will be taken into account in the content design. Besides, regarding the tool

mechanics, some unconformities were found about the avatar appearance of the Mayor, for this reason, modifications were made, and it can be proposed to the user to choose their avatar from a selection of eight options with multiple characteristics, where each of these represent a type of emotional intelligence according to Howard Gardner (Mercadé, 2019).

5. Conclusions

In the education sector, the use of new technologies has enabled students to have a greater number of tools allowing the development of their skills and to better acquire knowledge. The incorporation of new technologies in the teaching and learning processes represents an opportunity for improvement both in the functions performed by the teachers and the ones performed by the students, who learn with greater autonomy and efficiency. However, it is also indispensable a constant accompaniment by a teacher or tutor allowing continuity of the student process, because it was found that, in the online education context, the support of the tutor keeps students alert and aware about their progress, increasing their motivation and improving, therefore, their learning process.

Otherwise, it was found in virtual education, that writing skills development and the acquisition of civic knowledge are of great relevance because they are indispensable for the professional training and citizenship formation, that will enable individuals to understand their role within society. Regarding the gamified tool, it is evident in this case that the graphical user interface and the content is valuable for the users. In this sense, the students made an emphasis on the relation between these elements (characters, moral dilemmas, problem situations, among others) with real-life characteristics. Finally, the development of this project allows concluding that the incorporation of emergent tendencies like gamification in virtual learning environments is an opportunity to improve the teaching and learning process while also making it more enjoyable and motivational for students.

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On the Use of Bayesian Probabilistic Matrix Factorization for Predicting Student Performance in Online Learning Environments

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Abstract

Thanks to the advances in digital educational technology, online learning (or e-learning) environments such as Massive Open Online Course (MOOC) have been rapidly growing. In the online educational systems, however, there are two inherent challenges in predicting the performance of students and providing personalized supports to them: sparse data and the cold-start problem. To overcome such challenges, this article aims to employ a pertinent machine learning algorithm, the Bayesian Probabilistic Matrix Factorization (BPMF) that can enhance the prediction by incorporating background information on the side of students and/or items. An experimental study with two prediction scenarios and 24 experimental conditions was conducted to study the BPMF based on real online learning data. The results show that the lower rate of missingness and the appropriate dimensionality of latent features provided better prediction accuracy in both prediction scenarios. The use of side information enhanced the prediction accuracy but the effect was diminished for the high dimensional latent features when the data are sparse. The methodological value, applicability, and practical implications of the BPMF and side information to the online educational systems were also discussed.

Keywords: *digital educational technology; online learning; online educational systems; machine learning; Bayesian Probabilistic Matrix Factorization; student performance prediction.*

1. Introduction

Digital educational technology has advanced considerably over the last few decades. Thanks to the advances, particularly, online learning (or e-learning) environments such as Massive Open Online Course (MOOC) have been rapidly growing and getting attention. Such online educational systems have promising advantages in helping students access more easily to the qualified instructions and resources as well as in allowing them to manage their learning process flexibly (Zhang & Chang, 2015). Moreover, students would have more benefits from the adaptive assessment tailored to the behaviors and needs of individual students in the online learning environments. In the online educational systems, however, there are two inherent challenges in predicting the future performance of students and providing personalized supports to them: sparse data and the cold-start problem. First, as widely known in general online recommender systems, student-item interaction data are often inevitably sparse (in this context, *sparse* means that many elements of the data matrix are empty); there is a considerable number of students who respond to only a certain subset of all possible items in the online systems. Second, the online educational systems suffer from an inability to recommend and/or provide appropriate items for new students who have started the online assessment for the first time. The systems are often incapable of correctly matching the new students with the incipient items due to the lack of background information for each student, which results in inaccuracy of item recommendations (and hence a lot of dropout) at the beginning of online learning, which is called the 'cold-start' problem (Bobadilla et al., 2012).

To overcome such challenges, a pertinent machine learning algorithm for the online educational systems, the Bayesian Probabilistic Matrix Factorization (BPMF; Salakhutdinov & Mnih, 2008), can be employed. By incorporating background information on the side of students and/or items, it enhances the student performance prediction. This article aims to examine the methodological value, applicability, and practical implications of the BPMF and side information to the real online learning data, so that it would help facilitate a personalized learning for students, develop adaptive assessment, instructional strategies, and course curriculum for teachers and developers. An experimental study is conducted to apply the BPMF to the logging data of an online learning environment, Statistics Online. The experiment is designed to study the prediction in two challenging scenarios encountered in online educational systems: (a) existing students take only a part of the all items (some student-item interaction data are sparse), and (b) the data are entirely missing for new students who do not take any items yet. Given the two prediction scenarios, several experimental conditions on the rate of data missingness to be filled and the dimensionality of latent features to be used in the BPMF are considered. Then, background information variables on the student and/or item sides of the Statistics Online data are incorporated into the BPMF to see if either or both of them enhance the accuracy of predicting students' performance in both prediction scenarios.

2. Algorithm of Bayesian Probabilistic Matrix Factorization

The BPMF is an advanced version of matrix factorization that uses a collaborative filtering approach in machine learning algorithms (Salakhutdinov & Mnih, 2008). Compared to the previous matrix factorization methods, the BPMF can use additional information for students and/or items when making predictions on the two latent feature vectors, and hence it can implement more accurate factorization, resulting in better predictions especially for the entities that have few or no observations. Its prediction process is formulated in mathematical terms as follows. Let Y denote a response data matrix and Y_{ij} is the binary response value (0 = incorrect response; 1 = correct response) of student i on item j; U denotes a D-dimensional latent feature matrix for students and U_i is the i-th student-specific vector in U; V denotes a D-dimensional latent feature matrix for items and V_j is the j-th item-specific vector in V. Note that D-dimension represents a size of the latent feature vectors, U_i and V_j. In this setup, an optimization algorithm enables to predict the incomplete entries in the observed Y, which minimizes the sum of the squared differences between Y_{ij} and $U_i^T V_j$, the dot product of i-th row in U and the j-th column in V. Specifically, the following optimization problem is solved in terms of a loss function L of U and V:

$$L(U,V) = \sum_{(i,j)\in I_Y}(Y_{ij} - U_i^T V_j)^2 + \lambda_U \|U\|_F^2 + \lambda_V \|V\|_F^2 , \quad (1)$$

where I_Y is the set of observed entries in Y and $\| . \|_F$ represents the Frobenius norm, which is the square root of the sum of the absolute squares of the elements in the matrix. Regularization parameters, $\lambda_U > 0$ and $\lambda_V > 0$, are derived from Gaussian priors on the U_i and V_j and a Gaussian noise model on the observed Y_{ij}.

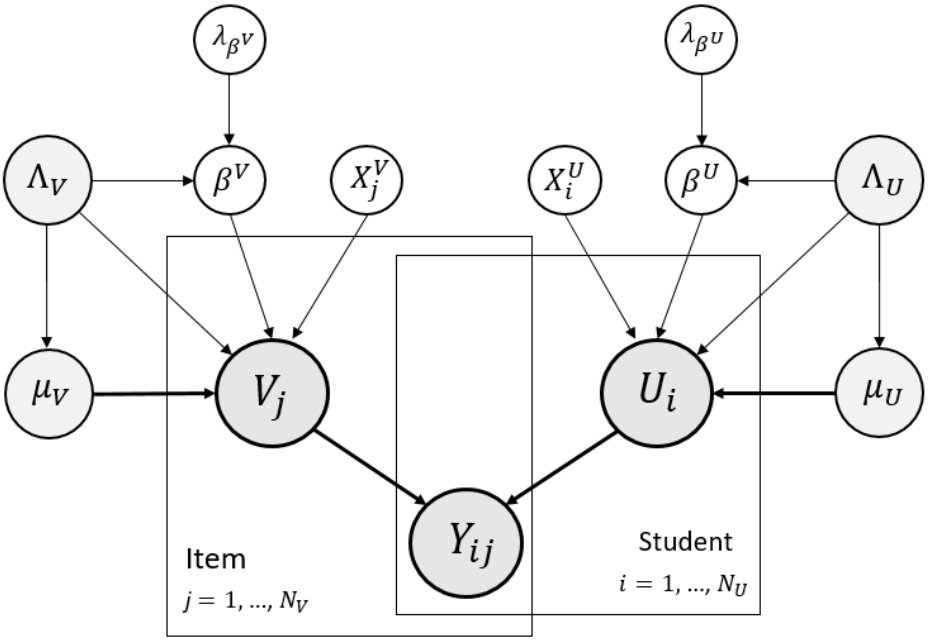

Figure 1. Model parameters and hyperparameters for the BPMF.

For the model parameters used in the BPMF (see Figure 1), each latent feature vector is assumed to follow a multivariate normal distribution. That is, $U_i \sim MVN(\mu_U + \beta_U X_i^U,\ \Lambda_U)$, where μ_U is a vector of prior means for U_i, Λ_U is a variance covariance matrix for U_i and β_U is a vector of weights for the i-th student's background variable X_i^U. Similarly, $V_j \sim MVN(\mu_V + \beta_V X_j^V,\ \Lambda_V)$, where μ_V is a vector of prior means for V_j, Λ_V is a variance covariance matrix for V_j, and β_V is a vector of weights for the j-th item's background variable X_j^V. Particularly, model parameters and hyperparameters are integrated out using Markov chain Monte Carlo methods, which enables to control the model complexity automatically based on the training data. Based on the discovered latent feature matrices, the missing entries are predicted on a probability scale between 0 and 1 by computing the dot products of the two latent feature vectors of the corresponding rows and columns, U_i and V_j, respectively.

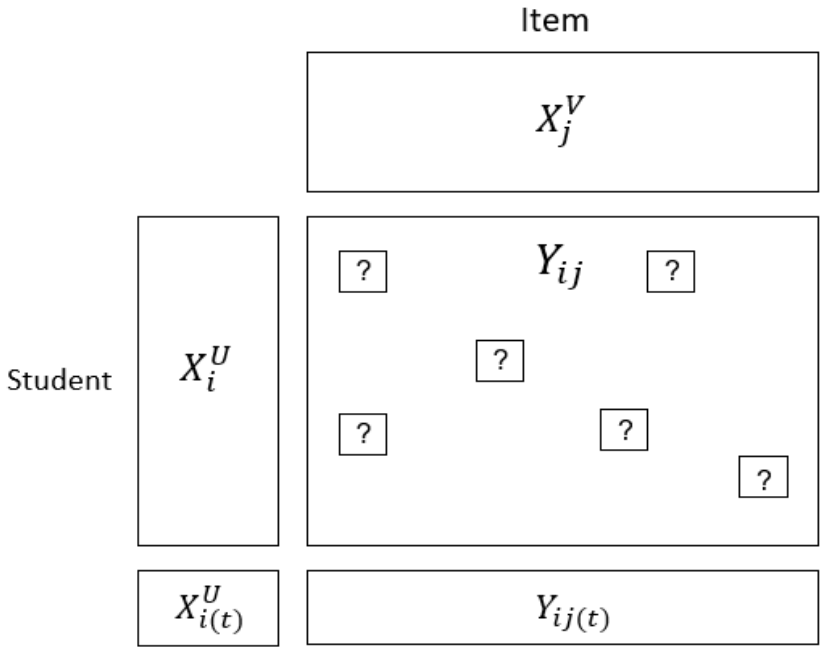

Figure 2. Illustration of the prediction scenarios.

3. Design and Evaluation

3.1. Prediction Scenarios

To consider the practical challenges in the online learning environments, two prediction scenarios for the BPMF are taken into account in an experiment as follows:

(a) Scenario 1 (sparse data); existing students have sparse response data because they take only a part of the all items,

(b) Scenario 2 (cold-start problem); new students have no response data because they did not take any items yet.

Figure 2 illustrates the two prediction scenarios in which the BPMF is implemented. For the first scenario, missing entries (indicated with a question mark) in the sparse data matrix Y for existing students will be predicted. For the second scenario, missing entries in the unobserved data matrix $Y_{(t)}$ for new students will be predicted, whereas background information $X_{i(t)}^U$ on the new student i may be available.

3.2. Experimental Conditions

To investigate the best working conditions of the BPMF for each of the two prediction scenarios, and to study whether the use of student and/or item information variables can enhance the prediction accuracy, several experimental conditions are considered:

(1) the rate of data missingness to be filled is varied by 10% or 50%,

(2) the dimensionality of latent features to be used is varied by 1, 5, 10, or 20 dimensions,

(3) none, only student information variables, or both student and item information variables are incorporated into the BPMF.

In total, 2 x 4 x 3 = 24 experimental conditions are considered in each prediction scenario.

3.3. Evaluation Method

For each data set, the prediction performance of the BPMF is evaluated by a 10-fold cross validation (CV). Note that *k*-fold CV means that the benchmark dataset is randomly selected by *k* subsets of equal size. Then, one of the *k* subsets is defined as a "test" subset for the evaluation of the predictions. The remaining *k*-1 subsets are used for "training" the model. This procedure is repeated by *k* times, each time a different subset is used as the test subset. Each subset (fold) is used only once as a test subset. In the end, the final result is calculated by the average of the *k* different results obtained from the *k*-fold CVs. To evaluate the accuracy of the predictions made by our system, we employed Receiver Operating Characteristic (ROC) curves and Area under the Receiver Operating Characteristic (AUROC). Note that a ROC curve represents the relation between true positive rates (true positive/(true positive+false nagative)) and false positive rates (false positive/(false positive+true negative)) at various thresholds. A precision recall curve is defined as the precision (true positive/(true positive+false positive)) against the recall (true positive/(true positive+ false negative)) at various thresholds. The true positive rate is the same as recall, and is also denoted as sensitivity, while the false positive rate is also denoted as (1-specificity). In case of totally random predictions the AUROC is approximately equal to 0.5 and Area Under the Precision–Recall (AUPR) is equal to the frequency of the positive class.

4. An Experimental Study

4.1. Data

The data set contains item responses of 2,044 students at KU Leuven (University of Leuven), Belgium to a total of 20 assessment items in the university's online course for regression analysis. The observed responses are all dichotomous indicating whether the student has answered the item correctly (= 1) or not (= 0). In addition to the student-item responses, there

are various side information about students and item themselves. Specifically, there are 23 student-side information variables that describe students' background (e.g., the status of dyslexia, dyscalculia, AD(H)D, ASS, another language problem, school type, resident area, and so on) and 6 item-side information variables for the items' properties (e.g., question type, attainment target, and so on). Although the initial response data and side information variables do not have any missing observations, they are adjusted based on the experimental conditions we considered for the purpose of an experimental study.

4.2. Analysis

For data analysis, 'Macau' (Simm et al., 2015), a Python package that provides wrapper functions for the BPMF was used. The MCMC sampling with 100,000 iterations (first half as a burn-in) was used to factorize a student-item matrix. The final estimates of the model parameters were obtained by taking the mean of the posterior samples after the burn-in periods of 50,000 iterations.

4.3. Results

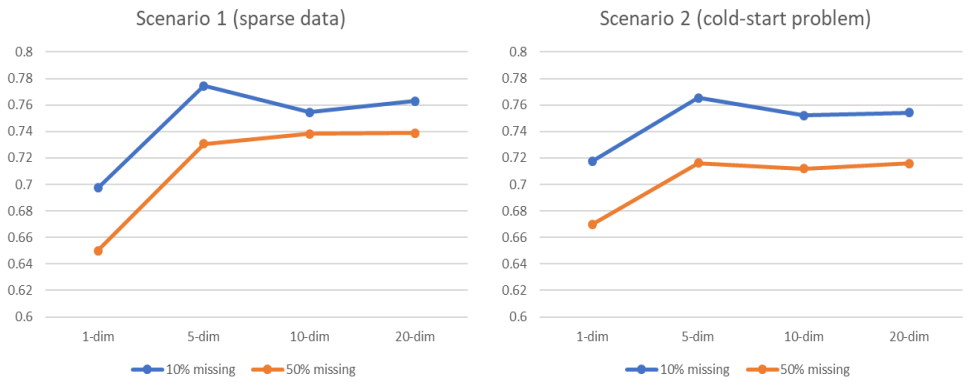

Figure 3. AUROC plots showing the effects of missingness rate and latent feature dimensionality in the BPMF.

As can be seen in the AUROC plots (see Figure 3), the results show that AUROC was greater in dataset with 10% missing values compared to the one with 50% missing values in both prediction scenarios, regardless of the number of latent feature dimensions. In both prediction scenarios, the prediction accuracy increased dramatically between 1 and 5 dimensional latent features, but afterward any changes look very minor even with a higher number of latent feature dimensions. The BPMF with 10 and 20 dimensions may overfit the current dataset.

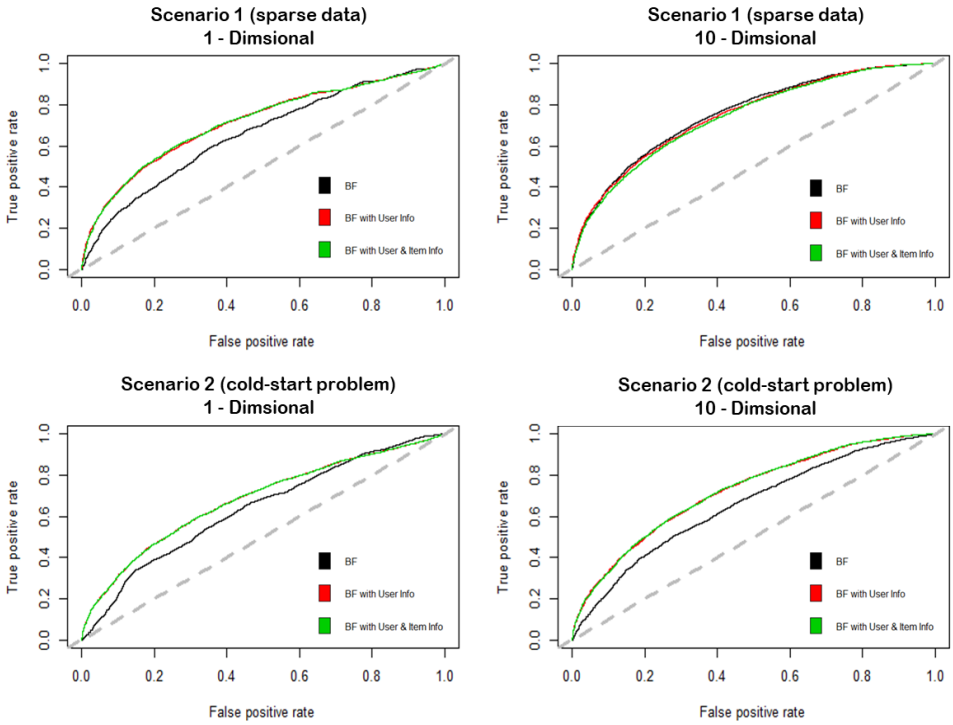

Figure 4. ROC curves showing the effect of using side information variables in the BPMF.

Figure 4 visualizes the relations between true positive rate and false positive rate using ROC curves. The top two panels show the results of Scenario 1 when predicting the existing student's performance on the unsolved items; it is found that compared to the BPMF without using any side information, using side information provided better prediction accuracy (top left). But the effect of using the side information was diminished when 10 dimensional latent features were used (top right). On the other hand, the bottom two panels show the results of Scenario 2 when predicting the new student's performance on the existing items; it is found that using side information provided better prediction accuracy for both 1 and 10 dimensional latent features. Additionally, there was almost no gain by adding item-side information on top of student-side information in both prediction scenarios.

5. Conclusion and Discussion

An experimental study to predict student performance using the BPMF was designed with the two prediction scenarios (Scenario 1 for the sparse data, Scenario 2 for the cold-start problem) and 24 experimental conditions. The Statistics Online data were adjusted and used for the experimental study to consider the reality in the online learning environments. The

results show that the lower rate of missingness (10%) and the appropriate dimensionality of latent features (5 dimensions) provided better prediction accuracy in both prediction scenarios. The use of student and/or item side information variables in the BPMF enhanced the prediction accuracy; the effect was diminished for the high dimensional latent features (10 dimensions) in Scenario 1 but it was kept for both of the low and high dimensional latent features in Scenario 2. Thus, considering the two challenging scenarios, this study helps us find optimal conditions on the use of the BPMF to predict student performance more accurately, which has a predictive value in a methodological perspective.

Moreover, this study sheds light on the applicability and practical implications of the BPMF and side information to the online educational systems. It can help tearchers and developers forecast individual or grouped students' performance on the online course, which allows them to develop and improve personalized or grouped instructional strategies, course curriculum, adaptive assessment, and other elements of the online educational systems. It can also help facilitate a personalized learning for the existing students as well as provide a suitable recommendation of the items and courses for the new students.

Lastly, more extensive simulations are desired for future studies to identify the effects of latent feature dimensions where different ratios of the number of students and items are given and the strength of relation between latent features and side information.

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Preventing university dropout: the relation between the student vulnerability features and academic performance in the first year

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Abstract

Educational services that universities offer to bachelor students are nowadays under the siege of numerous challenges, ranging from financial and institutional issues to fast changing labour market demands. Universities are confronting fast changes and uncertainties, being asked for adaptation, flexibility and higher ability to (re)act and find the best solutions. Within this broad context, university dropout is one particular new challenge that is often overlooked by decision makers and even by the teaching staff. Our study focuses on problems faced by the first year bachelor students of the Faculty of Geography and Geology at the oldest university in Romania, "Alexandru Ioan Cuza" University of Iasi, students who have benefitted from support from a program financed by BIRD and World Bank, named Romania Secondary Education Project (ROSE). In order to identify and analyse their academic pathway in the first year of study, we tried to correlate a number of qualitative and quantitative using the analysis of variance (ANOVA). The analysis of the results indicates that the prevention of school drop-out should be approached as a continuous process starting from the early years of education. The adaptability to student life depends on the treatment of these inherited and overlooked disadvantages.

Keywords: *academic adjustment; university dropout; first-year student experience; ANOVA; retention.*

1. Introduction

1.1. General background

Students come to university to learn and specialize in a particular field. Even if they achieve their goals, at the end of the three years bachelor studies, they are not efficiently trained to live in a real society, to face competition in the labour market or to take on the specific responsibilities of life as an active young adult. Teachers' work should focus, beyond the traditional teaching activities, on encouraging students' independence, on building confidence in their own strengths, on enhancing the skills that help them in life. Sometimes the antagonism between students' academic and social background and the university rigors can be quite high, leading to problems of adaptation.

The transition from highschool to tertiary education represents a challenging switch in a teenager's life, both socially and study-wise, as it changes the entire approach to learning and interacting with teachers (Tulbure, 2010). The most significant challenges: on a personal level (leaving family, managing the personal budget etc.), on an academic level (moving onto a stage of organized, guided activity, taking notes, team-work, time management, individual study etc.) (Lowe&Cook, 2003, Briggs et al., 2012, O'She& Vincent, 2011). Thus, it is not surprising that the student population is drastically reduced throughout the university years, only half of the students being able to graduate (Sava et al., 2015). University dropout, also known as attrition or dismissal, can be connected to the requirements of the institution itself i.e. formal stipulations regarding the minimum number of credit points, attendance and ethical behaviour. It can be also context-bound i.e. financial difficulties, abrupt changes within family relations, moving to a different town, getting a job, new demands in the approach to studying. Last, but not least, they can also be academic being caused by the lack of motivation, incapacity to rise up to a certain level of academic expectation, significant change of priorities, wrong choices, dissatisfaction regarding the whole academic experience, inability to properly manage time and workload etc.(Willcoxson, 2010, Bowles et al., 2014). Academic accomplishment is crucial for the successful development of teenagers within the society. Students who do perform well in school are more capable to handle the transition towards the responsibilities and obligations paired with adulthood and they are better equipped for achieving educational, occupational and economic success (Nimante & Baranova, 2019).

1. 2. Tackling university dropout in Romania. Case study: ROSE Project

One of the top priorities in the Romanian higher education, especially after Romania joined the European Union, is to ensure equal access to tertiary education for all highschool education. In accord with the Europa 2020 Strategy and the policies and directives established through the Bologna Process, the major educational objectives include

guaranteeing the equality of chances in accessing quality schooling and improving the enrolment in tertiary education for students belonging to certain categories with poor representation (RNOE, 2019). In Romania there is a relatively low degree of interest in university studies, and, consequently, the number of university graduates decreased to 24.6 % in 2018, compared to 26.3 % in 2017, for the age group 30 – 34, measured according to the European reference criteria. These figures are significantly lower than the European Union average (40.7%) as well as the established Romanian national objective of 26.7%, decided through the Europe 2020 Strategy. Student drop-out is a lingering phenomenon due to a combination of factors, among which we can single out social and economic factors as well as imbalances in providing quality education (World Bank, 2015). In the rural areas, where poverty is at its worst and the education quality tends to be the lowest, one in four persons aged between 18 and 24 has left school too early. In contrast, this percentage is 15% in towns and only 4.2 % in cities. (European Commission, 2019).

Romania Secondary Education Project (ROSE), which focuses on reducing school dropout and improving the transition towards higher education through subsidizing highschools with low performance markers, started in 2015, was later on also implemented in universities with the purpose of reducing dropout in the first university year and to improve students' transition onto the job market. One of the project's beneficiaries is the "AlexandruIoanCuza" University in Iassy, and, within this institution, the Faculty of Geography and Geology, where the sub-project GeoDA (*Become a graduate of the Faculty of Geography and Geology in Iassy!*) was implemented starting from October 2017. GeoDA targets all first-year students, focusing on certain priority categories, namely students who: come from socially and economically disadvantaged rural areas or low-income families; suffer from chronic illnesses or disabilities; are orphans (one or both parents) or come from foster homes/ institutional care centres/ orphanages etc.; are of Roma ethnicity; have obtained less than 7 at their admission exam; have graduated from vocational, sports or humanities highschools. GeoDA activities mainly consist in tutoring, guiding and counselling, organizing seminars in order to help students acquire the skills necessary in adjusting to student life.

The article focuses on a multi-layered analysis of quantitative and qualitative indicators that could indicate certain vulnerabilities of students from Geography Department that could make them more prone to abandon their studies during the first year. The purpose was to assess the factors that could affect academic performance and find way to tackle these issues by finding suitable solutions.

2. Data and Methods

Using statistical data gather in the first two university years of GeoDA (2017-2018 and 2018-2019), but also integrating the personal observation of (sub)project's members, as well as other official information obtained from the Statistics Department in the Faculty of Geography and Geology, current approach comprises two different stages as follows:

(1) A descriptive analysis of basic indicators, illustrative for the issue in question, such as dropout rate, students' scores at the end of their first year, the correlation between their baccalaureate grade and their results at the end of the first year;

(2) In order to assess the hypothesis that academic success and the possibility of dropout depend on a series of specific quantitative and qualitative variables, we used the Analysis of Variance method (ANOVA), that employs the principles of linear regression, but unlike the latter, it also includes qualitative variables, simultaneously comparing the mean values of several samples. Explanatory variables are often called factors. If p is the number of factors, the ANOVA model can be written as follows:

$$y_i = \beta_0 + \sum_{j=1}^{p} \beta_{k\,(i,j),j} \quad + \varepsilon_i$$

where y_i is the value observed for the dependent variable for observation i, k(i,j) is the index of the category of factor j for observation i, and ε_i is the error of the model. The dependent variable is continuous and it is the score obtained by students at the end of the first year of studies.

The following independent variables were taken into consideration in order to perform ANOVA analysis:3 quantitative variables -baccalaureate score (*BACC*),the score for the optional subject for baccalaureate (that is geography, in many cases) (*DISC*),final admission grade (*ADMISS*);7 qualitative variables -overall baccalaureate grades lower than/equal to (*BACC≤7*),students coming from low income families(*LOW_INC*),students coming from rural areas (*RURAL*),students suffering from disabilities or chronic diseases (*DISAB*),students coming from single parent households or orphans (SPO),students coming from foster homes, orphanages or other similar social care institutions (*INST*),students graduated from highschool specialized in sports, vocational skills or humanities/philological profile (*SVP*). By applying ANOVA, the analysis converged towards designing a "model for success" which is a weighted sum of the above mentioned indicators.

3. Results and discussions

3.1. ROSE GeoDA outcomes – basic statistics

As far as the dropout in the first year is concerned, in the case of the Faculty of Geography and Geology we can observe (Figure 1a) the fact that in the last years the dropout rate varies around 20%, with a spike in 2014 – 2015 and a tendency to decrease in the last 2 years. In absolute figures, however, the decrease in the number of students leaving school is connected to the decrease in the actual number of students. In its first year of implementation (2017 – 2018), 63 students dropped out (from a total of 310), that means 20.39% of all students enrolled. From the 63 only 13 were members of the target group included in GeoDA (20.63% of all dropout cases). In its second year, 2018 – 2019, 50 students dropped out (from a total of 285), meaning 17.54% of all students enrolled, from which 13 students belonging to the GeoDA target group (26%). The situation improved, in absolute values, but in relatives terms the impact of the program was not as big as expected. The influence of the activities in the GeoDA sub-project is highlighted when we comparatively analyse students' results after each exam session – on the one hand, students who were part of the GeoDA support group, and, on the other hand, students who were not included in these activities (Figure 1b).

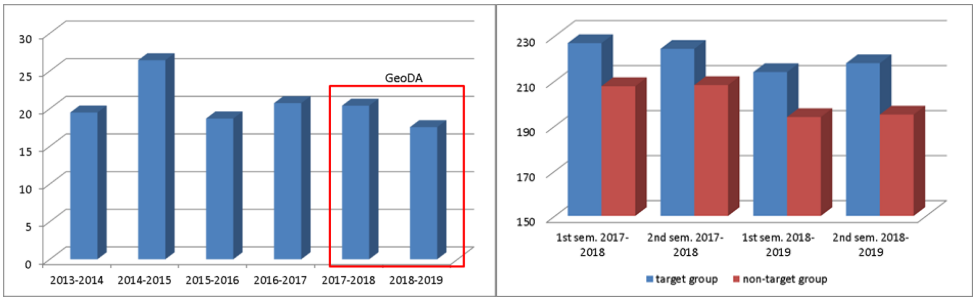

Figure 1. (a, left): Dropout rate (%) after the first year at the Faculty of Geography and Geology, UAIC, Iasi; (b, right): Average scores obtained by first year students, according to whether they were included or not in GeoDA activities (maximum score per semester = 300).

Analysing the data on baccalaureate results and the final score at the end of the first year of high education for the target grout, and taking into account a maximum score of 600, one can notice that there is a relatively strong positive correlation(0.228) (Figure 2*).*

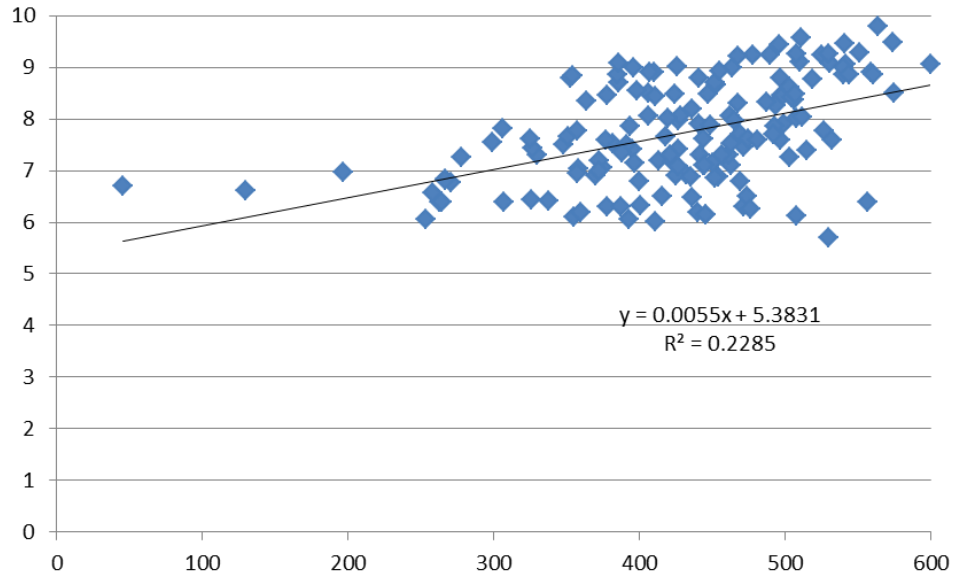

Figure2. Correlation between baccalaureate results - final score at the end of 2018—2019 university year

3.2. ANOVA Analysis

In order to integrate a larger number of both quantitative and qualitative factors, the ANOVA method was applied. Analysing the correlation matrix resulted from ANOVA (Figure 3) one can notice that the good results at the end of the first year of study are not directly influenced by the students' social background, various disabilities, chronic diseases or family issues (single parent families or students who are orphans). Being the resident of rural areas does not seem to be an issues for the lack of academic performance, as, by contrary the students from urban environment perform slightly worse than whose from the countryside. More importance lies in the family income and the type of highschool they graduated. Students with sports, arts or theological background (and, to a lesser extent, those specialised in philology) tend to have poorer results, as a sign that a focus on vocational skills or humanities in highschool may alter students' ability to cope with the requirements of a field of study focusing on (Earth) sciences.

Var_no	Variables	1	2	3	4	5	6	7	8	9	10
1	BACC										
2	DISC	0.75									
3	ADMISS	0.93	0.93								
4	BACC ≤ 7	**-0.77**	-0.66	-0.77							
5	LOW_INC	0.22	0.20	0.23	-0.18						
6	RURAL	0.01	0.09	0.05	-0.14	-0.11					
7	DISAB	-0.06	-0.04	-0.05	0.12	0.04	-0.11				
8	SPO	0.23	0.18	0.22	-0.12	0.84	-0.15	0.05			
9	INST	0.03	-0.03	0.00	0.05	-0.20	0.08	-0.01	-0.17		
10	SPV	0.21	0.16	0.20	-0.11	0.82	-0.14	0.05	0.97	-0.17	
11	total points accumulated after the first year	**0.43**	**0.26**	**0.37**	**-0.41**	-0.01	0.09	-0.02	0.00	-0.06	-0.01

Figure 3. ANalysis Of Variance (ANOVA). Characteristics of target group - correlation matrix.

Nevertheless, the most important factors of the success after the first year of university studies remain the former performance in school (before the admission at the Faculty of Geography and Geology). It is a form of "path dependence" that can be observe in most of the cases: at the end of the first university year the highest scores are made by students that also had high baccalaureate and admission scores, while students with scores under 7 at the baccalaureate are performing the worst in faculty too. However, some students who started the first year with relatively low scores finished it with significantly better ones, a phenomenon explained on two different levels: an individual one (the students improved their motivation, changed their priorities and focused more on academic success) and an institutional one (represented by the effort of the University or remedial programs, such as GeoDA, to provide students with a better study environment and facilitate higher performance). The design of a "model for success" was done based on standardized values of the analysed indicators. Figure 4 illustrate the model of first year academic success. One can notice that prior school performance, expressed as the baccalaureate score, can be a proper indicator of academic success, a low grade potentially pointing towards a certain lack of basic knowledge, which can be difficult to acquire as a university student. The equation of the model (the formula for integrating variables to explain the final score) can be written as following:

SUCC_MOD = 24.04 + 62.95*BACC - 26.51*DISC + 57.06*BACC≤7 + 32.08*LOW_INC - 20.40*RURAL - 52.58*DISAB - 12.75*SPO + 131.89*INST + 20.53*SPV

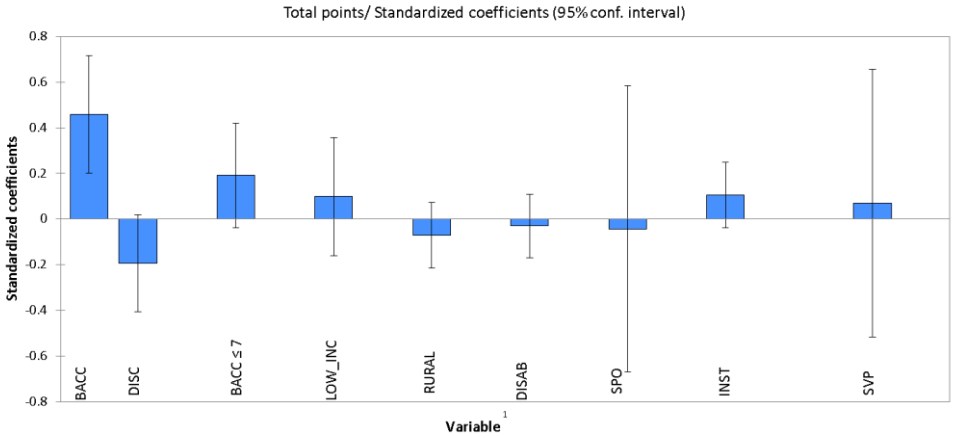

Figure 4. Graphic representation of the weights for the model obtained

4. Conclusions

The degree of student retention can be considered as a key and basic performance indicator for higher education systems. The goal should be to have as many students as possible to progress and successfully complete their studies. In the context of expanding participation in higher education, student retention is also a matter of social justice. Overall, highschool students' adaptation to the rigours of university life is influenced by personal but also academic factors. In many cases, the low quality of education provided by highschools acts as a serious obstacle, preventing students from being academically successful. One can notice certain "path dependence" in the evolution of the academic performance of students. Those who entered at the faculty with high scores tend to also have good results at the end of the first year. Being resident in rural areas does not generally create vulnerabilities for the students in the first year, nor the presence of disabilities. Moreover, living with low income in an urban area is worse than having a low income in a rural area, where people have different opportunities of capitalizing on the subsistence agriculture. Nevertheless, the familial incomes continue to have a high influence as well as knowledge and learning abilities gaps accumulated during highschool, especially for those that follower a vocational secondary education. Guidance and support projects, such use as ROSE, are useful, but they tend to display a certain degree of uniformity, stiffness and administrative incoherence that undermines their efficiency. Tutoring and guiding activities are optional, so students cannot be coerced into participation, the structure of the target group does not match the actual group of students at the risk of dropout.

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Sustainable Practices in research-integrated Education in HE: Towards an accepted Development Pedagogy

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Abstract

Teaching ever so diverse cohorts of students requires educators to keep abreast of their professional learning and to acquire an open mindset towards their practice. With HE policy placing growing emphasis on teaching excellence, questions arise about how to measure teaching quality and about whether or not educators from across the board of disciplines are supported in doing so. How can lecturers devise evidence-based, valid and reliable measures for evaluating the quality of their teaching? The following piece conceptualises the relationship between education research and teaching practice through discussing their sustainable integration. The overarching aim of this study is to discuss the potential for action research to help educators to measure the quality of their teaching to improve students' outcomes and moving from this, to gauge how sustainable such practices can be in a fast-paced HE sector.

Keywords: *higher education; professional development; sustainability; evaluation research; enhancement.*

1. Introduction

In UK Higher Education Institutions (HEIs) the idea of 'teaching excellence' and its interpretation have spurred a growing interest in teaching innovation and enhancement of the student learning experience. The pursuit of teaching excellence has inspired a gradual reconceptualization of the connection between education research and teaching practice. This concept of researching teaching practice has gradually upended the idea that research and teaching a separate spheres of action. Recent scholarship has invoked models underpinned by the ideal of the teacher as 'educational researcher' (MacFarlane and Hughes, 2009, pp.9-10) though the extent to which educators and lecturers in HE engage with this concept remains to be fully determined.

This study inquires about whether or not lecturers at one HE institution have a) changed their behaviours as a result of interrogating their practice and b) developed strategies to monitor, measure and improve the quality of teaching and the student learning experience. The overarching aim of this study is to offer a professional development perspective to the vexed question of whether a scholarly approach to teaching is sustainable as well as desirable, by analysing the complex iteration between education research and teaching practice.

This study is grounded in a longstanding and much researched approach to investigating teaching activity. Building on the principles of action research, (Van Manen, 1997; Walford, 1998; Norton, 2009 and Hoveid et al., 2019), this study develops teaching practitioners to engage with scholarly, evidence-based approaches to education and supports them to explore effective ways to transfer the outcomes into their teaching practice. The following discussion centres on the idea that teaching as research provides a valuable approach to measuring and improving the quality of students' outcomes and the learning experience. Herewith, I problematize the complex interaction of education research and teaching practice and I present practical suggestions for sustaining their integration in the long term.

2. The study: the reflection-mediated method

This study adopts a methodology based on the collection and analysis of qualitative evaluations and is underpinned by reflective practice as exemplified by Norton (2009, pp. 22-24) when arguing that reflective practice is inextricably linked to action research. Looking at engagement with education research through the practice of reflection has the potential to help us to determine whether or not teachers adopt scholarly approaches and what they make of these. Further, analysis of reflective texts provides a glimpse into the perceived outcomes of adopting scholarly practices and, in this way, it help us to gauge the impact this approach yields on learning development. Reflective practice is regarded as a means teachers utilise for making sense of how teaching works in their respective contexts. For this reason, I

maintain that using reflective texts in this study will surface participants' behaviours in relation to the adoption of scholarly approaches to teaching practice.

2.1. Data collection

Evidence was collected from texts produced by a small group of 12 participants in an accredited educator development programme (Postgraduate Certificate in Academic Practice). Albeit this is a small sample of texts, the data collected allow for a preliminary insight into the behaviours of academic staff in making sense of their practice through the adoption of evidence-based methods. Data of this kind are difficult to obtain for the very reason which instigated this study, that the level of engagement with scholarly practices in university education is elusive and fragmented. However limited, this analysis aims to examine a pool of data with the aim to gather a preliminary understanding of the potential impact that utilising scholarly methods to improve teaching practice may have on teachers and students alike, hence the reason for focussing on a small data sample (Tracy, 2010). The production of reflective texts is essential for meeting the requirements of the assessment. Participants/educators are required to reflect on how their teaching has developed during the period of time they spent carrying out a learning enhancement project, a requirement of the programme. The reflection is guided by a brief and written against the learning outcomes (LOs henceforth) tested in the assessment.

Participants are required to write their reflective texts against a set of LOs in order to demonstrate that they achieved these in carrying out their projects. By reflecting on how they have a) applied pedagogical theory, b) underpinned their projects with the analysis of evaluation data and c) reviewed and changed their education design, participants are required to provide reasons for their professional learning.

2.2. Data analysis

Raw data were extracted from anonymised individual submissions and organised into three macro-groups, one for every LO. Data were then further disaggregated and examined by singling out sentences indicating the actions participants took to achieve the LO, especially active verbs indicating action (Biggs, 2011, pp. 120-121). All texts examined were analysed after completion of the programme. Participation in the study did not affect performance assessment and results in the educator programme.

Original reflections were broken up into sentences and parsed for active verbs to highlight the behaviours activated by the LOs: 23 sentences were extracted from the reflective texts (forming a corpus of ca. 9000 words) demonstrating active engagement with the intended outcomes with participants focussing on the action they took in progressing their learning enhancement project. A further step to the analysis was to see whether or not there is an indication that educators changed their behaviours as a result of researching their practice

during the project. Although the sample examined is a small one, approximately 74% of the sentences extracted (n=17/23) for analysis show a cause-effect relation evidencing that application of education research and/or the adoption of evidence-informed approaches had a positive impact on practice. A further 53% of this portion (n=9/17 sentences) contain an indication that analysis of evaluation data justified a change in teaching and learning design.

Did educators translate research into practice? The statements reported above provide an impression of the participants' behaviours in using education research and evaluation data to understand their students' learning. The majority of the actions participants took had a positive impact on their teaching practice and are likely to have instigated change in teaching design which then entailed improvements in their teaching, in teacher-student relationships or in decision-making processes.

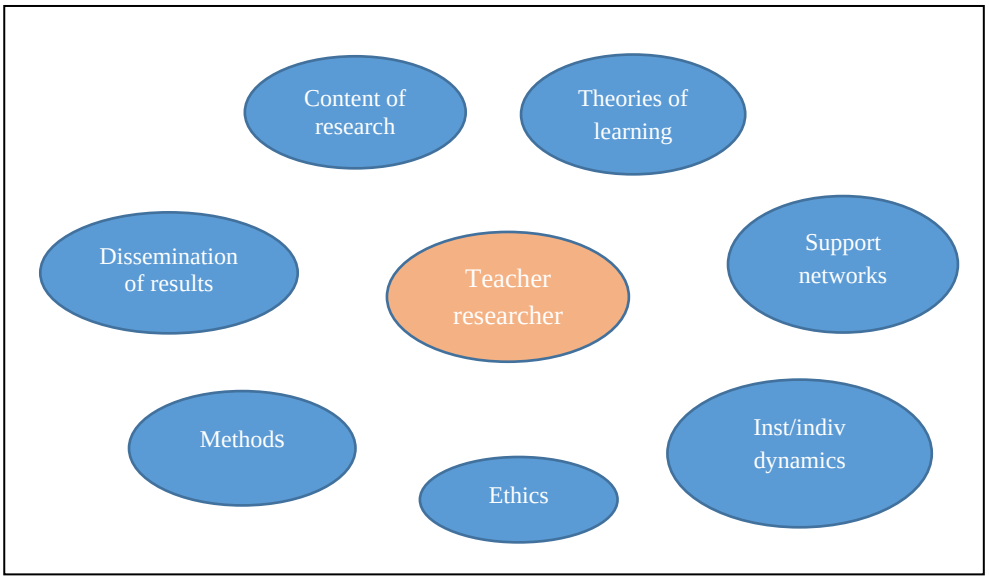
3. Transferring research into practice: the implications

Amongst the benefits of this study, four stand out which could potentially have an impact on the quality of teaching and learning. Data show that academics who engaged with education research a) developed an ability to transfer research outcomes to practice; b) used the data to make sense of their teaching; c) could replicate and implement the mechanisms across their practice and d) were able to support positive change and innovation with measurable benefits for their students.

3.1. Levels of support model

This study underpins the development of a model of support based on models developed by Evans (2017) and Paseka et al. (2019) in support of school teachers and emerging education researchers, respectively. In line with the studies mentioned above, the main problem about adopting scholarly practices in teaching is their sustainability. Similarly, a second area of concern is teachers' ability to make decisions and to take risks in teaching practice. Areas in which support could be provided to sustain the development of teacher-researchers are shown in the diagram below:

Table 1. Areas of academic development



The model represents visually the context in which teacher-researchers operate. At the centre of a complex picture, the teacher-researcher is required to navigate an environment riddled with hurdles, often under the many pressures deriving from an ever growing diversification of the roles an academic is required to cover. Providing support in these areas in order to avoid disengagement seems therefore worth reflecting on. Creating support networks, protecting spaces for experimenting with new methods could potentially create a support structure for engaging educators with education research, providing them with the space where they can evaluate the quality of their teaching, innovate and develop their practice.

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Beyond Degree Programs: How a Major University Immersed Itself in the Educational Landscape of New York City

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Abstract

In 2006 the Center for Educational Partnerships was established as the "outreach arm" of Fordham University's Graduate School of Education. In so doing, Fordham reimagined the role of higher education to go beyond degree granting programs, faculty expertise and research opportunities. In this paper, we describe how what began in 2006 as a vision to strengthen the presence of the Graduate School of Education in New York City public schools has grown into a thriving Center that touches the lives of more than 500,000 students in grades Pre-K to 12, thousands of teachers, and hundreds of administrators and parents throughout New York City.

We outline how each phase of Fordham's involvement and work developed during New York City's major educational reform agenda, resulting from the New York State Legislature's granting the City's mayor control of New York City's 1,500 public schools in 2002.

Keywords: *higher education; education reform; N.Y.C. Public Schools; partnerships.*

1. Introduction

In 2006, the Center for Educational Partnerships (CEP) was established as the "outreach arm" of Fordham University's Graduate School of Education (GSE). In so doing, Fordham reimagined the role of higher education to go beyond degree granting programs and certification tracks. By establishing technical assistance centers, and becoming a Partnership Support Organization, and subsequently a Community School partner, the CEP immersed itself in new models and initiatives to service public and non-public schools throughout NYC.

Both the New York City Department of Education (NYCDOE) and the New York State Education Department (NYSED) have always initiated programs and services for which eligible organizations—profit and non-profit, institutions of higher education (IHE), Community Based Organizations (CBO)—can submit proposals for funding. Most IHEs respond to expand the programs and partnerships they normally provide; namely, degree programs, faculty expertise, research opportunities, student teachers, and leadership interns.

In this paper, we describe the establishment and mission of the CEP which is enabling Fordham University's Graduate School of Education to advance beyond traditional programs and services. Section 2 describes the establishment of the CEP. The remaining sections of this paper are as follows: section 3 covers the early stages of Fordham's transition; sections 4 and 5 describe how Fordham through the CEP immersed itself in the educational landscape of New York City. Section 6 concludes the paper with a summary and discussion of further work in the future.

2. The Center for Educational Partnerships

What began as a vision in 2006 to strengthen the presence of the GSE in New York City public schools has grown into a thriving Center that touches the lives of more than 500,000 students in grades Pre-K to 12 (ages 3-18), thousands of teachers, hundreds of administrators and parents throughout New York City and the greater metropolitan area: with programs servicing both public and non-public schools.

The Center is not a think tank. At the heart of its mission since it was established in January 2006 by James J. Hennessy, Ph.D., now Dean Emeritus of the Fordham Graduate School of Education and Anita Vazquez Batisti, Ph.D., Associate Dean for Partnerships, is action and collaboration. The Center is research based and outcome oriented; with the goal of bringing critical resources and expertise to bear on services to those student populations most at-risk of academic failure.

A hallmark of the Center for Educational Partnerships is its community of professionals. Not only does our intellectual community involve faculty, but also practitioners and graduate students. We bring to bear a rich array of resources to each project, tailoring our approach to

the specific circumstances, unique challenges, and opportunities that exist. Current GSE Dean, Virginia Roach, Ed.D., states "Jesuit education is steeped in the notion of *cura personalis*, or care for the entire person as an individual endowed with particular gifts and insights." So too is our work.

3. Phase One—Transition

The New York City public school system is the largest in the United States, consisting of 1.1 million Pre-K to 12 grade students and 1,800 schools with a budget of over $34 billion. The need for instructional support in the form of professional development for current teachers is and has always been of importance.

3.1. Professional Development

"Not every teacher has the opportunity to go to Fordham, but all teachers can have Fordham come to them." In 2006, the Center began working on a daily basis in numerous schools throughout the city, providing on-site in-classroom coaching for teachers in support of mathematics and literacy instruction. Fordham coaches model, demonstrate, and team teach using the reflective practitioner approach. Fordham coaches are highly experienced active practitioners guided by research based best practices as part of our faculty input.

3.2. Technical Assistance

Also in 2006, Fordham's Graduate School of Education through the Center for Educational Partnerships was awarded a major contract from the New York State Education Department (NYSED) to establish a **Bilingual Education Technical Assistance Center** (BETAC) to serve all 326 New York City Schools in the Bronx. The success of this initiative paved the way in 2011 for a subsequent award from NYSED to establish the **NYC Regional Bilingual Education Resource Network** (RBERN), serving all of New York City. As the linear successor to Fordham's five-year BETAC, the new RBERN provides technical assistance and professional development to NYCDOE schools, which have large concentrations of students and parents who are English Language Learners (ELLs) with a focus on low achieving schools. Fordham's RBERN works in cooperation with NYCDOE's Office of Multilingual Learners providing services for the 149,000 English Language Learners throughout New York City's public schools.

During this period, Fordham also established a **Bilingual School Psychology Support Center**. Fordham teamed with the New York City Department of Education to recruit, train, and retain Bilingual School Psychologists city-wide. The Bilingual School Psychology Support Center was funded by the New York State Department of Education and served as an information clearinghouse for both aspiring school psychologists and those currently working in NYC schools. A hallmark of this project was its intercollegiate collaboration.

4. Phase Two—Further Transition and Involvement

4.1. Background

In May 2002, New York State under Assembly bill A11627 and Senate bill S07456B, granted Mayoral control to Mayor Michael Bloomberg. "After 32 years of governance by a seven-member appointed Board of Education in conjunction with 32 locally elected boards, the system came under the aegis of the city's mayor, who established the DOE in 2000 and had the power to appoint the chancellor and other key personnel." (Childress & Clayton, 2008). In October 2002, about nine months after Bloomberg took office, he and schools Chancellor Joel Klein unveiled "Children First: A New Agenda for Public Education" (Hill, 2013).

The Center for Educational Partnerships was established during the Mayor's second term; however the opportunity to be part of the further re-organization of the NYCDOE and expansion of the School Chancellor's reform agenda which sought and invited private entities to become a **Partnership Support Organization** (PSO), happened in 2007.

NYCDOE issued a Request for Proposals in 2007, stating: "Partnership School Support refers to the provision of a set of services to support principals, school leadership teams and school staff in improving student performance and achieving school level accountability goals, as described in Section 3 of this RFP. The Partnership School Support model described herein is designed to promote student achievement by providing the NYCDOE and school leaders with access to alternative models for support in coordination and collaboration with a Children First Network. It will also allow the NYCDOE to infuse greater accountability into relationships with external organizations that provide support to schools with the expectation that this will, in turn, result in improved support to schools and improved student performance." NYCDOE defines partners as "individuals and organizations who enter collaborative relationships with schools and school districts" (Scott and DiMartino, 2009).

4.2. Next Steps in Transition

Fordham through the CEP was ready for the next step in its transition. Through a competitive proposal application process, Fordham was one of seven organizations chosen as a PSO and the only private university. In the first year we began with a network of 10 (Pre-K to 12) grade schools; the following year 16 schools; then 24 schools; then to 35 schools serving 19,000 Pre-K to grade 12 students throughout New York City.

The mission of the Fordham PSO collaboration with New York City schools was to help teachers and administrators drive academic achievement through a process of reflection, self-analysis, and the integration of perspectives gained from research into school-wide and classroom practice. The goal was to move each school toward the tipping point at which its culture became one of accountability and accomplishment.

The Fordham team focused on keeping their network of schools prepared to meet the challenge of an evolving system by providing operational, instructional, and leadership supports that maximized academic achievement, built teacher capacity, and created environments that best served all constituents.

4.3. Results Obtained

As a result of the PSO, Fordham's partner schools demonstrated the following:

- **Growth and sustainability** (growth from 10 schools in 2007 to 35 schools in 2012)
- **Principals' Satisfaction Survey** resulted in 100% satisfaction with Fordham in all categories, well above the city average. Categories included utilizing resources, facilitation of community, best practice sharing among the network principals, crisis management, instruction, operations, and communications.
- **Academic Achievement** – Fordham accepted partnerships with schools applying differing instructional philosophies and provided tailor-made support to maximize student achievement. The following chart highlights the successes of a cross section of students from vastly different socio-economic districts and widely disparate student populations.

Table 2. Fordham PSO Elementary and Middle Schools Academic Achievement.

Joined	ATS DBN	School Name	Grades Served	2010 Prog Report	2011 Prog Report	2012 Prog Report
2009	05M129	PS 129 John H Finley	pK-8	B	C	B
2010	05M194	PS 194 Countee Cullen	pK-5	C	D	B
2009	06M004	PS 004 Duke Ellington	pK-5	B	B	B
2007	06M325	PS 325	K-5	C	C	B
2010	07X005	PS 005 Port Morris	K-5	C	B	B
2009	11X096	PS 096 Richard Rodgers	K-5	B	B	B
2010	16K335	PS 335 Grantville T Woods	K-5	B	A	A
2007	25Q209	PS 209 Clearview Gardens	pK-5	A	A	A
2007	09X117	Joseph H Wade	6-8	B	C	B
2010	09X454	Mott Hall S&T	6-8	-	A	A
2010	09X454	Mott Hall S&T	6-8	-	A	A

Source: CEP Internal Documents (2016).

Table 2. Fordham PSO High Schools Academic Achievement.

Joined	ATS DBN	School Name	Grades Served	2010 Report	2011 Report	2012 Report
2009	10X342	ISLA HS	HS	B	C	B
2009	10X549	Discovery HS	HS	A	A	A
2007	11X513	New World HS	HS	A	B	A

Source: CEP Internal Documents (2016).

High School Graduation Data

Four out of six of our High Schools exceeded the citywide four year graduation rate of 61% as of June 2011, as posted on the NYCDOE website. Additionally, five out of six schools increased graduation rates in the 2012 school year.

5. Phase Three - Full Immersion

5.1. Background

In 2014, newly elected mayor Bill de Blasio restored the power of the 32 District Superintendents and eliminated the NYCDOE networks and the private sector networks PSOs which included Fordham's network. De Blasio then unveiled a Strategic Plan implementing the Community Schools Model to address the needs of NYC's at risk schools.

5.2. Programs and Initiatives

Partnerships with Community Schools. In 2015, "Mayor de Blasio announced that the Community Schools model would be central to the City's ambitious efforts to support 94 Renewal Schools (schools identified as Priority or Focus schools by the State, demonstrated low academic achievement for each of the three prior years)" (Retrieved from https://sites.google.com/mynycschool.org/newyorkcitycommunityschools/home/about). As a result of Mayor de Blasio's paradigm shift in school improvement, the CEP refocused its efforts to partner with New York City public schools. Identifying two schools in the Bronx, P.S. 85 and M.S. 331, the CEP shifted its focus to delve deeper into the work of these struggling school communities. The efforts are driven by CEP staffing (community school directors, extended learning time coordinators, mental health providers, and educational specialists), all meeting the needs of the over 1,500 students in the two schools.

Community Schools Technical Assistance Center (CSTAC). In 2017, in response to the growing community schools movement, the NYSED announced its plan to establish regional

Technical Assistance Centers to support schools and school districts. The responsibilities of the TACs include statewide dissemination of information on effective and promising practices in the establishment and ongoing management of Community School strategies through professional development and technical assistance activities (Retrieved from http://www.nysed.gov/budget-coordination/community-school-regional-technical-assist-ance-centers). The CEP viewed this as an opportunity to expand its reach of support and capacity building to all existing and aspiring community schools within New York City. When awarded in 2018, Fordham established the CSTAC and immediately provided professional development targeted at the full-service community school model, conducted site visits to schools throughout NYC, and expanded its services to include building communities of practice, providing resource referrals for social and other ancillary services, and conducting webinars for the first time as a means of virtual training.

Professional Development Resource Center (PDRC) for Religious and Independent Schools. In 2019, as a result of significant advocacy efforts by the religious and independent schools in New York State, the NYSED posted a request for proposals for organizations to serve the schools with professional development. The CEP, with a track record of successful professional development in religious schools in New York City, responded to the State with a comprehensive and culturally-sensitive plan for services. The CEP was successful in its application and was awarded the PDRC for all 800+ Independent and Religious Schools throughout New York City. The PDRC is in the midst of start-up activities including the creation of a needs assessment and preliminary planning for a variety of professional development work including large-scale institutes, webinars, online communities of practice, and in-person workshops.

6. Conclusion

As noted by Wilson (2012), a vision to contribute in meaningful ways to improve New York City's public schools, coupled with faculty and graduate students' desire to work with schools in underserved neighborhoods fueled Fordham's outreach to New York City schools. The establishment of Fordham's Center for Educational Partnerships at the Graduate School of Education propelled Fordham's immersion in the educational landscape of New York City public schools and in so doing, transformed the university's relationship with the system.

"The projects at the Center for Educational Partnerships allow us to deepen our involvement with schools because the work isn't at the theoretical level. We are in those buildings working with teachers and administrators to help improve student learning." James J. Hennessy, Ph.D., Dean Emeritus, Graduate School of Education (2008). Immersing itself in the educational landscape of New York City was in keeping with the University's mission. "This is what Fordham is about: teaching teachers and helping them set hearts on fire in their

students, so that a greater city and a greater nation can be built." Joseph M. McShane, S.J. President of Fordham University (2007).

6.1. Summary

The programs and initiatives we have implemented in numerous schools throughout NYC have enabled students to reach higher levels of academic achievement, teachers and administrators to grow professionally, parents to become more knowledgeable and involved, and greater resources and services to be part of each school community. This assertion is evidenced by annual State criterion-referenced assessments in English Language Arts and Math, bilingual students' English proficiency, annual program evaluations and satisfaction surveys received from teachers, administrators, and parents. The work we are doing benefits our faculty and graduate students as well; namely in the areas of research, and doctoral work, increased field experiences, as well as tutoring and mentoring opportunities. "It's such a positive development for universities to become more interested in the needs of the schools and it's making the university a more well-rounded place as well." Dennis Walcott, Chancellor NYCDOE, "Inside Fordham" – Winter 2012

6.2. Future Work

The Center for Educational Partnerships at GSE, with support from GSE Dean Virginia Roach, has begun, and will continue, working with other Fordham University graduate schools to expand services. This includes enabling Fordham's Schools of Arts and Sciences, Social Service, Law, and Business to work directly in schools as part of joint collaborations with the CEP. We have also begun working with national and international organizations like Ashoka, who in 2015 invited CEP to be part of its Inaugural Education Track.

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Did the Bologna Process contribute to improving international students' success rates in Germany's HEIs?

Twenty years of success rates in Germany: how the Bologna Process impacts on the success rates of International and German students – the case of Germany's bachelor and diplom mechanical engineers

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Abstract

Low success rates are a thorn in the side of any Higher Education Institute (HEI). With increasing aspirations of attracting international students to Germany (HRK 2020), the international students' success rates are worthy of a review. For it reflects on how internationalisation processes, such as the Bologna Process, impact on success rates and whether the changing structures attract international students. We used the German administrative data, covering twenty years, to create this cross-cohort analysis of student success rates. By creating a common finishing point-in-time, the combined success rates of diplom and bachelor students in mechanical engineering show that the synchronised success rates for the increasing number of international students are not just comparable, but better than those of the German students.

Keywords: *International students - success rates - Bologna Process.*

1. Introduction

Reforming the higher education system in accordance with international processes such as the Bologna Process (BP) in 48 countries (EHEA, 2020) is no easy task. The success of the process depends upon how we define success, how high or low we set the bar, and what aspects of the BP we are considering. The success of the reform in Germany's higher education is at least two-fold. We can argue that the BP as a form of internationalisation of higher education within the global market (Wit, 2011) has been a success, where internationalisation includes the structural transformation, for example, Germany replacing its diplom[1] with the bachelor degree programmes. This transformation also incorporated a mechanism to reduce study time. This was a success because it reduced the 'regular'[2] study time from 10 semesters in a university or technical university diplom programme to a six/seven-semester[3] bachelor depending on the location, institution, field of study etc. Second, through the introduction of the bachelor programmes, the signatories achieved "mutual recognition" (EHEA, 2020) of higher education qualifications. This facilitates mobility and migration of not just international students, but also potential labour (King & Raghuram, 2012). However, understanding internationalisation is not without its criticisms, (Wit, 2011) for the demanding strictures need to include the approaches of HEIs and their environments (Knight, 2008). Thus, all the more reason to review two decades of success rates of those international students that choose to migrate to study in Germany's HEIs as a part of the process of internationalisation.

Analysing the international students' success rates in comparison to the Germans students' success rates is important also because we see how the political intervention (Lith, 2005) changed the space of German higher education for both German and international students. By reviewing this growing population, the comparable success rates can teach us about the strengths and weaknesses of processes, programmes, and approaches. Thereby portraying the impact of policies, and the overarching reach that the HEIs programmes have.

The migratory movement of the international students tells us about the socio-economy and the push and pull factors of sending and receiving countries (Grözinger 2011). Their success rates also demand that we consider the theoretical understandings of path dependency (Perkins & Neumayer, 2014). Thus, this paper will identify the comparable success rates of the international and nationally educated students, revealing both comparisons and differences. Comparable results amongst the international and German students imply

[1] Prior to the Bologna Process, instead of the bachelor, the universities and technical universities provided a five-year diplom, and universities of applied sciences awarded the four-year "Diplom FH".

[2] Regular refers to the given time but not the taken time.

[3] The BSc programmes in Mechanical Engineering are six- or seven- semester duration, there may be exceptions with a longer regular study time, and sometimes the study duration changes.

equality of opportunity is functioning. However, identifiable differences based on citizenship imply that the Bologna Process is not having the desired effect.

2. Literature reviewed

Being an attractive location for international students has many advantages, for both HEI, student and environment alike. The United States is often considered an esteemed location for international students (Cantwell, 2015). Despite the US's claim as "leading destination" (Thomas & Inkpen, 2017, S. 791) for international students this recognition is not exclusive to the US. Australia, too, recognises the added value that the international students make to their environment whilst in Australia because they contribute to the domestically educated in Australia and to much more through the daily living expenses that support local economies (Mazzarol, 1998).

The importance of international students per se on a societal level is such that the World Bank analyses areas of research worth considering, also because of the unknown potentials of international students and the complexities of their presence in contemporary society from a fiscal and migratory perspective (Chellaraj, 2019). Migration, both push/pull (Grözinger 2011, King 2011, Massey et al 2005) have been researched from different perspectives of how push / pull in part explains the international students, and the variety of migration theories that evolved (Massey, et al., 2005). The impact of the sending countries' demographical development, and how their younger cohorts are developing, was identified as a contributory explanation to understanding where and why certain nationalities are likely to continue sending students, and also that the countries growing GDP relative to growth in younger cohorts could reduce the outbound student migration (Thomas & Inkpen, 2017).

Various definitions contribute to various understandings and the methods taken to analyse whether we are talking about student dropout, retention, graduation or success rates (Wolf-Wendel, Ward, & Kinzie, 2009). For example, in Germany, low success rates in bachelor degrees begs the question why are the rates low. Studies have shown the success rates in mechanical engineering are improving (Heublein, Richter, & Schmelzer, 2014) and variable (Klöpping, et al., 2017). The acatech Study on success rates focused on a group including universities and technical universities, their sample of HEIs amounted to a group that accounts for almost 75% of STEM students and their analysis which showed the variability of discontinued courses initially used internal data (Klöpping, et al., 2017). Therefore, the continually ongoing internationalisation process reinforces the need to constantly review the structural and spatial impact of these processes on the HEIs.

3. Methods

This analysis of student success rates uses Germany's administrative data. Each of Germany's 16 federal states has its own ministry for education. Since 1995, all student and examination data are electronically recorded according to a master questionnaire. Each winter registration includes all students registered, with their respective semester in their respective course and HEI[4], thus each case is a registration. The examination data includes the final examination with the grade of that exam for each HEI, therefore exam data are cases of final exams.

We used all student registrations from 1995 up to 2015 and all examinations from 1996 up to 2015 (at the time of writing)[5]. Each HEI delivers its data to the German research centre (FDZ)[6]. There are various data centres in Germany, each one is responsible for a different field. The centre responsible for Higher Education is in Munich, therefore all data are stored in Munich and then released to the data centre where we request to work[7]. In the research centre, we analyse the datasets, and there is one dataset per semester for both students and examinations. The student datasets for one winter semester contain anywhere between 1,7 and 2,9 million registrations in Germany. Because of the data protection laws and because of the sheer size and limited capacities of the working stations we worked with smaller datasets[8].

The datasets (student and exam) include the year of reporting, federal state, HEI, the numbers of semesters in total in Germany, the number of semesters for this particular programme, the year of birth, the month of birth, gender, type of matriculation qualification (MQ), year of right to matriculation, place of matriculation[9]. The examination data contains the final grade, year and month of the exam, as is the programme examined included. Both student and exam datasets inclusion of place of matriculation and students' citizenship mean that we could create a dummy variable with four categories identifying if the student is German with a German right to matriculate (GG); non-German with a German right to matriculation (FG); German with a non-German right to matriculation (GF) or the fourth group which is foreign with a foreign right to matriculation (FF). This separation allows for a comparison between the German students (GG) and the internationals (FF) and a differentiation between the foreign residents (FG) and the international students (FF) (McGrory, 2020)[10]. However, it

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4 A change in laws in 2017 means that summer registrations will also be recorded https://www.destatis.de/DE/Methoden/Rechtsgrundlagen/Statistikbereiche/Inhalte/505_HStatG.pdf?__blob=publicationFile

5 The project began in 2017, therefore the initial purchase was for data up to the winter semester of 2015, since then more recent data (exam & student) have become available and will be leased in order to update our results https://www.forschungsdatenzentrum.de/de/bildung/pruefungen https://www.forschungsdatenzentrum.de/de/bildung/studenten

6 Forschungsdatenzentrum.

7 Kiel provides two working stations where we were allowed to work.

8 We used all cases, this was reduced to the fulfillment criteria explained in the methods section, see also Bandorski et al 2019.

9 Place of matriculation if in Germany is town or district, if not in Germany then the country code is recorded.

10 This work is part of ongoing research, and also in part of published work (McGrory, 2020)

must be taken into consideration that both the student and examination data record only one citizenship. Once neutralisation occurs in Germany, German citizenship will primarily be recorded.

A cross-cohort analysis provided a reliable method (Bandoski et al, 2019). The sample was based on those full-time students majoring only in the field of mechanical engineering with presence-based courses for the six-semester bachelor and the 10-semester diplom, and these formed the synthetic variable. This cohort merges the diplom and bachelor so their completion according to the regular study time is the common point, the respective starting point is the winter semester either six or 10 semesters prior to the common point in time of the examination. However, we extended the finishing time for our synthetic variable so that the completed time includes a total of four extra semesters. All the success rates in table one are based on the 14 semesters for the diplom or 10 semesters for the bachelor to create a total study time (McGrory, 2020). We researched the duration of the respective programmes because many bachelor programmes in mechanical engineering have six or seven semesters for their regular study time. The sample HEIs provided are from what is also known as the TU9 group (Klöpping, et al., 2017). Although the *acatech Studie* did not reveal the results per HEI's name, they listed the HEIs that were included.

To date, in our datasets we have 13 cohorts, beginning with the winter semester diplom in 1995/96, and the bachelor winter semester in 1997/98. Each cohort starts at two different points in time, point one for the diplom and two years later for the bachelor. This method is continued and is carried out throughout for all 13 cohorts, with the final cohort beginning in the winter semester of 2007/08 for the diplom and 2009/10 for the bachelor. By analysing the six-semester degree programmes according to the acatech study (Klöpping, et al., 2017) our sample includes the following HEIs: TU Darmstadt, TU Braunschweig, FAU Nürnberg-Erlangen, LU Hannover, KIT, TU München, Universität Stuttgart. We grouped the HEIs because the numbers would otherwise be too small for release, but it shows that this method can be further applied to identify individual HEIs' success rates (Bandorski et al, 2019).

4. Result

Table one has the absolute (abs) numbers of students starting in the synthetic cohort. The first cohort (c1) shows the absolute number of students starting in the diplom in 1995/96, were no bachelor starters for these HEIs in 1997/1998. It shows the percentage of students who completed their degree in the total study time. The synthetic success rates are for the diplom and bachelor as described in the methods section, the numbers of starters in the bachelor increases over time. The success rates in the synthetic variable are based on a total of 14 semesters for the diplom or the 10 semesters for the bachelor. What we do see is that, overall, the synthetic variable (in the earlier years just the diplom) shows that the international

students present better success rates than their German colleagues throughout the table. The smaller FF group is smaller throughout all cohorts. With 48% success rates for the international students in comparison to the 40% for the national students in C1, the international students' success rates are better than the rates produced by the German group. The low success rates for the FG students is very disconcerting, where their success rates are 24%. If we look at the bachelor success rates and then the respective (cohort) success rates for the synthetic variable a different picture emerges.

Table 1. Cohort 1,3,5,7,9,11,12 & 13 – Synthethic beginners and Synthetic and Bachelor success rates in the total study time (Source: FDZ, own calculations; McGrory, 2020).

Cohorts Dip/Bachelor	Group	Synth. Cohort - 1st Sem	Syn Cohort % Passed	BSc % Passed
1995/97 – c1	GG	1251	40,0	
1995/97	FG	74	24,3	
1995/97	FF	151	47,7	
1997/99 – c3	GG	1578	39,3	
1997/99	FG	89	18,0	
1997/99	FF	120	90,0	53,3
1999/01 – c5	GG	1759	47,1	
1999/01	FG	89	31,5	
1999/01	FF	185	67,0	54,5
2001/03 – c7	GG	2429	37,8	44,4
2001/03	FG	98	21,4	
2001/03	FF	357	47,6	16,0
2003/05 – c9	GG	3581	32,5	16,4
2003/05	FG	166	19,9	10,9
2003/05	FF	393	37,4	8,0
2005/07 – c11	GG	4241	40,4	33,2
2005/07	FG	168	27,4	28,6
2005/07	FF	301	54,2	22,2
2006/08 – c12	GG	6493	48,7	47,4
2006/08	FG	270	28,5	31,7
2006/08	FF	333	57,1	32,1
2007/09 – c13	GG	6818	55,6	55,8
2007/09	FG	325	33,2	31,7
2007/09	FF	357	64,1	36,2

The success rates with the synthetic variable imply that the international students (FF) have comparable success rates to the German students (GG). For example in c13, the success rates for FF students in the synthetic variable are 64% in comparison to the GG students with 56%, however, if we take a look at the respective bachelor success rates of 36% for the FFs in comparison to 56% for the GG students, then the picture tells us that bachelor success rates for the GG students are far better than the FF students. But here the success rates for the diplom[11] must be better for the FFs than the GG students[12]. I assume that the FF students begin in the bachelor and switch to the more "German" diplom. The synthetic variable also clearly shows the miserable success rates for the FG group- and not just in one cohort but consistently throughout the table. This groups' success rates in the bachelor from C11-C13 is comparable in both the synthetic and bachelor programmes, which possibly means there is little movement from one programme to the other, and from C9-C11 their results in the bachelor rates are better than those of the FF students but worse than their GG colleagues. Equality of opportunity should imply that there is no real difference in the results amongst any of the groups regardless of where they received their right to matriculation.

5. Conclusion

The international students in Germany's bachelor and diplom mechanical engineering degrees were both used to assess the success rates in the given HEIs which were universities and technical universities over twenty years. This took into account the Bologna Process and its' transition period from diplom to bachelor. The results of the synthetic variable showed that the success rates were better for international students than their German colleagues. However, the success rates for the bachelor alone (a Bologna Process product) are comparably low, but the synchronised variable which includes the diplom are higher. This implies that the given sample showed that the diplom remained attractive to international students. It is questionable if the political pressure to create "mutual recognition" (HRK, 2020) meets the aspirations of the students. It also emerged, through differentiating the FG students from the FF students, that the FG students have the lowest success rates in the synthetic variable according to this cross-cohort analysis with the administrative data in Germany. If higher education is supposed to deliver equality of opportunity, then realistically we need to continually pose the question: are our HEIs providing for equality of opportunity?

11 If however, the international students enter into the bachelor and switch to the diplom, it would imply that a) the international students were attracted to the diplom b) the question remains unanwered but worth posing as to whether the diplom is considered the key to employment in Germany or c) the German diplom was desired by the sending country or d) is the diplom considered an important step towards integration into Germany – linguistically, culturally, socially and economically.

12 Further analysis will be carried out statistical testing, –at the time of writing accessing the data centre is prohibited due to the Corona Virus, see also M'Grory 2020

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Entrepreneurship and University Spin-offs for (Academic) Employment?

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Abstract

In the new Millennium Italian universities have lived many changes deeply reshaping academic institutions. A relevant aspect was the more and more significant need to answer the demand of society and respond the social pressure to accountability through the transfer of knowledge, innovation and technology to economy. It led to an extension of the so-called university Fourth Mission, an instrument dedicated to create spin-offs to share scientific research results with society. The paper investigates the present reality of university spin-offs in Italy by considering their growing number also in the light of their role of an instrument for academic job substitution. In particular, a tool to respond to the current condition of young Italian academic researchers increasingly affected by job offer reduction due to budget constraints, consequent university policies and new management issues.

Keywords: *Entrepreneurship; University Spin-offs; Academic jobs.*

1. Introduction

Over the last few years universities have increasingly become aware of new demands from the economy (use of knowledge products) and society as a whole (extension of education level, needs for social mobility). This is an important root of the spin-offs' developing process, which is also related to the extended competition of academic institutions in a globalized world, confirmed by the exponential spread of MOOC (Massive Open Online Courses) and intensified diffusion of lifelong and recurrent university training. New aspects creating the conditions for a move from mass university to universal access to higher education (Trow 1973; 1999; 2006). The spread of these demands in the academic sphere meant a pulse for universities to better open to society in order to catch the needs of different social groups of users and to develop stronger ties with society as a whole. This active role implied a deep transformation of the identity of universities as institutions able at the same time to dialogue with society and to avoid to be overwhelmed by the contractual power of their interlocutors. A need also related to the present epistemologic feature of knowledge and to the changing modes of its production. Knowledge is a combination of explicit and tacit aspects were the transfer of results cannot leave aside users nor producers (Polanyi, 1966). As it is well known, knowledge production passed from the traditional "linear process" (basic research - applied research and innovation - innovation - engineering) to an 'iterative and interactive' mode where there is a continuous mix between producers and users (from *Mode 1* to *Mode 2*, as defined by Gibbons et al. 1994; see also Etzkowitz and Leydesdorff 1997; Nowotny et al. 2001). In some cases these transformations found universities inadequate or insufficiently prepared. Insufficiencies and shortcomings in the physical and pedagogical curricular as well as in the organizational and government structures have highlighted the increasing inadequacy of the quality of training and research products and overall of their organization in order to satisfy societal demands. This, in turn, has made urgent the problem of closer ties with the economic world seen as a potential source of resources and of orientating demand. At the same time, despite difficulties and inadequacies, higher education institutions remain key players, though no longer monopolistic, in the production, transfer and dissemination of knowledge and maintain a meaningful role for the social process of knowledge production. Academic institutions can act in knowledge creation and dissemination through a variety of mechanisms including contract work and collaborative research (Gunasekara 2006). This is the framework in which we see an increasing expansion of the set of activities that we call *Third Mission*, implying that they do not cover neither education nor research traditionally developed in the academic sphere. Here we refer to the generation, transmission, application, and safeguard of knowledge for the direct benefit of actors and groups outside the core academic bodies. These activities include different forms of knowledge transfer and encompass also the provision of lifelong learning and initiatives of social or civic

engagement of the university. Being presently considered fundamental co-actors in the knowledge transfer process, to the productive sector and service (McQueen and Wallmark 1982; Chiesa and Piccaluga 2000; Benneworth and Charles 2004; D'Este, Mahdi and Neely 2009), academic institutions do not cover anymore this role only by granting patents to outsiders, but are more dedicated to promotion, creation and support of new enterprises for the economic and social exploitation of scientific research results, an aspect considered the *Fourth Mission* of universities (Geiger 2006; Kretz e Sá 2013). Academic institutions have also the opportunity to turn into instruments of growth closely linked with innovation-driven regional development processes. Although not recent (it has been already reported by "classical" fellows, e.g. Clark 1998; Etzkowitz and Leydesdroff 2000; Clarysse and Moray 2004) only in the last years the phenomenon of university spin-offs has become a "popular" target of interest among higher education researchers. Moreover, in Europe the attention to this growing form of exploitation of scientific research results has been focused not only at regional policy level – spin-offs are a major mechanism in the relationships between universities and business, as well in the creation of jobs and wealth – but also at the level of the re-organization of academic structures, which aim at a maximum impact of the results of university research (European Trend Chart on Innovation 2002; Degroof and Roberts 2004; Laredo 2007; Algieri et al. 2011). Based on a field research carried out in the years 2016 – 2018, including more than forty qualitative interviews in five academic institutions, the present paper focuses on the spin-offs as substitute opportunity of research jobs for young researchers who cannot anymore be absorbed by the Academia.

2. University Spin-offs in Italy

University spin-offs are presently one of the typical themes involved in the debate on the country's ability to value the innovative capabilities of own economic system. In the Italian case, the media and the specialized publications seem to offer a partial, uninformed and sometimes distorted image of the phenomenon (Piccarozzi et al. 2013; Rahim et al. 2014). Moreover, they almost never link spin-offs with the transformations of the university system and the academic institutions. For this reason, it seemed necessary to undertake a deepening of an issue lacking of *qualitative* information on the relationship university spin-offs/academic institutions, although statistically studied in some important reports (Netval 2005-2018; Anvur 2013; 2014; 2016; 2017). These insights allowed us to try to come out of a purely statistical dimension and to investigate specific subjects, stories and dynamics.

The research started from a preliminary phase of synthesis, filing and disciplining of the numerous and disparate definitions of academic spin-offs, which are progressively elaborated by researchers in the various studies on this subject. The analysis of literature reveals a substantial absence of a unique notion of the subject, a phenomenon that ends with the use of the same term to describe phenomena which are quite different in terms of

nature and peculiarity. Such plurality of definitions «involves not only problems of a theoretical nature, but, above all, a practical one, as it makes very difficult to quantify the phenomenon and to compare it in terms of time and space dimensions, so that there are often significant deficiencies of the support policies that should be set in the programming phase and in the implementation phase» (Grossi and Ruggiero 2008, 58). Others (Steffensen, Rogers and Speakman 2000, 97) provided a definition we adopted in this paper because of its breadth: «A spin-off is a new company that is formed by individuals who were former employees of a parent organization, and a core technology that is transferred from the parent organization».

In Italy, the university spin-offs creation process started in the beginning of the 2000s and nearly 1.327 enterprises have been founded since (Netval 2018). In particular, the gradual increase in university spin-offs lasted until 2007, following a regular growth trend, with the creation of about 100 new entrepreneurial realities each year.

An important feature to be considered is the *composition* of university spin-offs research groups, an aspect which influences the future spin-offs life on the market. It is important that the group of researchers forming part of an academic spin-off be well calibrated in terms of research and technical-managerial skills. An analysis of the positions covered by founders of university spin-offs so far, shows that 52% of them are *research fellows*, 32% *full professors* and 16% *associate professors (Netval 2016).* The weight of the young researchers is quite evidently overwhelming. It would certainly be even higher if it could be possible to consider the data concerning other young researchers in the staff, an information missing for the whole Italian universities but present in some academic institutions. The prevalence of research fellows among the spin-offs founders group is interesting if projected to a broader analysis of the present condition of research staff in Italian universities. In 2010 a new law for university[1] has, among other effects, radically changed the research fellows recruitment. The law, abolishing the tenured *research fellow* (RTI), multiplied the apprenticeship[2] roles, drastically reducing the tenure possibilities for these positions. In fact, the data referred to 2011-2018 show a sharp decline in the number of tenured research fellows, who passed from 23.740 in 2013 to 12.200 in 2019. The "Type B" researchers (tenure track) are 2.422 in 2018 and the residual number of old tenured

[1] Law 30 December 2010, n. 240 – "Rules on the organization of universities, academic staff and recruitment, authorizing the government to enhance the quality and efficiency of the university system", promoted by the Minister Gelmini, and published in the Official Gazette no. 10 of 14 January 2011 – Suppl. Ordinary n. 11.

[2] These figures are: the *Research Grant*, which can be recruited for a maximum of 4 years (subsequently increased to 6); the "Type A" fixed-term researcher (RTDa) (3 years and renewable for 2); the "Type B" time-limited researcher (RTDb) (3 years non-renewable).

researchers (RTI) is 9778, when the "Type A" fixed-term (non-tenured) researchers is growing since 2011 (3.701 units in 2018). It is interesting to emphasize the gradual deterioration of academic job perspectives for young researchers, an aspect which we relate to the increase in university spin-offs as substitute opportunity to academic jobs. Despite the main nature of university spin-offs is predominantly to enhance and apply the results of academic research, it seems reasonable to assume that, over time, the phenomenon has taken on an additional configuration (Simmons 2017; Cocorullo 2017). The increasing difficulties in finding a permanent position in universities encourages researcher fellows to intercept possible alternatives to academic career, both in terms of accumulation of economic resources and in terms of finding a physical environments where is possible to pursue their research interests and relative activities.

In this perspective, the university spin-offs act as an "anchor" for those that would otherwise be excluded from the research world for the present restrictions in academic recruitment. This is fully in line with what previously said about the research groups composition: there is a predominant percentage of researchers compared to professors, whether associate or full. However, it is wrong to suppose that in these class of researchers what is defined "entrepreneurial commitment" (Parente and Feola 2003) necessarily collide with the traditional "academic commitment". The results of our field research on spin-offs of 5 Italian Universities (Politecnico di Torino, Università di Trento, Scuola Supariore Sant'Anna di Pisa, Università degli Studi di Napoli Federico II and Università degli Studi di Messina) show that spin-off's young researchers maintain a high level of aspiration to academic jobs. It would be interesting to check in the future whether (and in how many cases) the professional trajectory of young researchers-entrepreneurs will also evolve towards a formal academic position. If so, due to the dual purpose, the entrepreneurship inclination encouraged by the opportunity (what Acs and Varga 2005 and Acs 2006 call *opportunity entrepreneurship)* would come to establish an osmotic relationship of mutual compensation with entrepreneurship dictated by necessity *(necessity entrepreneurship)*. In fact, investigate this aspect would require a specific research activity over the years that the present study does not allow and that it could be a future development.

3. Conclusions

The quantitative analysis of the university spin-offs allowed the reconstruction of the configuration assumed by the phenomenon in the Italian case. Because of the high concentration in central and northern areas of Italy, the image that emerged is of a rather fragmented and inhomogeneous reality. More generally, the spin-offs diffusion is higher in those areas with higher economic activity and closers to incubators and/or business accelerators, whose broader presence is in the Center-North of Italy. More generally, it is interesting to underline how the inconsistency (which sometimes is simply a lack) of

national and local policies on scientific research has determined a quite inhomogeneous distribution of spin-offs at national level.

Another aspect which emerged is a likely correlation between the numerical decline of tenured academic positions and the growth of university spin-offs in Italy. As already stated, it is possible to put forward the hypothesis that spin-offs might play a role of *academy-substitution* for those who are unable to find a tenured academic position as a consequence of the job restriction introduced in the Italian legislation for universities. It is possible that this aspect might affect the researchers' enterprenurial attitude (in so far as they might perceive entrepreneurial activity as too risky and uncertain) and finally damage the market affirmation of the project they follow. A factor reinforced both by the lack of availability of venture capital and the real difficulty in identifying financial partners to join the project (Gupte 2007; Hayter 2016; Guerrero *et al* . 2016).

It's a pity that there still are present all these difficulties in university spin-offs. In fact, given the Italian industry structure – featuring from the large prevalence of small and medium-sized enterprises operating in sectors not always with a high technological impact – the university spin-offs would be among the most suitable subjects to start a revitalization and innovation process in a country traditionally reluctant both to invest in development and innovation and to interact with the research world.

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Breaking down Silos through Authentic Assessment: a Live Case Analysis

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Abstract

One of the aims of Technological University Dublin (TU Dublin) is to create graduates who problem solve as socially responsible global citizens. We wanted to provide an opportunity for our students to address relevant, marketing and consumption challenges in new and innovative ways, and to develop analytical competences and professional skills and comportment in a real-life context. This paper describes the design, implementation and outcome of an inter-disciplinary and cross-programme 'authentic assessment' method which we have termed a 'live case analysis'. The assessment comprised fieldwork, wider industry engagement, formative assessment components and a summative presentation. The method is discussed against the backdrop of a Curriculum Framework project which is underpinned by four design principles which centre around innovation, application, collaboration and flexibility. The performance of real-world tasks such as live case analysis strongly reflects the central pedagogical values of what, where and how people will learn at TU Dublin in the future.

Keywords: *Authentic Assessment; Live Case Analysis; Curriculum Framework; Formative Assessment; Real-world Application.*

1. Introduction

This paper describes the design, implementation and outcome of an inter-disciplinary and cross-programme 'authentic assessment' method which was developed and carried out in response to a rapidly changing learning and teaching environment and a new institutional context. The assessment comprised a live case analysis for a national tourist attraction 'Tayto Park'. Assessment components included fieldwork, industry engagement, formative assessment components and a summative presentation to the senior marketing team and theme park owner. The assessment is discussed against the backdrop of a Curriculum Framework project Co-Create (Collaborative Curriculum Reimagining and Enhancement Aiming to Transform Education) established in TU Dublin, and currently being designed and developed by a team of teaching fellows.

The relevant institutional context is complex and evolving. Ireland's first Technological University was formed from the merger of three Institutes of Technology in January 2019. TU Dublin, engages 28,000 students in research-informed, practice-led education across a range of disciplines from apprenticeships to PhDs. The strategic intent of this newly created institution is to deliver excellence in student centered learning through collaboration and engagement with students, the University and stakeholders from industry, the professions and wider society.

Curriculum is defined as the articulation of the university's values and principles with regards to teaching, learning and assessment, knowledge and the disciplines, and the cultural and political purposes of higher education (https://cocreatetudublin.wordpress.com/). A framework is an overarching scaffolding that influences the manner in which this articulation is approached. The curriculum framework emerges from the pre-existing values and strengths deemed most relevant to nurture, develop and enhance learning into the future. Four design principles have been developed to articulate how the final curriculum framework might shape what, where and how people learn at TU Dublin.

- Step forward and try new things
- Make our learning experience active, useful and related to the world (of work)
- Use our talents; everyone has something to learn and something to teach
- Create the space and time to do work that matters

In this paper we map our assessment innovation, a live business case analysis, against these design principles to frame our discussion and explore the ways in which this innovation reflects the pedagogical tenets encapsulated in the framework.

2. Step forward to try new things

The framework seeks to design in opportunities for evaluation and adaptation of the curriculum to allow innovation to flourish. De Vries' (2018) 'semi permeable curriculum' is open-ended and flexible with regard to content and is borne from a cognizance that faculties of higher education must develop professionals for an, as yet, undefined future. Hughes and Tan (2012) argue for a curriculum which is 'future-sensitive' and adaptable to change in work and society, as well as flexible in relation to diverse cohorts of learners and stakeholders. Stepping forward and trying new things is an appeal to the academic community within the university to try out new ways of doing things, share what works and why innovation matters.

We are three colleagues delivering two modules, namely Marketing, and Consumption, Culture and Markets taught across two postgraduate programmes. This assessment design grew out of our wish to leverage an experiential and authentic learning process for our students which emphasized an application to practice, critical thinking and the development of communication skills. In essence, we wanted our integrated assessment to develop students as holistic, strategic problem solvers. An additional but significant impetus in designing this inter-disciplinary, cross programme assessment was to acknowledge the growing convergence between the disciplines of Marketing and Consumption, Culture and Markets (Parsons, Maclaren and Chatzidakis, 2017).

Authentic assessment (Mueller, 2005) is not a new approach within business education but there is a dearth of empirical research on authentic assessments in business disciplines in general (Sotiriadou, Logan, Daly and Guest, 2019, p.14) and particularly in formal learning environments as opposed to work placements (Ashford-Rowe, Herrington and Brown, 2014). Mueller (2005) reflects Wiggins (1993) in his definition of authentic assessment as a form of assessment in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills.

Ashford Rowe et al. (2014) build on Gulikers, Bastiaens and Kirschner's (2004) work in their development of an eight principle framework and suggest that for an assessment to qualify as authentic it should be challenging, include a crafted outcome, foster the development of transferable knowledge, allow for self-reflection, simulate and measure a real-world test of ability, include formally designed opportunities for feedback and opportunities to collaborate.

The live case analysis assessment described in more detail in the next section of this paper qualifies as 'authentic' across these eight criteria. The development of the assessment fits with the curriculum design principle 'Step forward to try new things'. The inter-disciplinary cross programme live case assessment described in detail in the next section of the paper emerged as a result of, and as a response to, the changing theoretical and policy contexts in which learners and educators collaborate. The succesful implementation of this assessment

points to the import of this curriculum design principle for our university in the current higher education climate.

3. Make our learning experience active, useful and related to the world (of work)

The second design principle of the curriculum framework speaks to the substance and quality of learning experiences. Technological innovation coupled with demand from employers and government for a more highly skilled workforce have resulted in changes in relation to the ways higher education is mediated and accessed (Ashford-Rowe, Herrington and Brown, 2014). Existing modes of assessment need to be critiqued in the context of this changing terrain. Meyers and Nulty (2009, p.567) posit that in order to encourage deep learning, academics must provide tasks and experiences which are (i) authentic, real-world and relevant, (ii) constructive and interlinked, (iii) command higher order processing from students, (iv) aligned with each other and the desired learning outcomes, and (v) provide challenge and motivation to learn.

We wanted to provide an opportunity for our students to address relevant, real marketing and consumption challenges in new and innovative ways, and to develop analytical competences and professional skills and comportment in a real-life context. Having broadly reviewed the Irish brandscape for potential collaborators we enlisted Tayto Park as a client/partner for our live case analysis.

Tayto Park is one of Ireland's top ten fee-charging attractions and it is a unique mix of theme park, activity centre, zoo, and educational facility. The idea for the theme park was inspired by similar parks in the US, such as Hershey Park in Pennsylvania, which has grown to become a major tourist attraction. The business opened to the public in October 2010 and recorded attendance figures of 330,422 in its first full year of trading in 2011 and that number had grown to 770,000 in 2018. Tayto Park recorded profits of €3.1m in 2017, up from €2.9m the previous year, on sales of €17.5m. A significant majority of visitors are families with children under the age of twelve, drawn from Dublin and surrounding counties. Seventy five percent of visitor numbers are recorded between July and August each year, with footfall averaging 10-11,000 per day, depending on the weather. It is the ambition of the management team to target one million visitors by 2021.

The Tayto Park brand story was elicited from the Marketing Director over the course of a face-to-face meeting. From this, a detailed, live case study was crafted. The case comprised a theoretical backdrop incorporating marketing theory and consumption theory relevant to the brand, a detailed brand contextualisation and an outline of the challenges facing the brand. Specific questions were designed to actively engage the learners in immersive problem-solving. The questions are replicated below:

- Discuss the expectations, concerns, and desires families experience as they engage in planning 'a day out'?
- What brand attributes are currently being communicated by Tayto Park?
- Should Tayto Park continue to use the Tayto brand name? Argue for or against this strategy.
- Outline your key strategic marketing recommendations for Tayto Park over the next 5 years.

The live case analysis described here demonstrates the potential to create meaningful industry and employment-related assessment for full-time post-graduate students and provides an exemplar of what is envisaged by the mantra 'Make our learning experience active useful and related to the world of work'.

4. Use our talents; everyone has something to learn and something to teach

The third design principle of the curriculum framework calls for celebration of the opportunity's university life presents for collaboration between and among students, educators and partners. The live case analysis assessment described in this paper is an example of the type of student-educator-partner collaboration that sees people bring their unique talents and perspectives together to produce something tangible, dynamic and ripe for ongoing revision as the learning process is not a linear one. The curriculum framework provides support for authentic assessment and in so doing endorses Brew's (2013) contention that 'universities should become scholarly knowledge-building communities where academics and students work together to learn and solve problems of the world' (p.609).

Linked to this call is the need to breakdown existing silos between disciplines, promote inclusion and diversity of the university community and to think beyond summative assessments as a key success measure of teaching and learning (National Forum, 2017). This live case assessment fostered collaboration amongst the teaching team, breaking down disciplinary silos, while achieving a collective goal. It also promoted the integration of international students from eight countries and embraced a number of students registered with disability and learning support services at TU Dublin.

Meyers and Nulty (2009) argue assessment plays a pivotal role in curriculum design and acknowledge that an appropriate assessment task serves to underpin student learning, encourages student engagement with the associated learning resources and leads to attainment of the desired learning outcomes. The Irish National Framework of Qualifications states that programmatic learning outcomes at postgraduate level require learners to demonstrate higher order thinking (https://nfq.qqi.ie). In this live case analysis, we endeavored to build an assessment which allowed us evaluate four key learning outcomes (two from each module) designed to develop the requisite competencies. These learning

outcomes required the learner to (i) apply theory to analyse and develop responses to consumption-based issues in business and societal contexts, (ii) identify and apply advanced marketing techniques and frameworks for problem solving, (iii) formulate strategic responses to marketing challenges and finally (iv) be able to communicate and present advanced ideas competently.

Incorporating students from diverse undergraduate backgrounds ensured breadth and variety of perspectives was a contributory factor in fostering collaboration and engendering a climate of inclusion between and amongst students. In line with Asford Rowe et al.'s (2014) eight principle framework students were encouraged to actively engage with every stage of the assessment process across one semester. In order to achieve an immersive experience, students participated in a formal site visit to the theme park and meet members of the senior management team for a Q and A session. A two-stage formative assessment process followed the field visit and these collaborative meetings allowed learners to receive constructive formal feedback on their work to date. During stage one students conducted a guided literature search to inform a phase of primary research. In response, we assessed the quality and relevance of their chosen theoretical underpinnings. Stage two involved us meeting with each group to approve their research strategy and effectively 'greenlighting' them to move on to the research implementation stage. An industry expert from a global experiential brand was invited as a guest lecturer to give students a wider context within which to consider their Tayto Park challenge. At the end of the semester, student groups presented their case solutions to the Tayto Park senior management team, their lecturers and peers.

Mueller (2005) argues that good assessments of any type begins with meaningful goals and standards. We developed a rubric (Reddy and Andrade, 2010) which comprised five evaluative criteria along with performance level descriptions that described what 'instantiations of those criteria look like in work at varying quality levels, from low to high' (Brookhart, 2018, p.1). Criteria included depth of engagement in relation to research design and implementation, quality of insights generated, quality of strategic and tactical recommendations made, and, competence in relation to delivery of oral presentation and documentation. Students received the rubric in advance of commencing the task to enhance understanding around lecturer expectations regarding the completed assessment. Eight groups of six participated in this assessment. The overall average score was 66% with a top score of 77% and a lowest performing score of 51%.

We used peer group performance appraisal (Topping, 2009) to encourage students to take responsibility for their own learning, help them reflect on their contribution to the assessment, mitigate against social loafing behavior, and, importantly, allow them to appraise the performance of their group members (Wanner and Palmer, 2018). Performance appraisal is a critical work-related skill which dovetails with the stated objectives of authentic

assessment. The senior management team at Tayto Park remarked that deep insights had been uncovered and commented on the professionalism displayed.

5. Create the space and time to do work that matters

Priestley and Philippou's (2019, p.2) vision of curricula argue for learner-centred approaches, active pedagogies and facilitation of learning by educators. The final design principle articulated by the Co-Create team centres on the creation of time and space to do work that matters. Encouragement for innovation in teaching, learning and assessment, specifically provision for staff to upskill in the area of authentic assessment is pertinent to creating a learner-centred approach. We received the encouragement and support of our leadership team in a number of crucial ways. In order to be innovative we needed to invest more time and flexibility than that typically associated with a traditional assessment method. We were provided with resources to enable students to take part in a client site visit. We were afforded appropriate physical spaces depending on our needs including the use of an executive suite for the final presentations. The Learning, Teaching and Technology Centre (LTTC) in TU Dublin provided many opportunities for us to pursue continuing professional development. We are grateful for these supports many of which are encapsulated by Sotiriadou et al. (2019) as essential.

The overall experience of engaging with authentic assessment was a positive one. Students achieved the required learning outcomes, as demonstrated, for example, by the evidence of higher order-thinking in strategic responses to the live brief. We acknowledge some of the challenges this assignment presented for students including time-management, anxiety around presentations and group dynamics. Peer assessment provided a structured learning process for students to critique and provide feedback to each other, and developed skills to manage group conflict and dynamics. We helped the students navigate problems arising and utilised formative assessment and informal class discussion to check-in on student progress observing the development of important transferable skills. A particular advantage of this kind of assessment is the clear sense of ownership that students developed around their ideas and how their confidence built. Collaboration, teamwork, and empathy are designated TU Dublin graduate attributes and are considered highly desirable in the workplace.

6. Conclusion

The performance of real-world tasks in the academic environment is deemed reflective of the pedagogical values encapsulated in the emergent curriculum framework as envisaged by the Co-Create teaching fellowship team for TU Dublin. This paper describes the design, development and implementation of a 'live case analysis' for students across two Masters level business programmes. This 'authentic assessment' has been described in the context of

the four key design principles of the curriculum framework project; innovation, application, collaboration and flexibility and in so doing we have illustrated the value of a curriculum framework in helping to shape and support the development of meaningful authentic engagement between students, educators and wider societal entities.

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Practice tests improve performance, increase engagement and protect from psychological distress

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Abstract

The increasing prevalence of high levels of distress in university student populations has led academic and support staff to investigate options to help students cope with academic stress. Our research focused on investigating the benefit of early academic interventions for content engagement and feedback. In a 1st year psychology student sample of 547, we collected data on psychological measures (motivation and distress), practice test engagement and performance on assessment tasks. Assessment data from a baseline phase (practice tests were available) were compared to assessment data from an intervention (reward for undertaking practice tests). Our experiment also allowed an investigation into the type of benefit gained from practice tests engagement (content specific benefit vs general engagement effects). Results showed that undertaking practice tests ahead of assessment quizzes was associated with significantly higher assessment performance. Practice test uptake significantly increased when an incentive was in place resulting in much higher assessment scores for students. Students who reported high levels of distress on the DASS performed significantly lower on assessments. However, highly distressed students who undertook practice testing showed performance at the same level as non-distressed students.

Keywords: *Practice; Testing; Stress; Engagement; Assessment.*

1. Introduction

In educational settings, testing is most commonly used to evaluate a student's learning of core material and to assign students a grade for their course (Roediger, Putnam, & Smith, 2011). However, in addition to this summative assessment, formative testing has also been shown to have a significant impact on later assessment tasks (Sly, 2006). Some of the most common techniques for study involve rewriting notes, reviewing material covered in lectures or classes as part of a study group, rereading course notes and textbooks as well as completing practice questions or tests (Gurung, 2005). Extensive research has shown that testing, whether it be practice or the actual assessment, results in significant improvement of knowledge which is often superior to other methods of study (Carpenter, Pashler, and Vul, 2006; Cull, 2010; Glover, 1989; Sly, 2006). Roediger and Karpicke (2006) showed that practice tests are not superior to study alone if the assessment test occurs shortly after the study time (5 min). However, they found that knowledge appeared to significantly decay in the study alone condition with 50% retention at 2 days later and further decreased across a week. In comparison,knowledge also declined in the practice test condition, but even after 7 days was well above 50%. While uncued recall in short answer type questions has been generally shown to be the best type of testing (Carpenter, Pashler, and Vul, 2006; McDaniel, Anderson, Derbish & Morrisette,2007), other research demonstrates the importance of timely feedback (Butler, Karpicke and Roediger, 2007; Butler, Karpickle and Roediger, 2008; Butler, Godbole & Marsh, 2013; Phelps, 2012). Moreover, a recent meta-analysis revealed that multiple-choice practice tests can improve learning more than short-answer practice tests (Adesope, Trevisan & Sundararajan, 2017). Despite currently being underutilised in higher education (Binks, 2017), mounting evidence suggests that multiple-choice practice testing, together with the meaningful feedback it provides (Gikandi, Morrow & Davis, 2011; Wojcikowski and Kirk, 2013), may be an effective formative learning strategy.

While many strategies may aid academic performance, self-testing (i.e. retrieval practice) has been highlighted as one of the most effective ways to engage with course material. Karpicke, Butler & Roediger (2009) found that although this strategy is highly effective, students report using it less frequently than other study habits. It is unclear from prior research whether this gap is present because students do not have access to practice assessments or if this method is not yet recognised as an effective learning strategy. Results from Hartwig and Dunlosky (2012) suggest that while students may engage in self-testing when preparing for exams, they view this as a tool to evaluate knowledge, rather than to aid learning.

Although practice effects have been identified as having a direct impact on academic performance, anxiety and stress indirectly affect the information-processing components associated with learning tasks (Tobias, 1976). Tobias' model suggests that stress can interfere in pre-processing, during processing, and post-processing phases of learning, and can result in negative effects on student performance. Since almost all university students report

experiencing high levels of distress compared to 29% of the general population, the contribution of stress and anxiety is of great interest to educational psychology research (Bore, Pittolo, Kirby, Dluzewska, & Marlin, 2016; Stallman, 2010). Factors such as being female, reporting financial stress, and being a full-time student can predict higher distress, however, Stallman (2010) reported that the prevalence of stress is most evident in first year students and decreases across years of study. This can be attributed to a range of factors such as increased confidence and task familiarity as students engage in similar styles of content throughout their degree. Jackson, Kleitman and Aidman (2014) showed that practice improved performance and reduced stress in cognitive workload tasks. Putwain (2008) also found that task familiarity and workload can affect student stress levels. Students in his study were required to complete exams that were low, mid and high stakes. Students performed better as they completed more tasks suggesting that practice led to increased task familiarity which can aid in the reduction of stress and increased academic performance. Putwain also found that students performed better and reported the lowest stress around mid-stake exams, suggesting that there is an interaction between task familiarity, task weighting, and stress on performance.

The present experiment examined the relationship between practice test engagement and academic performance on assessments across the semester in a large first year course. We predicted that practice test engagement should improve assessment scores and that by providing an incentive to undertake practice tests (a second attempt at Quizzes 2 and 4 if students completed two or more practice tests), a larger number of students would undertake practice tests. Practice test uptake was expected to remain higher than the initial baseline (Quiz 1) as students would learn the value of practice for assessment outcomes. Within the incentive quiz conditions (Quizzes 2 and 4) we also manipulated the type of content within the practice tests which allowed for a direct investigation of the type of benefit of practice (content specific feedback vs general engagement with content). We predicted there would be both content specific benefits of practice as well as engagement effects. Finally we measured overall student distress using the short form Depression, Anxiety and Stress Scale (DASS-21: Lovibond & Lovibond, 1995) early in the semester and again towards the end of the semester. We predicted that students who reported higher levels of distress (stress and anxiety combined) would perform more poorly than those showing low levels of distress and that students with higher distress who engaged in practice would perform better than those with high stress who did not do practice tests.

2. Methods

2.1. Participants

The 547 participants (Male = 106, Female = 327, Undisclosed = 114) in this study were students recruited from the 2019 cohort of the first-year course "PSYC1010 Introduction to Psychology 1" at the University of Newcastle. Those who voluntarily consented to participate agreed to the data from their coursework and lab activities being analysed as part of the study.

2.2. Materials

Each of the following measures were completed by participants as part of their coursework; a Demographic survey, the DASS-21 (Lovibond & Lovibond, 1995) and the Psychology Motivation Questionnaire II which was adapted from the Science Motivation Questionnaire II (Glynn, Brickman, Armstrong, & Taasoobshirazi, 2011). A study habits self-report measure was completed prior to each assessment quiz. The questions for this measure focused on student engagement with course material, self-directed and peer assisted study habits, and the use of feedback given on practice tests when studying.

Students completed four multiple choice assessment quizzes over the semester with multiple choice practice tests (25 questions) available prior to each quiz. No incentives were in place for Modules 1 and 3. However, in Modules 2 and 4, students were given the opportunity to complete their assessment quiz a second time (with their highest mark recorded) if they completed at least two of the three available practice tests for that module. Prior to completing the practice tests in Modules 2 and 4, students were placed into one of two experimental groups that determined the type of practice questions they received. Group 1 received a higher number (12) of practice questions from content A and very few practice questions (4) from content B. For Group 2 these question weightings were reversed. Both groups received equal numbers of practice questions from content C (9).

2.3. Procedure

Demographic data was collected in Week 3, distress data in Weeks 6 and 9 (with a 2 week break between Weeks 7 and 8) and motivation data in Week 8. Quiz 1 occurred online in Week 5, Quiz 2 was completed in Week 8, Quiz 3 in Week 10 and finally Quiz 4 was completed after Week 12. Practice tests and quizzes were of the same multiple choice format and examined the same concepts but were drawn from different pools of questions. Thus practice tests gave students feedback on concepts but those questions were not present in the assessment quiz. For Quizzes 2 and 4, the 2nd quiz attempt also had new questions which were not in either the practice test or the 1st quiz attempt. While Quizzes 2 and 4 had two attempts, only the 1st attempt was used in our analysis to compare performance across all quizzes.

3. Results

Students uptake of practice tests dramatically increased between the first baseline condition (Module 1 where practice tests were encouraged) and the first incentive condition (Module 2 where a 2nd quiz attempt was given to those who did multiple practice tests). As shown in Figure 1, practice test uptake increased from 59% to 91% between Modules 1 and 2 and remained above 70% for the duration of the course. There was a smaller increase from Module 3 (73%) to Module 4 (82%). Higher practice rates were also associated with increased quiz performance (see Figure 1b) with significant improvements between Quiz 1 and Quiz 2 (t (517) = -8.281, $p < .001$) and between Quiz 3 and Quiz 4 (t (491) = -10.630, $p < .001$). What is perhaps more telling is the relationship between the number of practice tests completed (0 - 3) and quiz performance.

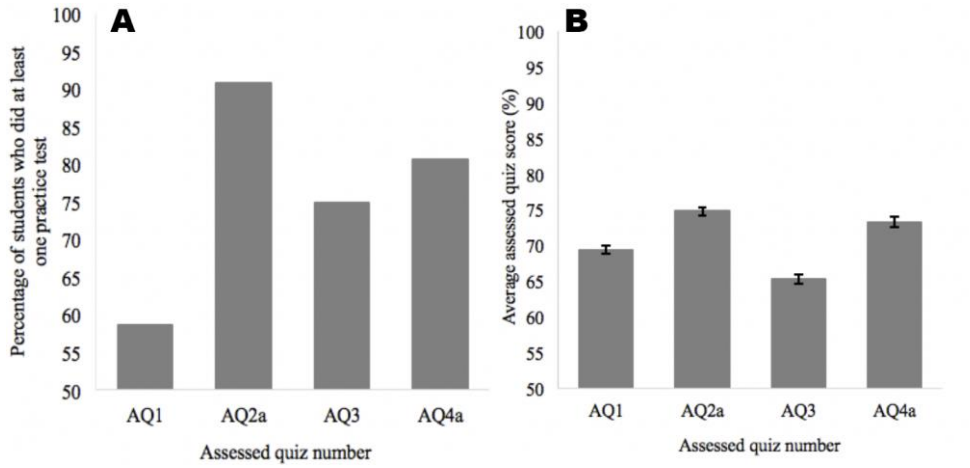

Figure 1. The percentage of participants doing at least one practice test for each module (A) and average quiz performance (B). Error bars represent standard error.

Practice test uptake was grouped into 3 categories (None (0), some (1 or 2) and All (all 3 available practice tests). Figure 2a shows a consistent pattern of performance on quizzes relative to their practice test completion with significant differences for each quiz when comparing None vs Some, None vs All and Some Vs All. Thus practice tests were associated with improved quiz performance and incentives to increase practice test uptake were successful for Modules 2 and 4 and resulted in overall better performance. Moreover, students who reported that they completed practice tests but did not review their feedback performed no better than students who did no practice tests. Consistent with this finding was a strong relationship between overall grade and motivation score (r = .289). Interestingly, all analyses of content specific effects for Modules 2 and 4 showed nonsignificant effects. Analysis of the relationship between distress and performance showed students with low

distress scored an average of 5 points higher on quizzes than students who reported high distress. Significant differences in quiz performance for distress level were found in Quizzes 1, 3 and 4 but not for Quiz 2 where over 90% of students did the practice. We also found the significant reduction in performance due to distress was only present in those students who had low engagement with practice tests (t (67) = 2.15, p =.035) but was not present in highly distressed students who also had high practice test engagement (see Figure 2b).

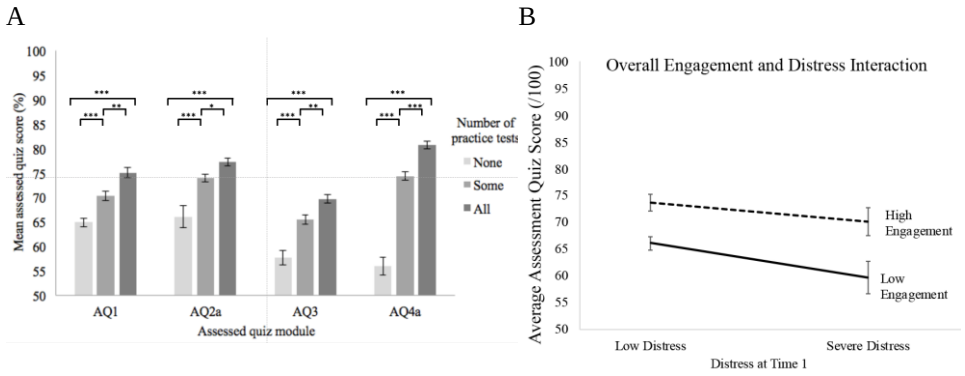

*Figure 2. Average quiz score as a function of engagement in practice tests (A) and as a function of engagement for high vs low distressed students (B). Error bars represent standard error. * p>.05, ** p<.01, ***p<.001.*

4. Discussion

The present study aimed to investigate the relationship between engagement in practice tests and performance on assessment quizzes. We also examined the role practice tests could play for those students who display high levels of distress. Our results show a clear benefit of engagement with practice tests for student learning. In our baseline conditions, the practice test uptake was lower and there was a corresponding reduction in quiz scores. When we provided a strong incentive to do the practice tests, uptake increased with a corresponding increase in performance on assessment. The effects of practice test engagement also relate to how many practice tests are done, with the most benefit coming from three practice tests. Students who completed no practice tests for Module 1 and continued to do so for the remaining modules showed no improvement in scores across the semester, whereas those who began doing practice in Module 2 or 3 or 4 showed improvements from when engagement began. One key aspect of this project was a clear distinction between practice tests, which were for formative feedback only, and assessment quizzes". Students undertake practice tests with less stress than an assessment quiz and use them for self evaluation of learning, which is essential for them to see their value (Karpicke, Butler & Roediger, 2009). Interestingly, our results showed the benefits of practice were not specificly related to the content for which they were given practice questions. Students who had proportionately

much higher numbers of questions on one type of content did not perform better on that content than they did for content where they received relatively few questions. This suggests that students are using practice tests as general performance feedback which may increase other types of review, as supported by the research of Carpenter (2012). An additional benefit observed with practice tests may be a general improvement in scores as they gain more experience with the test format (Meir, 2017; Snooks, 2005). This general reduction in performace stress that is observed across all students was especially relevant to students who present with an ongoing higher level of distress. Our results show that highly distressed students performed significantly poorer in assessments than students with low levels of distress. More importantly, providing these highly distressed students with practice tests allowed them to perform as well as those with low levels of distress.

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The bad and the ugly: a systematic review of technology's negative impacts' mentions in literature from 2005 to 2020

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Abstract

In an era of ubiquitous presence of several formats of technology throughout all areas of human interaction, it seems pertinent to assess the complete spectrum of possible impacts such technologies may have: not just the good, but the bad and the ugly too. Scientific research has been substantial on its efforts to map technology's benefits from which humans may profit on a myriad of activities. This is particularly evident in recent fields of study, such as gamification applications to marketing, education or business. However, it could be argued that in-depth analysis of potential nefarious impacts of technology use is currently lacking. In this paper, we perform a systematic review of contributions from top scientific publications over the last fifteen years in search of their concerns over the implementation and usage of technology, to gather proof that this is a promising study field, which deserves further study. Due to the limited literature and empirical evidence on the topic, this study contributes to better understand of nefarious impacts and limitations of technology.

Keywords: *Technology; Negative impacts; Dark side of technology; Systematic study; Technostress.*

1. Introduction

We monitor our health and fitness with a smart-watch, we choose where we will be having lunch online, register it on our social network pages and comment on the food on the restaurant's social network pages, we get our news from Twitter and Google notifications, make our doctor appointments through an app, we unwind from a tough work day including several screen hours by watching a series or a movie on a streaming platform of our choice, we buy online and receive notifications of when to sleep and drink water, all the while e-mailing and direct messaging each other several times throughout the day. We use technology so much and on so many levels on our daily lives, our jobs, our family life and our entertainment purposes, that it could be argued technology has become, in fact, a part of ourselves. "We are not living in isolation from our contemporary society and culture, from our contemporary environment, and this is a technological environment with specific features." (Coeckelbergh, 2018 pg. 8).

Whilst the positive outcomes of technology, its uses and potential advantages have been largely targeted on several studies throughout the last two years, we would like to look in a different direction and question its potential negative impacts on people and society and related ethical questions. The need to understand the way in which technology impacts our lives was prescribed by Pleasants et al (2019) on their studies about the relationship between science and technology, which sought to map the fundamental issues surrounding the Nature Of Technology and what the scientific community has been pointing as their main concerns about it in the area of educations studies. Out of ten questions asked by Pleasants (2019), two concern the need to understand how technology affects the way people think and behave as well as how it influences society, moving away from an oversimplifying means-end approach for the relationship human-technology.

With this study, our aim is to sustain the importance and utility of investigating potential limitations and negative effects that may arise from the use of gamification and gamified artefacts. The focus of investigation efforts on individual cases with positive outcomes can be seen an oversimplification , and gamification has been pointed out as a field requiring a broader perspective including not only consideration on the positive, but the acknowledgement of the negative "We should move our attention from tackling limiting problems to study and understand harmful issues" (Hyrynsalmi, Smed, & Kimppa, 2017). The volume of studies on this matter, however, seems to not be large. In this sense, we propose to justify the need for its exploration by assessing whether the scientific community's studies have been addressing potential negative impacts that technology may have. Our hypothesis can be explained by the outline of a simple causal relation: if there is a generalized concern with potential negative effects of technology in people's lives, then as gamification is used in technology design, there is a need for studying its potential negative effects as well. For this hypothesis, we will consider that the degree of concern of the scientific community

can be apprised by considering the number of scientific articles published on top journals (Q1 and Q2) either which were written about a negative impact of a technology or which tried to cover the full specter of impacts of a technology, including negative ones.

For this purpose, we will perform a systematic review of the literature from 2005 to 2020, following the structured approach recommended by Webster & Watson (2002) for investigation in Information Systems research. (Kasurinen & Knutas, 2018; Rodrigues, Oliveira, & Rodrigues, 2019; Subhash & Cudney, 2018). We will start by reviewing some ethical concerns about the interaction between humans and technology, technologies' life cycle and potential negative effects of technology. We will discuss the final sample of texts obtained by this study in light of the existing literature, its potential limitations and we will suggest some paths for future investigations.

2. Background

2.1. Some ethical concerns about technology

There have been prior studies concerning the relationship between humans and technology and its ethical surrounding: Verbeek (2011) has looked in depth into the ethical questions surrounding technology in order to initiate a "third turn" on ethical and morality studies concerning technology, one that sees technology as a mediator of human moral behaviour. In this perspective, technology creates ethical conundrums that directly depend on its use and would not have arisen without it, as well as the issues where technology is designed to change people's moral behaviour, which implies to responsibility for morality lying on both the designer's and the user's side. Designers should be aware that the technology they have thought out to have one specific effect on people's behaviour may have additional undesirable effects that should be accounted for; and users should be aware of the technology they are buying into. From this second type of mediation arises the assumption that individuals have the necessity and duty of defining for themselves how they wish to interact with technology, as opposed to blindly embracing it or rejecting it (Soltanzadeh, 2012). For this intent, we argue that in order to make reasoned choice, individuals should have access to information on the possible pitfalls of using a specific technology, as well as of its potential and capabilities.

2.2. Technology's lifecycle

The dawn of emerging technologies is often celebrated, however, with the investigative and informative focus pointed at the positive sides and promising effects of said technology. There is a tendency for its creators and promotors to overestimate it, seldom paying attention to its potential limitations and inefficacies; Landers (2019) calls it an irrational faith on the emerging technology. There is an initial phase when the brand-new technology is presented

to the world, in which there are attempts to apply it to every possible area, including those in which it is later discovered that it bears little to no efficacy, which eventually leads to a general disappointment with it, sometimes causing its disappearance. The technologies that survive this crash eventually return to the public's interest with a fresh perspective and built their way to stability and to the everyday life (Landers, 2019).

O'Leary (2008) suggests that scientific studies on technology follow Gartner's Hype Cycle, as a higher concentration of certain types of studies can be found according to the Hype Cycle phase that it was going through at the time. O'Leary (2008) concluded that initial stages of an emergent technology usually see mostly studies on prototypes and technology's behaviour, whilst case studies often start appearing once it reaches the trough of disillusionment. From our point of view, an analysis of Gartner's Hype Cycle curve provides some sustenance to the assumption that questions on the potential negative impacts of technology, or of a technology artefact, do have a place in its evolution path. In fact, this seems to already be a concern in the non-scientific world, as a few books have been published where authors take an inquisitive look into the matter, often assuming a 'make it or break it' position towards it: either advocating for its use, or prescribing its complete abandonment, as the titles in Figure 2 suggest.

Title	Author, year of publication
Who Can You Trust? How Technology Brought Us Together and Why It Might Drive Us Apart	R. Botsman 2017
The Shallows: What the Internet Is Doing to Our Brains	N. Carr 2011
The Glass Cage: Where Automation Is Taking Us	N. Carr 2015
Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor	V. Eubanks 2015
Habeas Data: Privacy Vs. *the Rise of Surveillance Tech*	C. Farivar 2018
Rise of the Robots: Technology and the Threat of a Jobless Future	M. Ford 2015
Winners Take All: The elite Charade of Changing the World	A. Giridharadas 2018
What Technology Wants	K. Kelly 2010
You Are not a Gadget: A Manifesto	J. Lanier 2011
Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy	C. O'Neil 2017
A Deadly Wandering: A Tale of Tragedy and Redemption in the Age of Attention	M. Richtel 2014
Alone Together: Why We Expect More From Technology and Less From Each Other	S. Turkle 2012
Technically Wrong: Sexist Apps, Biased Algorithms, and Other Threats of Toxic Tech	S. Wachter-Boettcher 2017

Figure 1. Recent general audience books with substantial NOT themes. Source: Pleasants, Clough, Olson, & Miller (2019).

More importantly though, it matters to assess how scholars have been approaching the negative effects of technology. What studies have been produced on this field, and what types of studies are there? The aim of this study is to review the most recent top scientific literature

in order to assess whether the negative effects of technology have been subject to study and to the concern of the scientific community. We expected to compile a significant number of scientific texts from top publications in which the purpose of the study was to assess or explore potential impacts that several types of technology may have on people's lives, from several different study fields.

2.3. About gamification

Since our final aim is to provide sustenance to the assumption that it is pertinent to systematically investigate the potential negative effects and shortcomings of gamification and its applications, it now matters to provide a theoretical framework for gamification. Gamification can be understood as a process through which game elements are added to gameless objects or situations in order to support attributes which will bring them closer to games (Yohannis et al., 2014). Another definition of gamification, and one widely cited in the literature, is to see it as using game elements to non-game contexts (Deterding et al., 2011). There is also an instrumentalist definition of gamification, being described as referring to a technology that uses games elements or game layers (Rodrigues et al., 2019) such as social interaction as a means to promote individual's intrinsic motivation to perform a certain activity (Hamari & Koivisto, 2015).

Despite the high volume of research found about gamification and its applications, there seems to be little effort to the study of its potential ethical conundrums (Kim & Werbach, 2016). Some have suggested the need to deepen the scope of investigations in order to include concerns about gamification as well as benefits (Brigham, 2015). In addition, there are authors who alert to the possibility of gamification leading to the same types of ethical issues that games have been rising, namely in the contexts of addition or of its use in labor contexts which might allow for attempts of exploration (Hyrynsalmi et al., 2017). Moreover, exploitationware has been used to describe gamification by one of its fiercest critics, Iain Bogost (2013), who mostly attacks its use to replace material incentives in the workplace. These seems to suggest that, in fact, further studies of the potential shortcomings and negative effects of gamification are needed. To further support this view, we may take the work of Koivisto & Hamari (2019) which pointed out the potential negative, adverse or non-preferable effects of gamification as one of the 15 possible paths of investigation on gamification.

3. Methodology

In order to reach this goal, we have thus performed a systematic literature review using Scopus, Web of Science, EDS, Google Scholar and B-on content aggregation platform, using the following keywords and keyword combinations:

- "negative effects" OR "negative impacts" OR "harmful effects" OR "counterproductive effects" AND "technology" OR "gamification" OR "games" OR "social media"; "technostress";
- "dark" OR "dark side" AND "technology" OR "gamification" OR "social media";
- "dark web";
- "dark side" AND "web".

These terms have been searched for on titles, abstracts and keyword sections, for a restricted period comprising the last 15 years; only articles from 2005 to 2020 were considered. Citing articles and referenced articles have also been reviewed for each relevant article identified by the researcher, which led to the consultation of different text subjects, which had not been initially identified by the search. The final compilation of texts, resulting from the above-described process, was then subject to filtering based its type, preferring scientific journal articles to conference proceedings papers; no periodic articles were considered in this research. Furthermore, journal articles were chosen according to the relevance of the publication in which they were included and only the ones from top publications - from Q1 or Q2 in 2017 and 2018 - were kept in order to ensure quality of the information, based on Webster & Watson's (2002) premise of major contributions pertaining to top publications. Two papers from the proceedings of scientific conferences were also considered for this study. Researcher's discretion and best knowledge has been used in the final selection of the texts to consider in this analysis.

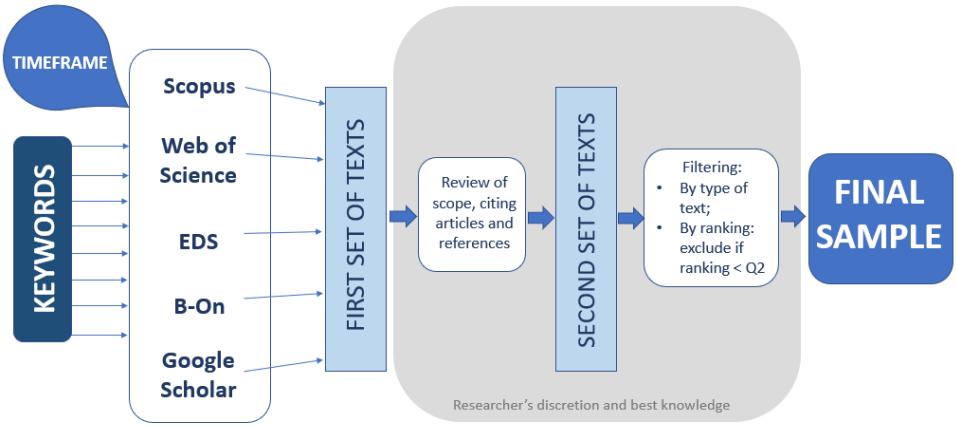

Figure 2. Methodology used for this paper.

Further to the selection and filtering process as explained o Figure 3, we had achieved a sample of scientific texts which content spanned from the study of human interaction with computers, to the effect of technology on people's mental health, to the influence technology may have on individuals' attitudes and the use of algorithms for media and politics.

This body of texts' reliability and scientific relevance is derived from the fact that they have been peer reviewed and published in some of the top scientific journals of their respective fields.

Table 1 - Texts resulting from research and filtering by date and relevance of publication criteria.

Theme	2019 - 2020	2015 - 2018	2011 - 2014	2007 - 2010
Gamification	Trang, S. and Weiger, W. H. Diefenbach, S. and Müssig, A. Landers, R. N.	Keusch, F. and Zhang, C. Kim, T. W. and Werbach, K. Imlig-Iten, N. & Petko, D. Woodcock, J. and Johnson, M. R. Leclercq, T., Hammedi, W. & Poncin, I.	Dale, S.	N/A
Mental Health	Moor, L. and Anderson, J. R. Al-Rawi, A. Doty, D. H. et al.	Enez Darcin, A. et al. Lowe-Calverley, E. and Grieve, R. Laconi, S. et al. Toner, J. Carbonell, X. et al Genni et al Vahedi, Z. and Saiphoo, A. Sampasa-Kanyinga, H., & Lewis, R. F.	Lee, Y. K. et al.	Charlton, J. P. and Danforth, I. D. W.
Education	Qi, C. Wang, X., Tan, S. C. & Li, L. Garzón, J., & Acevedo, J. Xu, Z., Banerjee, M., Ramirez, G., Zhu, G., & Wijekumar, K.	Patterson, R. W. and Patterson, R. M. Chauhan, S Kates, A. W., Wu, H., & Coryn, C. L. S.	Christy, K. R. and Fox, J Schmid, R. F., Bernard, R. M., Borokhovski, E., Tamim, R. M., Abrami, P. C., Surkes, M. A., … Woods, J	N/A
Technostress	N/A	Maier, C. et al.	Grover, V. and Purvis, R. Fuglseth, A. M. and Sørebø, Ø.	Tarafdar, M., Tu, Q. and Ragu-Nathan, T. Burke, M. S.
Social Media	Linvill, D. L. Sanz-Blas, S., Buzova, D. and Miquel-Romero, M. J. Sands, S. et al.	Fox, J. and Moreland, J. J. Maier, C. et al. Satici, S. A. and Uysal, R. Brooks, S. Loiacono, E. and McCoy, S.	Carpenter, C. J. Turel, O. and Serenko, A. Bucher, E., Fieseler, C. and Suphan, A. Dredge, R., Gleeson, J. and De La Piedad Garcia, X.	N/A
Security	N/A	Feri, F., Giannetti, C. and Jentzsch, N. Finklea, K. Jardine, E. Raguseo, E.	Bucher, T. O'Donnell, C. Boyd, D. and Crawford, K.	N/A
Sociology	N/A	N/A	Dotson, T.	N/A
Media	Millar, B.	Baruh, L. and Popescu, M Spohr, D.	Beam, M. A.	N/A
Marketing	N/A	Park, M., Im, H. and Kim, H. Y.	N/A	N/A
Smartphones	N/A	Enez Darcin, A. et al. Carbonell, X. et al Vahedi, Z. and Saiphoo, A.	Lee, Y. K. et al.	N/A
Politics	N/A	Dylko, I. et al.	N/A	N/A

4. Results

The outcomes of this research are shown on Table 1: 67 research pieces, 61 of which consist in scientific journal articles published on the top scientific journals of their fields. The articles compiled are linked to several scientific areas, spanning from health and psychology to computer science, marketing, politics and media.

From the texts selected as per criteria explained in Figure 3, we ended up with a final sample, 92% of which is composed of peer reviewed scientific journal articles against 5% texts representing papers from the proceedings of scientific conferences. The remainder 3%

correspond to a single Government issued paper from a specialist on Domestic Security from the U.S. Congressional Research Service.

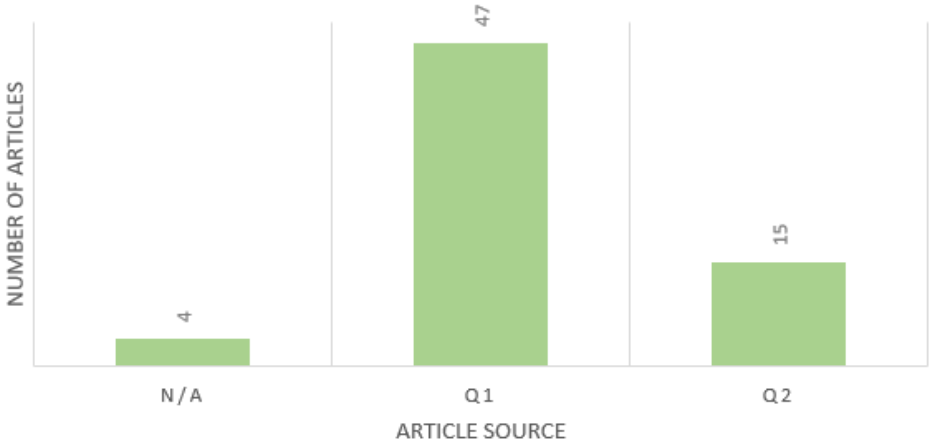

Figure 3. Number of articles by source ranking.

Although the research was performed for a restrict period comprising the last decade and a half (2005 to 2020 inclusively) the data seems to depict an increase of interest in the topics of potential negative impacts and effects of technology throughout, which according to this data spiked circa 2018 and 2019. It should be noted that the fact that 2020 is merely in its beginning most likely accounts for the small number of articles sourced for the purpose of this article. From the online databases and content aggregation portals utilized for this research, only Scopus' database considers articles still in press, which translates to the low representation in 2020.

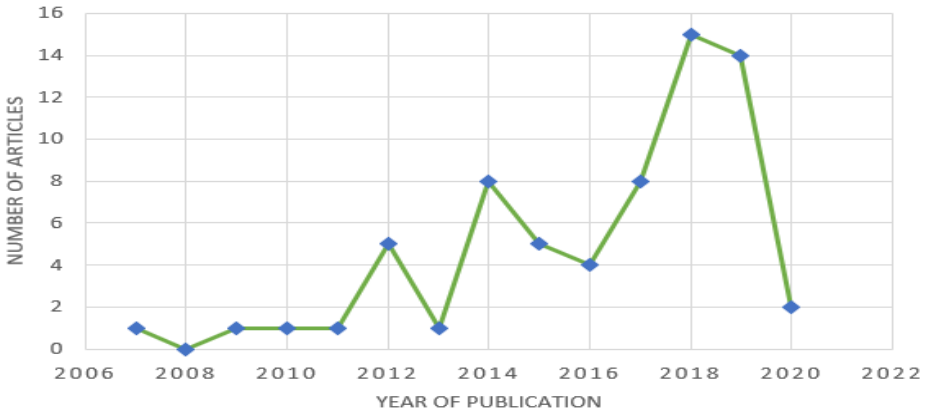

Figure 4. Number of articles per year.

Social media seems to be the main point of concern for these studies, with twelve out of the 67 being on this topic and often taking on a psychological angle. Education is also an area of concern, with eight out of 67 studies on educational topics and adding to the seven items concerning games and gamification. Five of the 67 studies refer to the concept of technostress, which is defined by Trafdar et al (2011) as a work phenomenon caused by techno-overload, techno-invasion, techno-complexity, techno-insecurity and techno-uncertainty which leads to negative feelings towards technology such as a compulsion about being permanently online, forced to respond and trapped in a multitasking loop. There are also some items concerning the media and security and data protection, although in less number than the aforementioned areas.

5. Discussion

The final sample of scientific texts obtained in this study seems to provide a close portrait of the scientific community's views on the negative effects of technology, as it fulfils the requirements needed for a systematic literature review. We have defined clear boundaries for the period to which our sample should pertain, as well as the keywords for the search and the platforms, which would be used in order to obtain it. The texts retrieved for this study cover an array of scientific areas, as per Webster & Watson (2002) recommendations for research on Information Systems' field "Because IS is an interdisciplinary field, you often must look not only within the IS discipline when reviewing (…) but also outside the field." (Webster & Watson, 2002, pg. xvi). Texts from top ranked publications account for 92% of the final sample, and both its references and citing papers have been reviewed and considered for the scope of this study. (Wohlin & Prikladniki, 2013). Finally, only recent texts – from 2005 to 2020 - have been considered for this research, thus accounting for the contemporary concerns of the scientific community.

Our results show that, whilst systematic reviews are lacking, specific area studies do show a concern about technology's impacts. With a final sample of 67 texts mentioning or deepening potential negative impacts of technology we seem to have obtained confirmation that, in fact, this is a valid and necessary angle to study technology. Top journals have been publishing articles which either directly approach a specific adverse effect of technology in human life, or it does so by studying impacts in a broader sense. We must, however, consider that the researcher's judgement had a significant impact on the final sample obtained, which means that this review is not free of some subjectivity; this being, it is possible that different researchers had produced a different set of texts as the outcome of a similar process (Wohlin & Prikladniki, 2013). Furthermore, there is also the fact that a closed set of search engines and platforms were used for the retrieval of these texts. Together with the degree of subjectivity mentioned, these results in the possibility of missing some important article, which could have been mentioned in the final sample. The keywords chosen a priori could

also be a limitation in this study, as their combination might not be enough to target all the articles discussing the topics of interest. It is also a possibility that there are studies, which, despite discussing negative impacts of technology, do not mention any of the keywords on its title, abstract, keywords or final section. It is almost certain that some articles have been missed by this study (Webster J. & Watson, 2002). We cannot thus be sure that our sample is the definite one, and further research would likely shape it differently. Studies following this one could take the review a step further and use the studies from our sample to perform a concept mapping, by use of text mining techniques in order to obtain a lexicon for the negative effects of using technology.

6. Conclusion

This study has investigated technology from a slightly darker point of view. We have proposed to assess the concerns of the community about its potential adverse effects on people's lives. Our findings can lead to deeper investigation on the potential adverse impacts of gamification and the application of gamified artifacts. Our purpose, which we believe was successfully fulfilled, was to aggregate theoretical grounds sustaining the need and scientific relevance for such a study. Thus, this paper provides a starting point for further studies into technologies' potential shortcomings. It shows that there has been concern in the scientific community about this topic, and that it has been intensifying over the last couple of years. Next steps on this path should include a review of the scientific community's thoughts about negative sides of gamification, as well as the application of quantitative techniques such as machine learning to obtain data that allows the definition of a solid theoretical framework on the subject. Further transversal studies on the potential negative effects of one particular technology or the mapping of mediator and moderator variables capable of mitigating the discovered adverse effects could also be derived from ours, as well as deeper transversal studies about the concept of dark technology.

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Service-learning by PhD students to aid socially neglected people

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Abstract

In recent years, there have been calls for change in higher education to meet the needs of today's society. A higher education that enables our students to offer solutions to struggling areas of our society. Innovative and differentiating solutions from what we have been used to until now. In view of these needs, it is necessary to unite the society, which reveals its main needs, and the university community, which offers solutions on the knowledge acquired. One of the ways to carry out this integration is based on developing a methodology called "Service-Learning" (SL). This learning method is based on a strategy of collaboration between educational centers and society itself. At present, this methodology is spreading within higher education institutions worldwide. This learning strategy emerged as a learning methodology in America, to be later extended to Europe, from the United Kingdom to the rest of the continent, and from there, reaching a global impact. Throughout this long road, this methodology has been improving, encouraging the creation of increasingly strong links between educational institutions and universities, and society, by promoting the improvement of student training as well as the development of certain areas of society. This paper presents a SL project where two apparently disparate areas are related, such as doctoral students in the area of chemical engineering and sectors of society at risk of exclusion. Specifically, the objective is for the students to present some of the technological developments they have achieved to a neglected sector of society, which should participate not only in the developments, but also learning about the technical base of such technologies.

Keywords: *Service-Learning; Infrared Thermography; Teaching; Social Integration.*

1. Introduction

Many of society's advances are marked by the need to reach solutions to problems found in society itself. The field of learning is not unconnected with this improvement procedure; indeed, many of the problems affecting our society serve to mark the lines of development in the training of our technicians and researchers of the future (Martínez, 2007). Today, the union of the educational community and society makes it possible for trained students to offer innovative answers that solve deficiencies in society itself, receiving in turn vital values for the development of their skills in working environments (Annette, 2000; Rodríguez Gallego, 2014). Values such as effort, ethical and civic values, social responsibility, solidarity, among others, are features that in some cases are difficult to acquire within the educational environment and by communicating with society, it facilitates their acquisition. This integration between society and educational centers is attained with an educational project or proposal that combines learning and service to society as a whole. A project in which its members learn to work in a real community environment in which their needs are present and whose main objective is to improve existing deficiencies.

In recent years, this integration has been carried out with the help of a methodology called Service-Learning (SL). It is based on a form of experience-based education, in which students spend their time helping society by presenting their acquired knowledge in certain subjects. Some authors describe SL as a non-profit program of activities led by the students themselves, oriented to satisfy the needs of a certain community, and planned in an integrated manner combining the curricular content and the student's learning objectives (Tapia, 2008). In other words, SL is the union of content learning and skills with the performance of real tasks that solve problems in society (Tinkler and Col., 2019), thus generating learning that extends from the classroom to society itself. The methodology, unlike other activities such as community service or volunteer activities, presents characteristics in areas of learning and aspects of integrity (Rodríguez Gallego, 2014). Specifically, SL is one that presents positive aspects in areas related to the training of students. Among these, it should be noted that SL promotes learning or understanding human values, without forgetting academic development, by making the skills applicable to society within the professional environment. The link between learning and society is also noteworthy, since the activities of an SL project respond to the intervention of a professional nature in a problem of society (Rodríguez Gallego, 2014; Manzano, 2010). In short, the main difference between SL and other activities are the training aspects that are integrated within a project within the academic and social fields (Butin 2006; Manzano, 2010). So much so that some authors believe that quality university education cannot be separated from social education (Martínez, 2007; Rodríguez Gallego, 2014). Along these lines, in recent years, a large number of American and European universities are actively

implementing SL methodologies into their educational programs. This has even led to the execution of institutional programs and networks that facilitate the implementation of these SL methodologies (Duffy et al., 2011; Rodríguez Gallego, 2014; Elsafty et al., 2020). The use of a methodology based on SL represents a great step forward in the pedagogical field, since the advantages mentioned will be incorporated into educational centers, including universities (Dillabaugh, 2019; Sewry and Paphitis, 2018) and doctoral studies (Sewry and Paphitis, 2018; Saitta et al., 2011). All of this will undoubtedly generate more knowledge as communities can focus the lines of work on their needs (Ching, 2018).

The main objective of the work presented is to use SL activities to train potential researchers during their doctoral period. To this end, the results obtained in various research projects that are serving as the main topics for doctoral students linked to this SL project will be used. Among the specific objectives to be achieved are: (i) to bring the main technological developments to society; (ii) for society to help transmit values to potential researchers; (iii) to foster the union between the university and society. These SL activities will focus on a part of society at risk of social exclusion located in centers belonging to the Madrid City Council, Spain. Specifically, in different centers within the Department of Social Inclusion for Integration in the Community and Social Emergency belonging to the aforementioned City Council.

2. Service-Learning Methodology Applied

This article presents a model of SL that has been developed within the doctoral studies in the Chemical Engineering program of the Chemistry Division of the Complutense University of Madrid (UCM) (Spain). This project has been carried out during two academic years 2018-19 and 2019-20. This development is focused on the design of a plan to integrate SL activities into the training of doctoral students. The team is made up of four university professors, six doctoral students, and 120 students from day centers with a significantly lower level of training than the doctoral students linked to the project. With this whole team collaborating in this project, the total number of 130 people were actively involved. In addition to the values that the doctoral students will receive, this project will significantly improve their ability to present ideas. Within the development stages of the project that is presented, different phases are contemplated and will be carried out in a sequential way (Rodríguez Gallego, 2014):

a) Diagnosis: in this first phase, not only the available human resources will be known, but also the situation and the specific problems of the community to which the model is addressed. It must be considered that almost all the people addressed by the project are in a situation of social disadvantage/exclusion, have suffered

from alcohol and/or drug addiction, and/or are under psychiatric treatment that hinders their cognitive abilities.

b) Initial coordination: a program of activities has been drawn up by the teachers in the consortium for the development of the project. This project established the guidelines for the collaboration between the professors and the SL students (PhD students). Before starting, it was necessary to contact the Madrid City Council and make a series of visits to find out in detail where the SL model was to be applied.

c) Design: different coordination meetings were held in which each of the postgraduate students organized their schedules to adapt them to the centers where the project was to be applied. They also had to start working on common strategies to carry out the activities. The total dedication of each student to these activities was two ECTS credits.

d) Implementation: two activities were carried out for different communities. The events began on 7 March 2019, with the first one, entitled "From Heart to Stroke - Food and Innovation". In this first activity a workshop/conference was held related to the application of the technologies developed by the AlgoReach research group in the prevention of cardiovascular diseases. Subsequently, on 13 March 2019, the second event was held, entitled "Thermography, a Photograph of the Human Body". This event took place at the Faculty of Chemical Sciences of the UCM. In this event, the research group AlgoReach presented several developments in the field of infrared thermography. Also, they developed a workshop where they brought the technology closer to the assistants. Besides these activities, they have planned an additional series of them within the scope of the work areas that AlgoReach is developing. Currently, the last group of events that are contemplated within the SL project "Learning-Service in the transfer of technological results", financed by the UCM.

e) Reflection: in this phase, the information gathered will help to improve and facilitate other SL students in the search and design of new events. Likewise, after each event, meetings will be held with all the parties involved in the project to know the relevant aspects and improve its quality.

f) Evaluation: to carry out the evaluation of the events, interviews were conducted among all the members of the project. Also, surveys have been carried out among those attending the event in order to know their opinion. These surveys will also inform about whether the specifications marked for the SL event have been reached in their eyes. The evaluation of the main results of this SL project is based on interviews with all the groups involved. The interview conducted is based on the structure shown in table 1.

Table 1. Interview stages planned in relation to the SL activity.

Point	Interview Stage
1	Is it linked to significant learning?
2	Is it designed to make individuals reflect on what was done during the event?
3	Does it promote understanding values?
4	Does it promote personal growth?
5	Does it promote and strengthen social ties with the community?

3. Results

At present, two events are still to be held to finalize the results shown in this project. That is why in this section the results shown are preliminary. However, the results are representative of all the results that will be obtained at the end of the project. The system for processing the surveys has been arranged on the basis of transcriptions of recorded texts, identifying complete sets. The analysis of the content has been carried out with Statgraphics 18. The analysis has been revealing, so the task of categorization and coding of the information collected was carried out. For the validation of the system of categories, it has been the teachers linked to the project that is being developed and also a group of three more teachers not linked to it. The kappa index is being calculated to reflect inter-observer agreement (Rodriguez Gallego et al., 2014). This coefficient, in all cases, has exceeded the value of 0.80, it can be considered as good coefficient value (Rodriguez Gallego et al., 2014). The results were captured through surveys of both students and teachers.

At the student level, the categories addressed focused on the three areas of student training during the development of the SL methodology, specifically: (i) in principle, the results will be approached considering the academic requirements, where mastering the contents, the positive attitudes towards work, knowing the options of presentation, and recognizing realistic ideas in the world of work among others will be considered; (ii) then, the characteristics implicit in the formation of values will be analyzed, including aspects such as self-esteem, teamwork, self-improvement, motivation, creativity, communication, responsibility, and more; (iii) and finally, relevant aspects in the area of community relations will be considered, such as social development, community intervention, diversity and values, coexistence and interaction, among others.

Among the results of the interviews, it is important to highlight the importance of problem solving by the PhD students directly from the students trying to satisfy their curiosity (point

2, **table 1**). Also, the complementarity and the teamwork among the teachers (point. 3, **table 1**). In addition to seeing more real problem solving through the union of different knowledge, not only linked to the research that is presented (point 4, **table 1**). Another characteristic that most impacted the teachers is the possibility of defending their theories and techniques in other forums different from the technical approach, responding to different types of questions (**point 5**, table 1). In practice, in all cases, the return to work in the laboratory made them see their tasks and objectives from other points of view, considering the advantages of the application of what they are doing (point 1, **table 1**). In general, one of the most generalized results is the pleasure caused by helping people that have or are suffering (point 5**, table 1**).

Considering that the students belonging to the centers, apart from allowing them to learn about new applications, in appreciation of this activity, they have proposed the creation of equipment for collaboration by helping in the design of the sensors presented at the events in which they have participated (point. 5, **table 1**).

In the field of the teachers, the categories that were addressed are distributed in the same areas considered although they do not contemplate the same points, specifically (i) within the scope of the academic curriculum, the articulation of contents, the quality of learning, the didactic strategies, and the active participation, among others, will be considered; (ii) afterwards, the implicit characteristics of the formation in values will be analyzed, including aspects such as teamwork, motivation, etc. Leadership, responsibility, among other aspects; (iii) and finally, in the area of community linkage to social development where diversity and values, pro-socialization, community intervention, among others, will be taken into account.

In general, the teachers who have participated in this project consider this methodology to be tremendously positive in order to present the potential researcher with a new scenario in which to promote and share his or her technological developments. The teachers in charge of preparing the events have also considered that based on the opinions received in the previous section, it has been worthwhile to complete the training of the teachers involved. It also complements one of the aspects that always gives great importance to the development of research projects concerning the influence on society of the results obtained.

4. Conclusions

This paper presents a service-learning (SL) project through which communities at risk of exclusion are integrated with doctoral students from the chemical engineering program at the Universidad Complutense de Madrid in Spain. Although this project is not yet finished, the results are very promising, both for the SL students and for the communities where the activities have been applied. It should be noted that the PhD students (SL students) have

acquired social skills regarding community work and collaboration. This synergy has greatly promoted not only knowledge but also value formation and community service. So much so that the activities developed, and the pleasing results obtained, open up the possibility of periodically establishing new activities based on presenting currently active technological projects.

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Drugs, Achievements and Educational Systems: Predictive Models for Society and Education through Speculative Data

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Abstract

Higher Education Student burnout is an increasingly educational and social concern. The problem is complex and multilayered, demanding new approaches in predicting hazardous situations that can lead to the demise of the mental and physical well-being of the students. This work proposes a new model that can be used to predict and prevent such educational and/or social scenarios, resourcing to new tools, as the Reductio ad dystopia *and speculative data. It departs from recent social quantum-based models and selected speculative literature works while introducing the use of social network theory to add the time variable to the model. The results clearly indicate that speculative and real scenarios can be juxtaposed in such a model, and concludes that a time interval for predicting the occurrence of the problem can be one of its advantages.*

Keywords: *Higher education; Student burnout; Social quantum-based model; Reductio ad dystopia; Predictive social networks; Drug use.*

1. Introduction

Higher Education student burnout and the resource to drugs to address it, as well as the anxiety or cognitive demands related to it, are becoming an increasingly social and educational problem (Salmela-Aro & Read, 2017; Böke *et al*, 2019). New approaches regarding this, as well as other educational matters, demand that new models be developed to research these problems, propose effective and humane solutions, and, ideally, predict future issues that jeopardize the life and the mental well-being of students. Recently, new models proposing that creative literary works can provide data to research educational and sociological issues have been presented (Moura *et al.*, 2018a; Moura *et al.*, 2019; Moura *et al.*, 2020). The models depart from the fact that imagination is a recognized neurocognitive capacity, essential to survival and creative endeavor, something that can be verified as it allows to interact in preventive manners with both real and virtual scenarios (Fuster, 2013).

Speculative fiction, namely science fiction literature, explores hypothetical scenarios regarding not only technological but also sociological situations, especially in the case of dystopias. The models based their departing premise from an already existent educational quantum model within the higher education context (Márquez-Ramos & Mourelle, 2018) and adjusted it to include data gathered from selected works of speculative literature. Then, by applying a new tool, the *Reductio ad dystopia*, which is inspired by the mathematical tool of *Reductio ad absurdum*, the model evaluates the likelihood of a speculative scenario. As in its mathematical counterpart, one departs from a hypothetical hypothesis – an absurd mathematical answer to the problem is replaced here by a hypothetical dystopian future – and the probability of such scenario will be evaluated juxtaposing it to reality in the social quantum-based model. Figure 1 illustrates such a situation for a studied case of how the use of Ritalin and similar drugs with the sole purpose to solve bad behavior in small children can be a severe infringement of Human rights (Moura *et al.*, 2020).

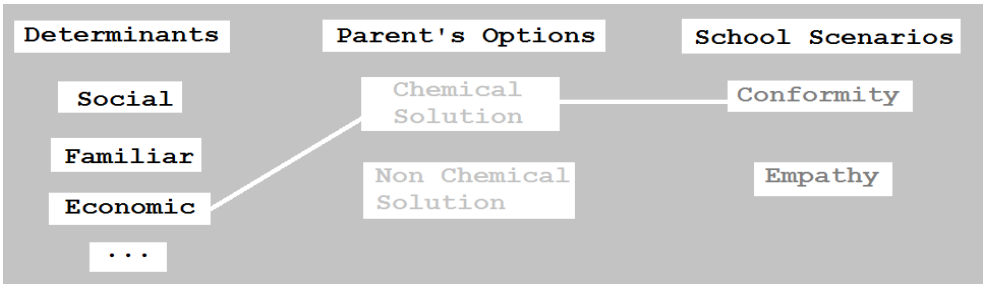

Figure 1. Scheme illustrating the Reductio ad dystopia social quantum model for educational scenarios within the Ritalin context. The first column presents several determinants that may affect the choices of the second column, leading to one of the social scenarios of the third column. By including on the three columns the data from the speculative works, one can apply the Reductio ad dystopia tool. Source: Moura et al., 2020.

However, the social quantum model lacked the 'time' variable, *i.e.*, the introduction of time as a variable to study the degree of anticipation of the dystopias for a likely future. In this work, we propose to join this model and the *Reductio ad dystopia* tool to another new model within the use of speculative data for probing sociological situations, and explore the context of Higher Education student burnout and resourcing to drugs as a solution (Moura *et al.*, 2018b). This latter model is inspired by the use of social networks in researching not only biological or medical factors, but also sociological and ethical behavior (Barabási, 2007; Kim *et al*., 2015; Gentina *et al*., 2015). To our knowledge, the combined use of these two models in such context is completely new.

2. Material and Methods

In this section we present the selected speculative literature works used to gather data, as well as the principles of graph theory used in the dystopian social networks.

2.1. Selected Literature Works

From the plethora of published dystopian/science fiction stories, seven were selected: *Brave New World*, by Aldous Huxley; *Beyond Bedlam*, by Wyman Guin; *Flowers for Algernon*, by Daniel Keyes; *Fast Times at Fairmont High*, by Vernon Vinge; *Nexu*s, by Ramen Naan; *Metaquine*, by François Rouiller; and *The Genius Plague*, by David Walton. The order of the selected books reflects their chronological order of publishing.

The selection focused on the use of drugs as a solution to eliminate unhappy, stressful or aggressive states and/or promoting enhancement of neurocapacity. As the model explored time as a variable in predicting the future, an interval of almost one hundred year was chosen.The selected published works belong to different decades within the interval.

2.2. Extraction of speculative data

The selected works were read and analyzed. They were given an identity reference to allow the use of graph theory.. In the present context, the graph nodes represent the selected literature works and the edges represent the connections between them. Two different types of connections were established. The idea/concept of two speculative stories was 'kinship' type, *i.e.*, they could be similar or analogous, or the idea/concept of two speculative stories was 'vicinity' type, *i.e.*, they present a logical progression or subsequential nature. For example, *Brave New World* describes a society where the use of drugs induces normative behavior, eliminating unhappiness and aggressiveness. Therefore, it has a 'kinship' connection with *Beyond Bedlam*, where drugs are used to eliminate aggressiveness from human beings and achieve world peace. However, *Brave New World*, as well as *Beyond Bedlam*, will have a 'vicinity' connection with *Fast Time at Fairmont High*, which explores a dystopia where students use drugs to increase their mental capacity or become social

pariahs, as unsuccessful students. The indication of the connection is made using the identity reference numbers. As *Brave New World* and *Beyond Bedlam* have been allocated '1' and '2' respectively, the indication of their connection is '1,2' . The gathered data, the classification of speculative dystopian concepts and connections, as well as a summary of social and individual options of the selected dystopias, are displayed in Table 1.

Table 1. Summary of selected speculative works regarding mental enhancement and/or socio-educational conformity through imposed social or exogeneous means.

Identity Ref.[1]	Story	Decade / Year	Social Scenarios[2]	Individual Consequences[3]	Concept type Kinship[4]	Concept type Vicinity[5]
1	*Brave New World*	30s/ 1932	Conformity || Exhile	Social acceptance || Freedom of thought	1,2; 1,5	1,6; 1,4
2	*Beyond Bedlam*	50s/ 1951	Drug acceptance || Freedom of thought	Schizrophenia || Aggressiveness	2,1; 2,5	2,4; 2,6
3	*Flowers for Algernon*	50s/ 1959	Cognitive impairment || Cognitive enhancement	(Blissful) Ignorance || Existential stress	--	3,4; 3,6; 3,7
4	*Fast times at Fairmont High*	00s/ 2001	Social status || Social pariah	Drug addition || Health	4,5	4,1; 4,2; 4,3; 4,6
5	*Nexus*	10s/ 2012	Mind connection || Individual preservation	Integration || Social pariah	5,1; 5,2; 5,4; 5,6	5,7
6	*Metaquine*	10s/ 2016	Higher brain performance || Personality integrity	Cyberaddition || Educational Outcast	6,5	6,1; 6,2; 6,3; 6,4; 6,7
7	*The Genius Plague*	10s/ 2017	Increased abilities || Individual freedoom	Social disruption || Maintenance of social paradigms	--	7,5; 7,6

[1] According to chronological publication; [2] Scenario 1 *versus* scenario 2; [3] Consequence of choosing scenario 1 *versus* consequences of choosing scenario 2; [4] Connection through similar concept between two identity references; [5] Connection through subsequent concept between two identity references.

3. Social quantum-based model and occurrence prediction

In this section we explore how the speculative data predicts the present state of affairs and the time anticipation it could have provided to predict and prevent the problem.

3.1. Social quantum-based model for Higher Education Student burnout

From the selected speculative works, two major individual and social scenarios were applied to the social quantum-based model proposed by Moura *et al.* (Moura *et a.l*, 2018a;

Moura *et al.*, 2020). The model with the speculative data is illustrated in Figure 2, and presents a well juxtaposed parallelism with contemporary Higher Education student burnout context. Therefore, the *Reductio ad dystopia* indicates the likelihood of these scenarios being matched with reality.

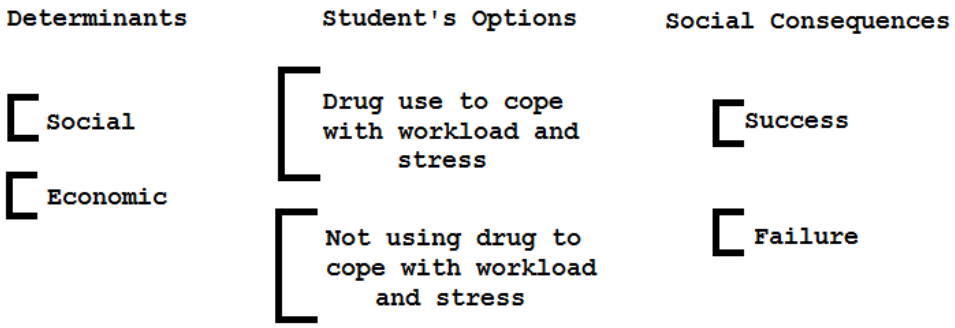

Figure 2. Social quantum-based model using the more recurring scenarios of the selected dystopian and science fiction published works.

3.2. Time prediction with graph theory and visualization

Using the connections presented in Table 1, three types of predictive social networks were developed through graph theory and visualization. In Figure 3, the layers regarding 'kinship' (layer 1) and 'vicinity' (layer 2) connection types are displayed in graph a) and b) respectively. In layer 1, regarding the 'kinship' type connections, there is a dominance of the 'neurocapacity enhancement through drug use' concept, being the prevalence of connections met at the node representing the Nexus story. The *Nexus* dystopia approaches the hypothetical student choices through the social imposition of connecting minds while eliminating individuality. However, when you consider the 'vicinity' type connection, layer 2, the subsequential ideas regarding emotional inhibition or control for educational achievement gain eminence, as noticed by the multiple connections with *Metaquine*. This is a story where the use of drugs to enhance neurocapacity while producing apathy and conformity in the students is normative.

The third graph visualization allows perceiving how the dystopian scenarios reinforced themselves through time until meeting the contemporary state of affairs. Allocating a color to a specific decade, and departing from 1931 to the final selected narrative, published in 2017, one can see in Figure 4, the emphasis met by the scenario of *Fast Times in Fairmont High*, which connects either through 'kinship' or 'vicinity' most of the nodes. In this story, either the student is able to be successful in their studies or will meet a future of social exclusion. The high demand and pressure of the workload force many students to resource to drugs to increase their mental capacity and memory, at the risk of health consequences.

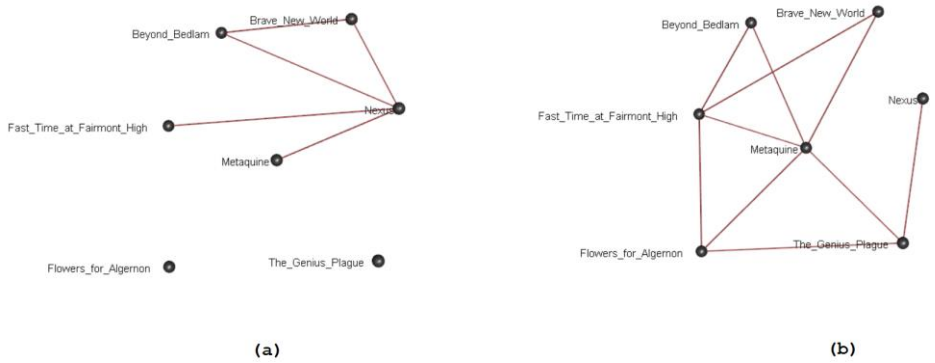

Figure 3. (a) Graph visualization of the connections between speculative literary sources regarding similar concepts or ideas - Layer 1. Each node represents a speculative work and the connections indicate that the nodes share similar concepts or ideas. (b) Graph visualization of the connections between speculative literary sources regarding subsequent or ensuing concepts or ideas - Layer 2. Each node represents a speculative work and the connections indicate that the nodes share subsequent or ensuing concepts or ideas. Original data and graph.

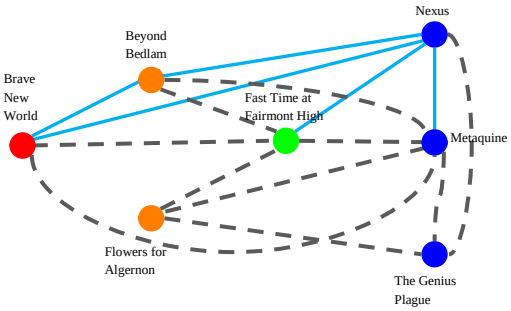

Figure 4. Graph visualization of Layers 1 and 2 per decade (Red, 1930s; orange, 1950s; green, 2000s; blue, 2010s). The dashed line indicates a Layer 2 type of connection (subsequential concept) and the continuum line indicates a Layer 1 type of connection (similar concept). Original data and graph.

It is noteworthy that the publication of *Fast Times at Fairmont High* is, on average, seventy and fifty years apart from the preceding dystopias but only ten to fifteen years apart from the more contemporary stories. These more recent stories include cyberaddiction and online context in many occasions, as well as the present-day pressure on students that leads to burnout and the resource to drug use to keep up with both the workload and the stress of educational situations. As such, the use of these models could help prevent such real-life scenarios by exploring *Reductio ad dystopia* juxtaposition of initial cases *versus* the time period when the speculative data begins to present a 'focal' node, as was the case of *Fast Times at Fairmont High*.

4. Conclusion and Future Perspectives

Higher Education faces many challenges, the least of them not being the fact that an increasing number of students face burnout during their academic path. Moreover, the options many students chose to deal with such a possibility may be as damaging as the burnout itself. The damage this and other social situations provoke, as well as the need to evaluate solutions that avoid future or new grievances needs to be explored by new methodological approaches. The use of *Reductio ad dystopia* models with time prediction through social networks can be a useful tool to predict not only these scenarios but the likelihood of 'when' they may become a significant problem. It would also allow us to explore solution scenarios as well, and prevent the loss of the overall well-being of many students.

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Marking Schemes for an Authentic Group Project, Trial by Statistics - A Case Study

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Abstract

This study is an analysis of two different marking schemes for an 'authentic' Group Project worth 50% of a first year undergraduate university agribusiness course at The University of Queensland (UQ). A number of different marking schemes for the Group Project had been trialled over the last ten years in an effort to obtain an equitable method of marking individual students doing the Group Project. In 2019, a marking scheme for the Group Project that had been successfully used previously was advertised for 2019 prior to the commencement of semester. However, issues during the semester within some of the Groups meant that students requested a Peer Evaluation marking scheme be employed. Eventually, for a class of 105 students, both marking schemes were used in assessing students' work and a Pearson Correlation coefficient was run on the results of the final project mark to determine how equivalent the two marking schemes were. A good correlation (0.75) between the two schemes was returned, which was also reflected in a good correlation in the comparison for the final overall mark for the whole course (0.87). These statistical results suggest that there is a good argument for the existing marking scheme to continue to be used rather than a peer evaluation, which can have behavioural issues associated with it that are difficult to resolve.

Keywords: *Authentic; Group Project; Marking Scheme; Peer Evaluation; Correlation coefficient.*

1. Introduction

When lecturers meet in the corridor or chat over a cup of coffee, inevitably they get around to discussing issues they are facing in their classes. Often, the discussion quickly moves towards the assignments being undertaken by students, how they are doing them (or not) and the marking of them. Much can be learned by colleagues and peers during such informal discussions (Nonaka and Takeuchi 1996). In fact many times people find that 'their' problem or issue is not theirs alone but has presented itself already to others who have managed to create a solution or workaround. The project presented in this paper came about because of such discussions.

This study resulted from three issues in teaching a first year undergraduate course about the use of 'E' technologies in the agrifood chain in the Bachelor of Agribusiness at The Universiy of Queensland (UQ) in Semester 2 2019. The issues were that (i) the main piece of assessment for the course was worth 50%, and needed to be an 'authentic' assessment piece that engaged students in making use of content taught in the course which related strongly to industry practice; (ii) with 105 students in the course, this piece of assessment needed to be undertaken in small groups (no more than 4 students in a group); and (iii) the markng system used had to deliver a fair and equitable mark to individual students within each group, which was more difficult than it initially sounds, because while the course was ostensibly a 1st year course, other higher year level students were able to take it as an elective. This meant that quite apart from potential issues of students not pulling their weight in the group because of poor scholastic effort (for example), group members were quite diverse in their knowledge, maturity and abilities, which did impact on the overall quality of the final projects delivered by groups. This in turn meant that a high performing individual in a low performing project could be penalised as a result of the make up of the members of the group (Chang and Brickman, 2018).

The project described here looks at the three issues in the context of contemporary educational literature and provides a statistical analysis of the validity of two criterion based marking (grading) schemes used in order to deliver equity to individual students in terms of their final marks for the Group Project in the case described.

1.1. Group Projects as Authentic Assessment

A group project can be defined as "a graded assignment requiring students to work collaboratively across multiple class periods and involving some time outside the normal class meeting" (Ettington & Camp, 2002, p. 357). Group projects as part of university course assessments are a widely used teaching tool (Wilson et al, 2018), and there is a well established pedagogical literature on the topic showing a number of benefits of group work for students, including: (i) learning teamwork skills (Davis and Miller 1996; Michaelsen et al. 2014) - a skill often requested by employers (Graduate Outlook Survey 2010); (ii)

improving critical thinking skills (Anderson et al. 2001, MacGuiness, 2005); (iii) improving communication and collaborative skills (Slavin, 2014); and (iv) gaining insight into a particular topic at a deeper level than individual research (Burke 2011). Furthermore, as large organizations have become increasingly dependent on small groups or teams to achieve their goals, it has becoming increasingly important for employees to have the ability to work together collaboratively in today's business world (Aggarwal and O'Brien 2008). As an 'authentic' piece of assessment (Frey et al. 2012), a group project, if designed properly, can often tick all the boxes. The definition of authentic assessment is commonly agreed to be an assessment with real world applicability and one that students can employ what they have learnt during the course to perform real-world tasks (Mueller, 2018).

Despite being a good teaching and learning tool, there are challenges associated with group projects, which if not managed can prevent effective learning and result in poor-quality outputs, unequal distribution of workload, and conflict among team members (Chang and Brickman 2018). Indeed, the concept of 'social loafing' or scholastic laziness (Aggarwal and O'Brien 2008, Pandeira and Aseng 2017) creates an imbalance of effort, such that 'free riders' are able to benefit from the contributions of others, which is received badly by other students. Lecturers also need be aware that group projects introduce their own grading complexities – and it is the grading complexity of a group project that arose during the course of the semester that forms the focus of the study described here.

1.2. Marking/ Grading of Group Projects

Marking (or grading) a group project is a complex task. Koshy (2009) and Brookhard (2018) give good overviews of the literature and a multiplicity of university 'how to' webpages give advice. Essentially, however, what has to be determined is whether the lecturer assesses the product (overall piece of assessment or project) or assesses the process (evaluating an individual's work within the project), or both. Once this has been decided, the actual marking schemes to be used needs to be developed.

Barnes, (1997) describes two main schemes (i) criterion based reference frameworks, where assessment of an assignment is made on the basis of performance defined by pre-specified criteria; and (ii) norm referenced approaches, where assessment is made on the basis of performance relative to that of other members of the class or cohort. Criterion based frameworks have become more popular over time and requirements for more transparent schemes with better learning outcomes for the student have ramped up in recent years (Koshy 2009). Thus rubrics that 'articulate expectations for student work by listing criteria for the work and performance level descriptions across a continuum of quality' (Brookhard, 2018)) within criterion based schemes have become more favoured compared to norm-based schemes.

2. The Case Study

This case study is based on the marking of an authentic piece of assessment for a course entitled "ETechnologies in the Food & Fibre Industry" where students were asked to create an innovative "E" product within an electronically enabled Agribusiness and to 'sell' this product in as innovative a manner as possible, documenting how the new product could add value to the business. The project had to be undertaken in small groups of four students

(Burke, 2011 indicates that small groups generally realise better learning than larger groups), and was worth 50% of the overall course assessment marks. The groups were put together by the lecturer to prevent groups of friends or year levels 'ganging up'. The project when completed was delivered via a new online platform at UQ called CIRRUS, which also had a facility to create a PDF document to be uploaded into the Course Blackboard site by each student. The Project was scaffolded with an instruction document with clear guidelines of requirements and Marking Criteria (Table 1) and was assessed on two main areas: The "Idea" (20 marks): and an 'E' Product/Agribusiness Business Plan (30 marks).

Table 1 Marking Criteria and Ratings for the Group Project

CRITERIA	MARK
EAgribusiness IDEA	**(10)**
Creativity / Idea	
Logic in terms of an E Agribusiness and how it fits	**(15)**
Presentation method within CIRRUS (Innovative / Interesting)	**(20)**
TOTAL x/45 = x/20	
REPORT	
Business Snap - Overview of the Business Mission, Vision, Goals, Products & Services Evidence of reading and desktop research (What, Why, How)	**(20)**
Key EAg issues for the agribusiness industry sector you are dealing with in general.	**(15)**
Product Canvas Model - Diagram correctly filled in	**(20)**
IT & Info Sys Plan - What do you need	**(10)**
Budget- Income and basic costs	**(10)**
Marketing Strategy- What is it	**(5)**
Cyberdefense Strategy- What is it	**(5)**
Report Presentation - Appropriate use of CIRRUS as per guidelines, Grammar, spelling, writing skills, quality of diagrams, flow charts, URLs etc,	**(20)**
TOTAL (x/105) = (x/ 30)	
TOTAL *(Idea + Business Plan Report)* **(x/50)**	

A marking scheme (the ECP Weighting system (ECPW)) that has been successfully used since 2013 for evaluating an individual's mark for the group project was used and advertised prior to commencement of semester (*success here defined in the sense that students have reported that the ECPW reduces 'free riding' that can occur in group projects*). Table 2 shows a worked example of how an individual's mark was calculated using the overall Project mark as basis. A weighting for each student in a Group was assigned by averaging their marks over the previous assignments in the course equivocated to projected final grade.

Table 2. Worked example of Individual's mark calculation example is for a 5 person Group with an overall Project mark of 85%.

Weight/Grade 1,2,3	**Weight/Grade 4**	**Weight/Grade 5**	**Weight/Grade 6,7**
0.7	0.8	0.9	1
Persons 1 &2	(average grades 7&6 respectivly)		85*1 = 85
Person 3	(average grade 5)		85*0.9 = 76.5
Person 4	(average grade 4)		85*0.8 = 68
Person 5	(average grade 2)		85*0.7 = 59.5

However, issues during the semester within some of the groups (social loafing and free riding, not logging onto the CIRRUS platform to deliver any physical input into the project, poor or no communication, plagiarised work from websites), meant that several groups of students requested a Peer Evaluation marking scheme (Dyrud, 2001).

Consultation with the class to verify that this was what was collectively wanted and that everyone was familiar with the process from previous classes, took place. With an affirmative answer, a formal evaluation scheme with rubrics was developed (Table 3) which was mandatory for all students to use – uploading their evaluations with the CIRRUS linked PDF of their project into the Course Blackboard site Project assignment link for marking.

Table 3. Peer Evaluation (PE) Marking Scheme and rubric. 7 Assessment Criteria and 5 levels of performance 1 (no input) - 5 (high input). Mark converted to PE weighting (PEW) factor 0-1.

Assessment Criteria	Poss Mark 5	0-1 No input	2 Low/ poor input	3 Average input	4 Substant input	5 Frequent input
1. Level of input in the *dev of the concept (The IDEA)*						
2. Level of input in *designing the Project*						
3. Level of input in *collecting required background information*						
4. Level of input in r*eport writing (The REPORT)*						
5. Level of input in finding Graphics and Graphics design						
6. Group work & Communication **• Collaboration** **• Understanding** **• Editing**		No work in group & little effort Plays no part in Group	Barely worked with group & min effort shown	Adequate comms & effort. Ave team member	Good comms & effort put into report. Imp team memb	Excel report work, & comms. Vital team memb
7. Quality of Work		Poor	Low	Accept	Good	Exel
Total Peer Evaluation Mark based on above criteria = x/35						

3. Marking Process for the Group Projects and Results

Eventually, for a class of 105 students, both the ECP weighting scheme (ECPW) and Peer Evaluation weighting scheme (PEW) were used in assessing students' work. A Pearson Correlation coefficient was run on the results of each group's overall project mark obtained using each marking scheme in order to determine how equivalent the schemes were. The process of marking the group projects was an exhaustive practice to ensure equity, given the concerns that students had voiced.

The project was first assessed overall (to obtain 'product' mark) and a group mark was assigned based on the Marking Criteria shown in Table 1. Individual student marks within each group were then calculated using their group's overall project mark and the ECPW shown in Table 2 (Individual Project Mark 1). An individual's project mark was also calculated using the overall project mark and the PEW scheme shown in Table 3 (Individual's Project Mark 2).

A Regression Analysis on each individual's marks for their *project* was calculated in Excel using the ECPW vs the PEW system and also on their ultimate overall *course* mark using the ECPW project mark vs the PEW project mark. An R^2 of 0.7469415 and 0.876877 respectively was obtained meaning the two marking schemes were strongly correlated, and that neither would penalise students in terms of their overall final grade for the course.

There were some actual mark differences for individuals between the two marking systems (Figure 1). Most were less than 1 or 2 marks but eight student marks were significantly different (>5 marks). On review these were due mainly to individuals either 'opting out'of being in group (n=2, with one student being given a PEW of 0.1 but having a much higher ECPW of 0.8, and the other a PEW of 0.35 and an ECPW of 1.0), or simply not participating at all and not submitting anything (eg PDF from CIRRUS or PEW document) on the Blackboard site (n=2), or they were in a group in which all students gave each other full marks on the PEW (n=4) such that poor early assignments giving a low ECPW, were negated.

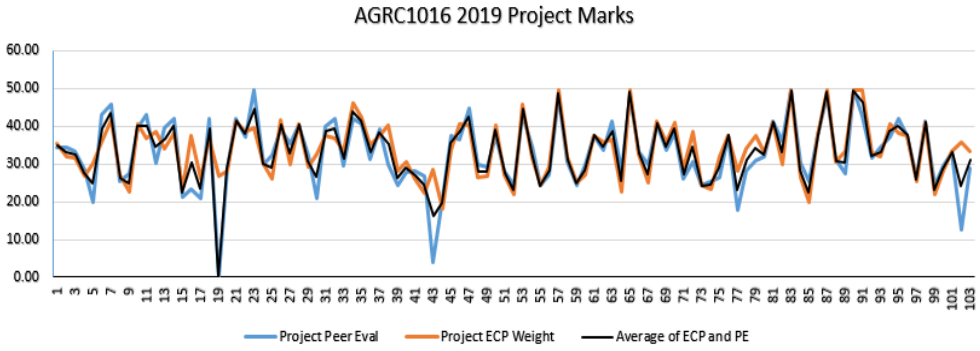

Figure 1. AGRC106 Group Project marks for 105 students.

My own observations and discussion with students indicated that the PEWs were fairly accurate in most cases, although it is acknowledged that scores were skewed in others. This reflects the literature where in a number of studies, PEW schemes have been shown to be both positive and negative – positive in that it gives students a chance to participate in the marking of their projects which gives ownership and interest and to some degree prevents 'free riding' but negative in that occasionally some students may not give honest evaluations or evaluations that really reflect other students efforts (Strong & Anderson, 1990, Dyrud, 2001). This, plus the fact that the PEW was introduced late in the semester and students were not thus 'prepped' for its use, made it seem fairest to calculate an individual's final project mark and thus final course mark using an *average* of the PEW calculated marks and the ECPW marks. As expected - the average had a strong correlation to both systems = PEW = 0.968871 and ECP = 0.968589 respectively.

4. Conclusion

The results of this small statistical analysis between two criterion based marking schemes suggest that there is a good argument for the established and advertised ECPW marking scheme to remain in place for the Group Project in this course because it accurately reflects how students go on to work in their groups as assessed using the PEW scheme. This result, despite the previous years' of success in using the ECPW for marking the Group Project in this course, also allays a minor procedural concern that the ECPW - through its structural adjustment using the past quality of assignments to predict a future mark in the Group Project - could be seen as not facilitating a student to improve their final course mark over the semester. This potential issue which aligns with setting deep learning goals, is discussed in Hermida, (2015:Ch 1) and will be tested during a further iteration of the marking systems' comparison when the course is run again in 2020.

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Alternative Strategies for Higher Education Provision at TAFE Queensland

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Abstract

Australia's tertiary education and training sector consists of Higher Education, predominantly funded and controlled by the Federal Government, and Vocational Education and Training (VET) where both the Federal and State Governments have policy and funding responsibilities. While there has been increasing funding and stable policy in Higher Education over the past decade there has been significant change in the Australian VET sector in policy and reduced funding at both the Federal and State Government levels. TAFE Queensland, the public VET provider in the state of Queensland, has undergone a huge transformation of its own over this period of extensive policy change. As a result of policy and organisational changes TAFE Queensland has had, and will continue to have to seek alternatives to ensure that students who choose to study at this public provider are able to access higher education courses. This paper outlines various policy change impacts over the past decade and TAFE Queensland's innovative approach to ensuring that quality applied degrees are available to interested students who prefer to study with this major public vocational education provider.

Keywords: *Policy; competency; applied; change.*

1. Introduction

Australia's federal system of government is enshrined in the Australian Constitution. This structure provides for six states and two territories with power being divided between the state governments and the central or Federal Government.

The total population at September 2018 was 25.1 million – with over 50% in the largest two states of Victoria and New South Wales. Queensland is the third largest by population; the second largest by area; with the third highest population density at 2.97 people/km^2.

The Federal Government has responsibility for developing national policy in areas such as defence and foreign affairs; trade, commerce and currency; immigration; most social services and pensions.

State responsibilities include schools, hospitals, community services, sport and recreation; consumer affairs; police and emergency services; prisons; public works and such like.

The Council of Australian Governments (COAG) structure, that includes all state, territory, and the federal government, acts as the peak intergovernmental forum for Australia.

Higher education responsibility sits with the Federal government who are responsible for support through policies, funding, and programs. Universities and higher education providers are either publicly or privately owned with the majority being publicly owned.

Public university students are eligible for 'Commonwealth Supported Places' (CSP) which in most cases cover the majority of their course fees regardless of the state that they are studying in. All university students are entitled to access the Federal student loan scheme, known as HECS-HELP, that covers an gap fees and thus allows almost all undergraduate students to enter university at zero up front cost.

The regulator for the university sector is the Tertiary Education Quality Standards Authority (TEQSA) which enables the majority of university providers in Australia to be self-accrediting in terms of course offered.

In the Vocational Education and Training (VET) sector there is a joint responsibility between the Federal and State and Territory governments. Each state supports a public owned training organization(s)[1] and there are many more for profit private training organisations. While there are some Commonwealth VET Student Loans (VSL) arrangements that are common across States, the cost of courses and subsidy provided by

[1] These are referred to as Technical And Further Education (TAFE) institutes – most states have a single institute except Victoria where there are multiple TAFE institutes

each individual State/Territory can and do vary widely. The impact of the Federal VSL system and differing State/Territory subsidies means that there can be widely different costs of entry to the same course for students who are studying in different states or even across public and private providers in the same state.

The VET sector in Australia operates across a Commonwealth Department of Education managed 10 Level Australian Qualifications Framework (AQF). "*The AQF is the national policy for regulated qualifications in Australian education and training. It incorporates the qualifications from each education and training sector into a single comprehensive national qualifications framework. The AQF was introduced in 1995 to underpin the national system of qualifications in Australia encompassing higher education, vocational education and training and school*" (AQF, 2019). While the AQF covers up to Doctoral Level very few university courses are actually registered on the AQF.

Qualifications registered within the AQF and the majority of organisations offering them are subject to regulation by the Australian Skills Quality Authority (ASQA) and consist of national training packages, qualifications, courses, and units of competency. There is very limited provision for self-accreditation of courses of study under ASQA regulations.

2. Major Policy Changes Impacting TAFE Queensland

Over the last 20 years the Australian VET system has undergone significant transformation through successive changes of government (at Federal and State levels) in response to changing economic and societal needs. A number of significant changes have been made across that decade that has negatively impacted the funding for and therefore participation within the VET sector whilst the university part of the higher education sector has remained mostly unchanged. A precis of the most critical policy impacts are:

- November 2008, COAG endorsed a new Intergovernmental Agreement on Federal Financial Relations (IGA FFR) that included there six new National Agreements (NAs) including one for Skills and Workforce Development (NASWD). At that time there was also agreement reached on new forms of payments to "fund specific projects and to facilitate and/or reward states and territories that deliver on nationally significant reforms". (SCRGSP, 2009).

  The NASWD has at its core a fundamental shift from being driven by the providers (at that stage predominantly State and Territory publicly owned TAFE institutes) to a system notionally driven by the needs of industry and the economy. It was, in every way, leading to a shift from a 'supply-driven' system (i.e. old public TAFE) to a 'demand-driven' system (i.e. fully competitive market) that had

at its core a very clear marketization signal associated with the pervading neo-liberal agenda of most western governments.

- In 2012 the Federal Government committed $1.7b over 5 years to a new National Partnership Agreement on Skills Reform (NPASR) to further the reform of the vocational education and training system – a clear sign to increase the user pays, fully competitive, market led system in the States. This provided an incentive for every state to even more fully open their training market to competition for Government subsidised training places which increased the pressures on TAFE institutes to become more 'commercially' focused. At the core of the NPASR was an 'entitlement' or voucher style funding model to guarantee each eligible citizen access to an entry level vocational education and training qualification though a provider of their choice – this took slightly different forms in each state.
- In 2012 the Australian government removed the cap on government funding available to support university enrolment for eligible undergraduate domestic students attending public universities. The reform permitted public universities to receive Commonwealth support for all eligible students they enrolled, and to choose the course mix they offered which was at direct odds to the market based reforms occurring in the VET sector.
- In 2016 the Federal Government announced that the existing VET FEE HELP loan system was to be scrapped due to rorting of the system by a large number of private providers (Dodd, 2016). It was replaced by the VET Student Loan (VSL) system that reduced the amount of funding for students and increased the underlying cost of entry to VET study – particularly at the Diploma level.
- In 2017 the Federal Government reinstated capped university places (i.e. the number of CSPs) at 2017 levels for two years.
- In the 2017/18 Budget the Federal Government announced a review of the AQF. The AQF report was published in October 2019 and proposes a significant review of the AQF which includes a significant structural change from the existing ten levels to eight bands of knowledge and six levels of skills (Noonan, 2019)
- In 2019 COAG agreed to a process to reform the VET sector and the Skills Council has developed a VET Reform Roadmap which has developed to a consultation draft.

3. Policy Impacts

Historically, affordability and accessibility of TAFE to students and business has been intrinsically linked to the level of government funding provided to certain priorities. Affordability and accessibility were impacted by the transformation of the Australian VET system to a managed market model. Priority qualifications under the national training entitlement meant that other programs attracted less government funding and therefore the cost to students wanting to undertake lower priority courses increased. This had the unintended effect of limiting training for low socio-economic and/or disadvantaged groups and also contributed to higher deferred debt through income contingent loan schemes.

Figure 1 clearly shows that marketisation through policy changes drove down government investment (i.e. combined Federal and State) in VET which in turn led to increased costs for students and thus further decreased TAFE enrolments. This led to decreased VET investment over the period 2011/12 to 2015/16 – both in real terms and even more so in comparison to the increase in university based higher education where the introduction of uncapped demand driven funding led to a significant increase in enrolments and thus funding. The proportion of private training providers seeking registration each year has risen steadily over the past 10 years and in 2015 was almost 95% (Korbel & Misko, 2016) of the total providers. The total number of VET providers has been approximately steady over the past decade at around 4,500 across Australia – but this figure is high compared to other OECD countries when proportioned across the total population (ibid).

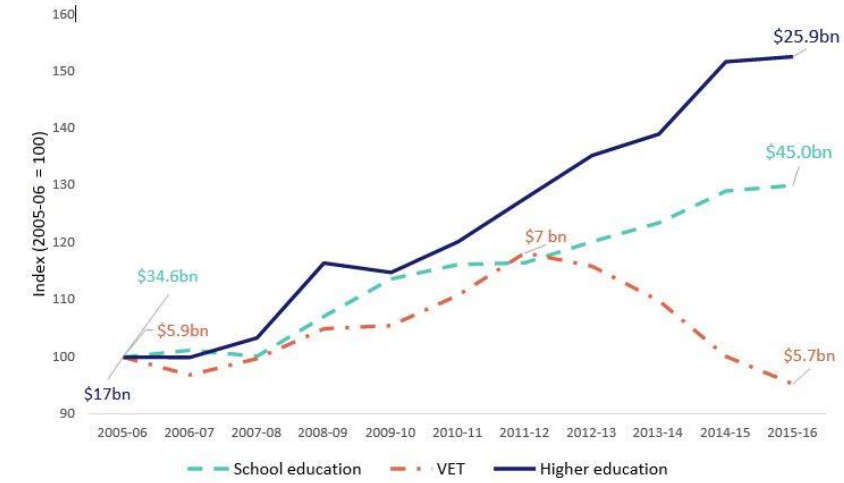

Figure 1. Government Investment in Education.

The challenge nationally, and for VET sector stakeholders and clients, is the propensity and ability for clients to pay fee increases for services that are no longer prioritised for government investment. This issue is a natural consequence of shifting priorities for government funding in a fiscally restrained environment.

The initial years (2014 to 2017) of TAFE Queensland's existence was in the context of fundamental change in the VET sector across Australia. The Federal student Loan system VET FEE HELP (VFH) was established in 2008 and grew from $25 million in its first year to $1.3billion by 2013. This was a direct result of changes in 2011/12 that removed a requirement for VFH courses to hold articulation agreements with a Higher Education Provider and other changes that encouraged greater private sector provider access to the scheme. Unfortunately, some private RTOs saw this as an opportunity and over the next four years the annual Commonwealth loan amount for diploma level courses blew out to $2.9billion.

It was identified that many of the students were falsely enrolled through incentives and the completion rates for some colleges were as low as 8%. In late 2016 the VFH scheme was halted and a much more controlled VSL scheme was introduced for much smaller number of providers from January 2017 onwards (Dodd, 2016). As with so much central policy work the unintended consequences of the change has negatively impacted on the remaining providers including TAFE Queensland where courses subject to the new VSL system have seen enrolment reductions in Diploma courses approaching 30% over the past two years.

In 2018 the Federal Government instigated an expert review of Australia's vocational education and training system. This review was undertaken by the Honourable Steven Joyce, a former Minister of the New Zealand Government. Amongst many other findings it was identified that "*Funding system inconsistencies between States and Territories, between States, Territories and the Commonwealth, and between the VET and higher education sectors – were all identified by Review participants as creating unnecessary complexity and inequity*" (Joyce, 2018). This is a major concern for TAFE Queensland whose aim is to provide seamless pathways for all students to reach their desired learning goals.

4. TAFE Queensland Reforms

The Queensland State Government introduced legislation in 2012/13 that included full open competition within the VET sector from 1 July 2014 and a concurrent ambitious reform of the Queensland TAFE sector. At that time, the sector consisted of 13 semi-independent TAFE Institutes with two operating as Statutory Bodies. The legislation established TAFE Queensland as a new single entity Statutory Body that commenced operations in July 2014 with six semi-autonomous regional bodies. On establishment of the new TAFE Queensland

entity there were some 50 locations across Queensland; just over 5,000 FTE employees; servicing some 125,000 students each year. The new TAFE Queensland was the largest VET provider in Queensland by a significant margin and was the second largest in Australia after the recently reformed TAFE New South Wales.

Prior to the reforms each TAFE institute offered a range of VET diplomas that provided pathways into university courses with varying credit arrangements. Only Southbank TAFE offered its own TEQSA approved Associate Degree program that allowed students to access student loans under the FEE HELP scheme. Under the new TAFE structure it was decided to investigate offering degrees to enable students who wished to continue their study by providing pathways from diploma to degree without having to change provider.

5. Higher Education delivery at TAFE Queensland

During 2014 two applied degree programs were developed by staff within TAFE Queensland that subsequently gained TEQSA accreditation and approval. These were the Bachelor of Dental Prosthetics and the Bachelor of Creative Arts and Entertainment.

The Bachelor of Dental Prosthetics degree was specifically developed to meet the needs of the dental profession and was subsequently accredited by TEQSA. This program recently attained Australian Dental Professional Association accreditation following graduation of the first cohort of students in 2018.

It was also recognized that the Bachelor of Creative Arts and Entertainment was unlikely to be supported by TAFE students due to the high entry cost to them as it was not eligible for CSP. Through 2015 negotiations commenced with a number of potential university partners to identify a source of CSP places for TAFE students.

The University of Canberra (UC) had a desire to increase its student cohort and was also keen to expand its creative industries program offerings. A formal agreement was reached to allow UC to offer the contemporary TAFE Bachelor of Creative Arts as UC branded and accredited courses. In return agreement was reached with UC that TAFE could offer those UC courses at its Southbank Campus taught by TAFE teaching staff with students enrolled as UC students thus allowing them access to UC's CSPs. Furthermore, the arrangement recognized that the TAFE Diplomas were of a standard that allowed the students to gain advanced standing of up to one year. This meant that students could enroll in a TAFE Diploma, pathway into the second year of a UC degree, and in three years graduate with two qualifications.

While there was good take up from students in the creative arts area within the large urban Southbank Campus of the Brisbane region similar options for other course areas such as business and ICT were not as easily developed. It became readily apparent that internal

champions at both entities were essential for this novel partnership opportunity to be formalised and made operational.

Through 2016 the attractiveness of the UC partnership model was identified by other smaller regions within TAFE Queensland. A 'hub and spoke' model was implemented to provide a way of enabling students from smaller cohorts in three regions – namely Gold Coast, East Coast, and North. During 2016 and 2017 enrolments were accepted in these regions but due to the low numbers of potential students wanting to take up this option coupled with a lack of expertise in higher education delivery this model ceased to operate in 2018 with those regional students being taught out through 2019/20.

With the re-introduction of caps for university students from January 2018 UC identified that it wished to re-evaluate the existing arrangements. Negotiations continued over the next 18 months and in late 2019 a new UC partnership has been signed. This new agreement focuses on the five creative arts majors that have formed the backbone of enrolments for TAFE students and is constrained to the Southbank campus of the Brisbane region.

Over the 2018/2019 period negotiations have also continued with other universities with other regions. This will allow TAFE Queensland to add diversity to the CSP supported degree offerings that can be made available to our students that recognizes the strengths of individual regions and their partner universities. As we enter 2020 there is an emerging multi-partner model that provides a much wider range of opportunities for our students:

- TAFE Queensland Bachelor of Dental Prosthetics and Associate Degree in Engineering at the Southbank Campus, Brisbane region
- UC Creative Arts at the Southbank Campus
- Southern Cross University Music and ICT courses at the Coomera Campus, Gold Coast region.
- Federation University Applied Management at Southbank Campus.
- Central Queensland University Creative Arts at the Cairns Campus, North region.
- Central Queensland University Cyber Security and Robotics at the Southbank Campus.

With an innovative approach to partnerships TAFE Queensland has made it possible for students to commence with a Diploma program and exit with a Bachelors degree with the same minimal entry costs as students who choose to enter university directly – something that few other TAFE institutes across Australia are able to emulate.

The VET Reform Roadmap Consultation Draft (2020) proposes, amongst other objectives, a *"stronger alignment and integration between VET and Higher Education"* sectors, as previously outlined in the AQF review, that will allow VET students to access Commonwealth loans to study applied degrees offered by TAFE institutes. This will make the cost of entry lower and ensure that students studying degrees at TAFE Queensland are not disadvantaged c.f. those who enter universities.

This will provide opportunities for TAFE Queensland, a known high quality VET institute, to continue to develop its own higher education programs to allow students who chose to pathway from entry level certificates to degrees at the one quality provider. By working with university providers through the change period TAFE Queensland is building its own expertise to be ready for the new tertiary education framework in Queensland, Australia.

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A score methodology to assess concept maps in medical education in the context of pathophysiology teaching

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Abstract

The main objective of pathophysiology teaching is to facilitate the learning of mechanisms of diseases and the understanding of their expressions in patients (symptoms, signs and tests). This objective requires the application of basic biomedical science to explain the abnormalities expressed by the patients. The capacity to integrate this new organization of knowledge is essential to the understanding of pathophysiological mechanisms, which explain expressions of specific diseases. Our group has a longstanding experience in the teaching of pathophysiology to medical students using problem-based learning (PBL) and concept mapping (CM). This semestral discipline has a yearly intake of 190 students, divided into 18 tutorial groups and supported by 14 tutors. The students' learning progress is evaluated by their performance during the tutorial sessions and the CM methodology has been introduced as an additional tool to visualize the integration of knowledge and how it is displayed in the different pathophysiological mechanisms. Until now, the evaluation of CM has been qualitative and used as an additional assessment tool by the tutors. The presentation will show how we are changing this approach by training the tutors and developing a scoring methodology, together with a preliminary application of the score to selected maps.

Keywords: *Concept maps; Critical thinking; Medical Education; Pathophysiology; Score.*

1. Introduction

Concept maps are graphical tools that depict relationships between concepts, representing the organization of knowledge structure. During construction of CM, students organize concepts related to a certain domain and link these concepts in a hierarchically organized knowledge framework (Novak & Gowin, 1984). CM have been increasingly used in medical education and in a recent review (Torre et al, 2013), it was clearly stated the importance of developing scores to assess the validity and reliability of CM to evaluate the students' ability to display acquired knowledge by connecting and integrating newly acquired information with previous knowledge and develop critical thinking (Torre, 2017). These skills are important in medical education where students have to integrate and apply basic sciences knowledge to the understanding of disease manifestations, diagnosis, and treatment. Pathophysiology is a discipline that helps to develop those skills.

Pathophysiology teaching was introduced at NOVA Medical School (NMS), in 1982 and pioneered the introduction of Problem-Based Learning (PBL) in undergraduate medical education in Portugal (Rendas et al., 1998; Neuparth & Rendas, 2016). The CM methodology was an additional educational innovation, starting in 2002 (Rendas et al., 2006), to allow the visual display of pathophysiology learning during the analysis of the PBL cases. In the academic year of 2018-2019, it was decided to reorganize the tutorial sessions, reviewing the use of CMs without any change in the previous syllabus. The main reason for this review came from the feedback from the students of the previous years, namely 2017-2018, expressed in the anonymous responses to a standardized questionnaire, which is part of the institutional policy of NMS to evaluate the quality of teaching.

Concept maps can be an important measure of knowledge structure in medical education, but there is limited information regarding the validity and reliability of CMs assessment scores (Schmidt, 2004). Since the introduction of CM in the pathophysiology course at NMS, no scoring methodology has been used and the assessment is still currently based on a qualitative analysis of the various components of each map. The current project aims to address this issue within the context of a whole course involving tutorial sessions to around 190 students, divided into 18 tutorial groups and accompanied by 14 tutors for a whole semester.

According to Torre et al. (2017), two main scoring systems are currently used:

1. Structural scoring based on the work of Novak & Gowin (1984) and adapted by West (2000) which considers five components: concepts, connecting links, hierarchies, cross-links, and examples. In this context, a concept is a label given to any information considered relevant and enclosed in a circle within the map; a proposition is a relationship between two concepts (two circles), with an arrow pointing to the direction of the relationship and a connecting word, or short sentence (connecting link), in between; in hierarchies, each subordinate level of concepts,

usually more specific and detailed, is drawn below the more general, or global, propositions; cross-links, are connecting links between concepts or propositions displayed between hierarchical levels; examples, are specific objects or events that validate instances designated by the specific concepts or propositions.

2. Relational scoring developed by Yin (2004) aims to quantify the number of propositions in order to access the meaning of the relationships between the concepts, for example by constructing a CM with created connected words or with selected linking words.

In medical education, the situation is very complex because the clinical information about a patient with a specific disease usually encompasses various knowledge domains and new developments in science and technology are constantly applied to diagnosis and treatment. For all these reasons, we are reporting our work in progress to develop a scoring methodology that will consider these issues in the context of pathophysiological teaching and learning.

2. Methods

2.1. Background

In the academic years of 2017-2018 and 2018-2019, the pathophysiology unit was composed of lectures and tutorial sessions using CMs, based on an organ/body system approach, covering the following five blocks: digestion, respiration, circulation, renal and body fluids and the endocrine system. Each tutorial group participated in twenty sessions, four per block. In the initial tutorial session of each block, the students received a clinical vignette (patient case), and discussed, with the assistance of the assigned tutor, the relevant information from the case, including the underlying pathophysiological mechanisms and the ways in which they can be visually displayed using CMs. The students installed and used the freely available software program Cmap tools (IHMC Cmap Tools, Florida, USA). In the following three sessions, the students, in smaller groups (3-4), improved the CMs, based on learning issues identified during self-learning which occurred between the tutorials. In the last session of each block, the whole group presented a final CM for discussion.

Concept maps were constructed to be read in a clockwise manner, beginning with the available clinical information of the patient in the center of the map (name, age), with the disease hypothesis and etiology placed on the right of the map. The pathophysiological mechanisms were placed in the center and below, hierarchically organized and related to the clinical information from the case. The final map also displayed multiple concepts placed at different levels of the hierarchy of the map and connected by cross-links (Fig.1). The qualitative assessment of the maps was based on the analysis of these different components.

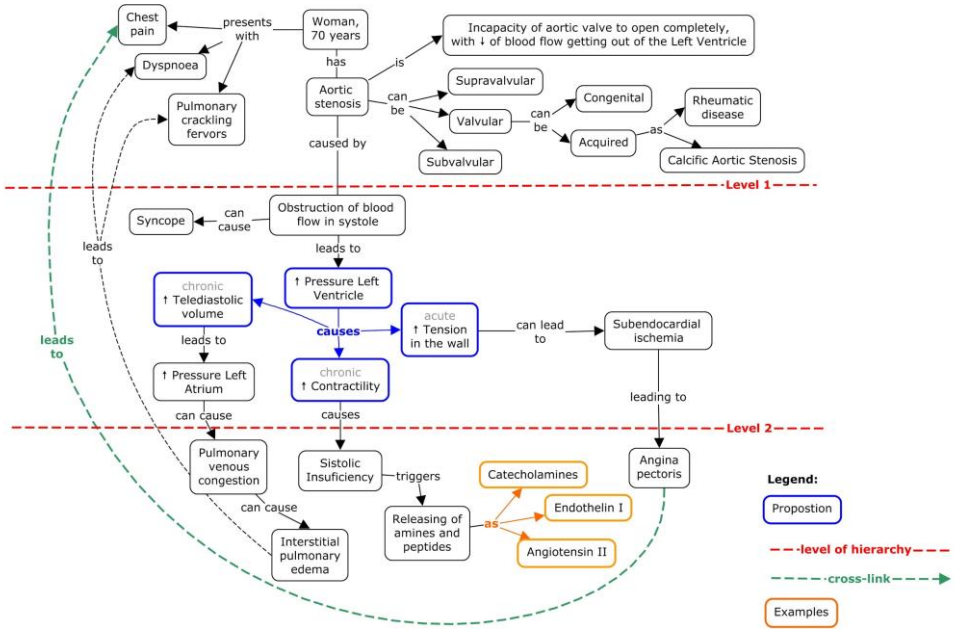

Figure 1. Example of a concept map.

During the academic year 2017-2018 a coordinator group formed by the course director, the two most senior faculty members, a junior faculty member experienced on concept mapping and a medical student from the previous year performed an analysis of the CMs made by the students of that academic year and concluded that they were heterogeneous in many ways, namely regarding the structure (some of them were not readable in a clockwise manner, as described above, others would not have well-constructed propositions and the number of propositions used in each map was very variable). Regarding the content of the maps from different tutorial groups, the pathophysiological mechanisms were approached with different levels of detail and there was heterogeneity in the depth of representation of the main disease expressions within the same clinical vignette. The main hypothesis for this heterogeneity between maps produced by medical students was that there were lacking more strict guidelines and guidance for concept map construction. This analysis, together with the feedback given by the students to the questionnaire of NMS institutional policy for the quality evaluation of teaching were the starting points for the revision of pedagogical methodologies in the academic year of 2018-2019. The main steps introduced were a preparatory training period for the tutors and a revision of the CMs' methodology, including its construction, presentation, discussion and assessment criteria.

In the formative pedagogical training sessions, developed for the staff, besides the review of the pedagogical use of CMs, eight core concepts were identified for each clinical vignette, to

provide a more homogeneous approach to the study of the mechanisms of disease displayed in the different tutorial groups. These core concepts were used to construct mini-maps, during the tutorial sessions in the following years, starting in 2018-2019. In each of the five blocks, the students constructed eight mini-maps, which were assembled and reorganized into a final CM, which was presented and discussed in the final session of each block.

2.2. Proposal of a CM scoring

The scoring methodology developed by the core group not only aimed to create a more homogeneous approach to evaluate knowledge acquisition, but also to provide guidelines and guidance for the students to construct the CMs, as it was stated by the teaching staff at the beginning of the academic year of 2018-2019. The proposed evaluation score is divided into two sections: qualitative (Table 1) and quantitative (Table 2). The qualitative score intends to evaluate the overall structure of the map, including the clockwise reading methodology, the insertion of patient information from the clinical vignette, the inclusion of all eight nuclear concepts and their pathophysiological explanations and the usage of a legend. The quantitative assessment is based on the structural scoring from Novak and Gowin (1984) and adapted by West (2000), regarding usage of propositions, hierarchy levels, cross-links and examples. The number of propositions was limited to 25 in order to provide readable CMs in a printable A3-size and aiming to avoid the huge divergence of the number of propositions inserted between CMs that were assessed in the ones from the previous academic year. In this way, students were guided to choose only meaningful and pertinent concepts. Despite this overall educational planning the coordinator group decided, in the previous and current academic year, to apply only the qualitative score and to monitor the production of the maps in order to evaluate the effect of the training of the tutors and the increasing awareness of the students in the correct use of the CMs methodology.

2.3. The scoring methodology - work in progress

This proposal is currently being analyzed and tested by the coordinator group using maps produced in the last two academic years, by different tutorial groups from different tutors in order to assess the reliability and validity of the proposed score when applied to a large class of students, for a whole semester. Examples of the application of the score will be presented in the conference, using a limited number of selected maps.

Table 1. Scoring method - Description of each parameter and associated scoring guidelines (qualitative parameters).

Method	Parameter	Description	Quotation
Qualitative (Weight 50%)	**General Organization**	The map should have a general organization, using concepts and linking words, structured in hierarchies from top to bottom, from more general concepts to more particular ones. The map may also contain sequences of concepts, illustrating some pathophysiological mechanisms. The map should be read in clockwise order, following the structure of disease definition, causes, classifications, pathophysiological mechanisms, clinical manifestations and diagnostic tests.	**0** - no map. **1** - badly structured map, limited number of connecting words, no hierarchical levels, not well-defined reading and structure. **2** – similar to 1 but with more connecting links. **3** – similar to 2 but limited hierarchical levels and disorganized structure. **4** – similar to 3 but with an organized overall structure. **5** - exceeding reference guidelines. **Maximum > 5 points**
	Information from the clinical case	The map should contain the information relating to the clinical case, as described in the vignette, marked in a different color. The information should be appropriately inserted in the map and integrated into the pathophysiological mechanisms.	**0** – no clinical information. **1** – some clinical information. **2** – some clinical information, well placed. **3** – all the clinical information displayed. **4** – similar to 3 but well placed. **5** – exceeding reference guidelines **Maximum > 5 points**
	Inclusion of core concepts	Each clinical case has eight associated core concepts, which should be displayed in the map using different colors. The core concepts should be developed and integrated with the remaining information of the case, whenever applicable.	**0** – no core concepts. **1** - some core concepts. **2** - all but not well placed in the map (lack of interrelations). **3** – similar to 2 and with an adequate display. **4** – similar to 3 and and well interrelated. **5** – exceeding reference guidelines. **Maximum > 5 points**

Table 1. Continuity.

Legend	The legend should appear on an attached sheet, signed by the class with the date when the map was made. The legend should explain the color code (and/or other symbology where applicable) used in the map to signal the clinical information, the core concepts and the cross-links.	0 - no legend. 1 – limited use of the legend to interpret the map. 2 – useful but with limitations. 3 - clear and well organized. **Maximum > 3 points**

Table 2. Scoring method - Description of each parameter and associated scoring guidelines (quantitative parameters).

Method	Parameter	Description	Quotation
Quantitative (Weight 50%)	**Valid Propositions**	The preposition is the elementary unit of the map and consists of a concept connected to two or more concepts, through the same connecting word. A proposition is valid when the form meets the definition and the content is correct.	**1** point per each valid proposition **Maximum > 25x1 (25)**
	Hierarchy levels	Each hierarchical level corresponds to the new horizontal level of concepts originated by the linking word from the previous concept. Hierarchical levels are considered valid when the respective branch of propositions that originates has a pathophysiological meaning and corresponds to a progression from more general concepts to particular ones.	**5** points per each valid hierarchy level **Maximum > 4x5 (20)**
	Cross-links	Cross-links are arrows with connecting words that relate concepts of different hierarchical levels and/or concepts of different map areas, in order to highlight a relevant pathophysiological relationship within a given context. Cross-links are marked on the map with a wider arrow (information to be included in the legend).	**10** points per each valid cross-link **Maximum > 5x10 (50)**
	Examples	They allow exemplifying a certain concept, enriching the map. Considered valid whenever they are appropriate to the subject and have justification for their reference. The examples are marked in the map outside of circles or rectangles, in a simple text box, with an arrow whose linking word is "example" ("e.g.").	**1** point per valid example **Maximum > 10x1 (10)**

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hybrid Design based research for Agile Software development (hDAS) in ISD contexts: a discovery from studying how to design MUVEs for VET

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Abstract

In this discussion a class of instructional design (ISD) processes is posited, that intrinsically trend towards increasing complexity in their design, in order to meet newly formed theoretic perspectives. hDAS is introduced, that addresses an on-going increase in complexity of ISD, through a paradigmatic change, in which the outcome of the design is also the design process adapted to current theoretical understanding and discipline needs. The way forward, as formalized in hDAS, is tailoring of ISD through DBR and Agile software development. In this paper a context for hDAS is presented by reflection on hDAS in ISD that uses: ADDIE, Agile and explicitly tests educational theory. hDAS resolves gaps identified for each of these. By enacting hDAS a tailored ISD method is induced that meets the current theoretic and vocational understanding for the instructional situation.

Keywords: *DBR; Agile; ISD; MUVE; Virtual Worlds; VET.*

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1. Introduction

This paper discusses a paradigmatic change in processes for instructional design to instructional design through design-based research (DBR). Study of the process of educational DBR lead to the discovery of "hybrid Design based research for Agile Software development" (hDAS). In detail, the design of Multi-User Virtual Environments for vocational education and training (VET) was studied through enactment of an educational design based research (DBR) (Plomp & Nieveen, 2007) process to create Multi-User Virtual Environments (MUVEs), i.e. Virtual World (VW) based learning and teaching environments, for vocational contexts: temporary traffic management and ship's bridge communication. "hybrid Design based research for Agile Software development" (hDAS) was discovered, that induces fit-for-purpose instructional design (ISD) process.

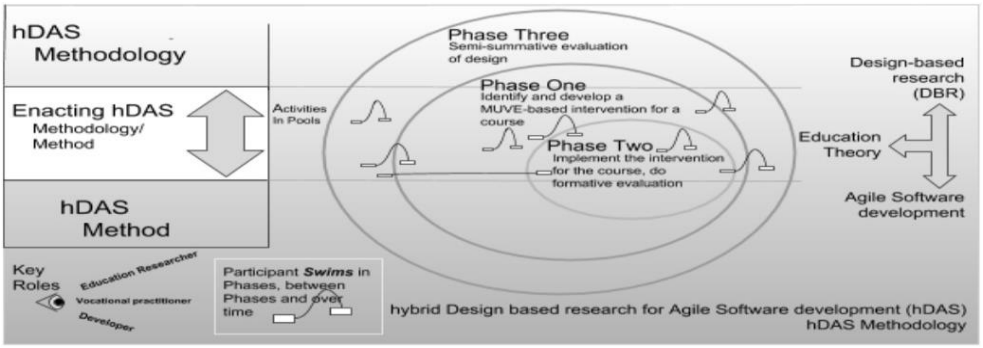

Figure 1. The relationships of key components of hybrid design based research for Agile software development (hDAS) methodology

The purpose of the hDAS methodology is to produce a MUVE-based intervention for a vocational context, and in the process, test educational theory in the effective design of MUVEs as interventions in VET. The hDAS methodology deploys professionals from at least three disciplines to develop a MUVE: software engineering; education and the selected vocational discipline. Figure 1. depicts the relationships of key components of hDAS methodology. hDAS methodology in phases determines the tailored hDAS method. Enacting the hDAS method then leads to discoveries for and from method and methodology, which leads to further tailoring of the method. hDAS methodology is enacted in three phases. Phase two is depicted at center stage because the goal is to implement an intervention using the MUVE for VET. Phase three builds on the other two phases with ongoing feedback and evaluation of design in research practices. Phase one is depicted between Phase three and Phase two to represent the origins of design and development between research design evaluation and running an intervention. For the hDAS methodology participants take roles from three disciplines; education, software engineering and the selected vocation. The terminology used in hDAS is mainly that of the disciplines of education and software engineering (see Table 1.0). Therefore, at least three participants are required: an educational

researcher, a vocational practitioner and a software developer. Participants from the vocation include an instructor, who is expert in the vocation, and students of the vocation. Development roles are further divided into software development, graphic design and technical support. Participants take part in enacting hDAS according to their role, which determines the phases they participate in. That participation is identified as a swim during enactment of a phase.

Table 1. Key hDAS roles by discipline and phase.

Role	Discipline	Brief description	Phase/s
Developer	Software engineering, Computer graphics design Information technology support	A developer designs and develops digital artefacts i.e. a software developer, or a graphics designer. A technician provides technical support for the development and during the run of an intervention	One and Two
Educational researcher	Education	The educational researcher directs MUVE development according to the research design, collects and analyses the data in research on theory in practice. At least one educational researcher is required.	One and Three
Vocational practitioner Vocational trainees	Selected vocation	A vocational practitioner is an expert member of the selected vocation. A teaching practitioner is preferred. Students of the vocation participate as trainees in practices of the vocation.	One and Two

Throughout the enactment of the methodology, DBR hybridization with Agile software development tailors the Agile method, because the design research pragmatically determines new and required objects, including those that provide guidance of the design for the vocation. For example, the vocation has specific, legitimate practices that are used for the initial tailoring of the Agile method mandatory for the design and development to proceed. As more is learned about the professional practice, the Agile method is refined (re-tailored or re-factored in software engineering terms) to implement an improved understanding of the requirements, while still conforming with the Agile principles. Each time the hDAS Agile tailored method is enacted, all documentation and tracking of the Agile software development method as it is enacted is archived by the software developer for use in phase three.

hDAS addresses an on-going increase in complexity of ISD, through a paradigmatic change, in which the outcome of the design is also the design process adapted to current theoretical understanding and discipline needs. In this paper ISD through hDAS is placed in context by reflection on hDAS with three exemplars from the following categories of ISD. As identified

by Soto (2013) the most prevalent approach to IDS for MUVEs was ADDIE (Allen, 2006); a second category applies Agile in ISD and a third explicitly selects educational theory to use in ISD. hDAS resolves gaps identified for each of these categories; by enacting hDAS an ISD method is induced that meets the current theoretic and vocational understanding in the instructional situation.

2. Background – ADDIE and Agile method tailoring

Soto (2013) identifies ADDIE as the most prevalent approach to ISD in MUVE based instruction. Allen (2006) describes Analysis, Design, Development, Implementation and Evaluation (ADDIE) as an ISD model developed post-World War II in the 1940s, applied in highly specified jobs for "systematic training within a military context of learning highly specified job tasks by a continuous cadre of homogenous learners" (p. 432). That is, ADDIE models mainly take a behavioral learning theory approach that meets training in procedural tasks. As noted by Allen (2006) ADDIE models can be classified as first, second, third and four generation models. The second-generation models adopted systems theory to control and manage more complex instructional development processes. The third-generation models were developed for flexibility needed outside of the military and phases were considered interactive processes that could be entered into at any point. While these were still mainly driven by behavioral learning theory, cognitive theory was applied in their process, e.g. in simulations to gather "cognitive expertise in decision making (Driscoll, 2005)" in Allen (2006, p. 431). Fourth generation models use developments in artificial intelligence to handle the complexity of the ADDIE system "with a continuous evaluation and troubleshooting process" Allen (2006) citing (Gagne et al. 2005), (pp. 432 to 433). The new "complexity of the ADDIE system" (p. 432) comes from "advancements in understanding how humans learn and educational technology … provided major changes in many of the system variables" (p. 432). The ongoing focus on evaluation appears to be related to an emerging understanding that ADDIE required integration or adjustment to base it on new theory.

In order to meet newly formed theoretic perspectives processes like ADDIE, are of the class of ISD processes that intrinsically trend towards increasing complexity in their design. The way forward is to take a paradigmatic shift towards formalized tailoring of ISD through DBR and Agile software development perspectives. The Agile Manifesto (Beck et al., 2001) is a declaration of the fundamental behavior that identifies an Agile software developer, by asserting practices valued by the practitioner. In an educational context Agile software development reflects conformance with the Agile manifesto. In this study tailoring for an educational design context was through method engineering (Esfahani & Yu, 2010). The Agile method is integrated into a DBR methodology. In one sense, the contingency factors that determine a tailored Agile method were determined through the DBR methodology in a

bottom up manner. In another sense the over-arching DBR methodology drives the Agile development in a top down manner. Hence, the observation by Easterday et al. (2014) that DBR is designed for each study, and each DBR method appears to use a different process, is like Agile method tailoring. Although an overarching DBR process can be summarized as in Plomp and Neiveen (2007), ISD emerges from DBR processes discovered during design for the given research study, in a manner that is equivalent to One Method Per Project described by Cockburn (1999) in which an Agile method is tailored for the project. DBR lead Agile method tailoring through hybrid DBR Agile software development revealed suited ISD.

3. hDAS in ISD contexts

To consider the context of ISD using hDAS, three categories of ISD are discussed for the design of MUVE based interventions in VET.

3.1. Category 1 ISD – uses ADDIE

Wang and Hsu (2009) present an example of an ISD that uses the ADDIE model for the design of MUVE-like instructional environments. Wang and Hsu then describe ADDIE as it was applied in the design. Analysis was undertaken to determine the requirements for the learning context. In this case, the instructor conducted an online survey to determine students' backgrounds and motivations. Design was the major task; the instructor created a list of tasks and made them into instructions for the students. Development was undertaken by the instructor, who worked on the navigation in the VW, took images for the webpage and made sure the objects of interest were in the VW. During implementation of the intervention, student instruction was assisted through a learning management system on a webpage outside the MUVE. According to Wang and Hsu (2009) evaluation was facilitated by inviting a faculty member to observe the MUVE.

In this case, ADDIE constituted a systematic method that helped the instructor design learning tasks that would take place in a MUVE and that would ensure the MUVE's function as a tool assisting teaching and learning, (p. 81). The use of ADDIE described by Wang and Hsu (2009) differed from hDAS in several ways: (1) it did not undertake any investigation into educational theory; (2) ADDIE did not inform the design process; (3) it was an ad-hoc, checklist approach to designing and developing an instructional situation; (4) it did not inculcate theory into ADDIE; (5) although ADDIE expressed behavioral learning theory, opportunities for constructivist learning were not pursued and (6) did not inculcate constructivist-guided activities during the instructional design. This comparison shows that the hDAS focuses on research into how to design MUVEs for VET whereas using ADDIE as a checklist for instructional design of the MUVEs would not.

3.2. Category 2 ISD – uses Agile

In the second category of ISD, the application of Agile in an instructional design process is presented in two studies. Dass and Cid (2018) describe the application of Agile in the design of a medical simulation, and Cooney and Little (2015) describe how Agile was used to overcome issues with ADDIE in a large project. Both papers compare ADDIE with Agile in the context of implementing instructional design. Cooney and Little's (2015) study is representative of the application of Agile in instructional design. They describe using Agile principles in the context of an ISD project that was not making good progress. They implemented a Kanban-style Agile process (Raju & Krishnegowda, 2013) that avoided issues with the first generation ADDIE, in which they had difficulty with the formal turnover of work from one step to the next in the sequence, and the Agile process removed the complex communication that would arise in later iterative versions of ADDIE. Moving to Agile as a process for ISD, the project was delivered by the small team. They note that Agile has been used in various forms for ISD and conclude that, "What is missing from all of these is an emphasis on the Agile values and principles fundamental to Agile ISD's success, and a meaningful commitment to incorporating scrum methods" (p. 11).

Comparing the Agile-based ISD process as applied by Cooney and Little (2015) with the hDAS reveals several differences. Cooney and Little describe the use of the Agile principles to ensure they kept on track during the ISD process, while in hDAS, the Agile principles become a foundation for directing the Agile software development method in the process. The hDAS does not explicitly use Agile to manipulate design; it is the process through which design is enabled, and hence, hDAS is guided by the Agile principles. The Agile-based ISD process, as applied by Cooney and Little (2015), does not consider educational theory and is not informed by research that tailors an Agile software development method to suit the changing situation as the educational design is better understood. These features are the hallmark of the hDAS methodology.

3.3. Category 3 ISD – explicitly tests educational theory

The final category discussed are ISD models that explicitly select educational theory to use in the ISD process. Davies, et al. (2018) present an ISD model to address the gap between the development of simulation systems and the applied use of educational theory. They apply a five-stage educational framework called the ADELIS model to ensure that both learning, and assessment are valid in the simulation intervention. The focus is on developing an authentic learning activity. According to Davies, et al. (2018), the framework provides opportunities for measuring the intervention, the learning and behaviors in the immediate situational context, and the impact of the exercise from the view of educators and participants. Design using the ADELIS framework starts with the selection of a part of a course or curriculum that is suited to simulation and considers the simulation across course units and

interconnections between simulations. The first process is followed by a constructive alignment process where the intervention through the simulation design is aligned to develop Learning Outcomes (LO) using an educational taxonomical vocabulary, based on the LOs assessment is derived based on appropriate theories that suit the learning process from that simulation. The third step develops content based on the LOs using educational theory that underpins and addresses Los and assessment criteria, and the required psychological and technical quality (fidelity) that encourages participant buy in is determined. In the fourth step aims methods of associated research, with validated and reliable evaluation tools are determined by the designer. In the fifth step a protocol is established for the simulation developer that identifies and assures educational fidelity and authenticity in the simulation.

The ADELIS Model is a framework, from which to induce a process for the design of simulations for interventions, that are going to be developed by a developer who is a third party to the design process. Educational research is part of the framework, but there is a sense that the research is not intrinsic to the overall process. hDAS is a research methodology by design, hence enacting the hDAS methodology intrinsically becomes design-based research. hDAS prescribes a Swim technique for analysis that generates semi-summative evaluations of the process, while at the same time reporting of the effect of theory in the context of the enacted hDAS process, that includes design development and running of interventions in with the MUVE is live educational contexts. ADELIS presents a framework that does not include refinement of its use in practice in the direct manner that is intrinsic to hDAS. hDAS goes beyond ADELIS in the aspect of development of the MUVE, by inducing and tailoring an Agile software development method that suits the design of the MUVE based intervention through practice and as the needs of the intervention are discovered.

4. Conclusions

hDAS provides a solution that is supported by Cockburn (1999) “one method per project” assertion and proposal for real-time adjustments to methods for software development. By hybridizing with DBR to maintain the fitness for educational purposes over time, ISD induced through hDAS avoids the trap, in which although the software development process is Agile, the methodology was tailored to fit an early understanding of the requisite design, however as the focus of the design is refined and better understood the original methodology no longer suits the project. As discovered in this study on how to design MUVEs for VET, hDAS paradigmatically changes the approach to ISD. hDAS tests theory in practice to produce useful artefacts, and design research becomes a foundation through which to develop an understanding of theory in practice while producing vocationally suited MUVEs that are VWs of the vocation. That means that there is no longer the stress where an ISD model and/or process must be adjusted to fit new education theory; instead the design process reflects the research and development contexts.

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Bridging the gap between academic and policy-oriented activities in higher education institutions

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Abstract

There are three different types of activities performed in higher education institutions that, taken together, form the components of a trilemma in higher education. These include traditional academic activities (research and teaching), along with those that aim to transfer knowledge beyond academic research (policy-/industry-oriented activities). I argue that there are potential synergies across these three components that can be exploited to resolve this trilemma. This is illustrated in an augmented research value chain that introduces teaching and policy-/industry-oriented activities as phases that complement the research process. The interaction of the different phases in the research process contributes to the generation of new knowledge, increasing the value-added of the organization. This proposal relies on an application in an organizational unit specializing in international trade within an Australian university. Australia provides an interesting case study because research-intensive Australian universities are no longer evaluated purely in terms of their research quality, but also in terms of their transfer of knowledge and contributions beyond academic research. In this context, I conceptualize how to resolve the trilemma, and increase the feasibility of bridging the gap between academic and policy-/industry-oriented activities in higher education institutions.

Keywords: *higher education; policy-/industry-oriented activities; teaching; research; trilemma; research value chain.*

1. Introduction

Recent reforms in higher education have led to the emergence of what are known as managerial universities, which focus on effectiveness and efficiency and give rise to important changes in related organizational structures (Hagerer 2019). In this context, universities' success in rankings becomes more important, but at the same time, they must be able to attract funding. A key trade-off is how to secure more funding, which normally arises from applied, professional, and policy-/industry-oriented projects, while ensuring the necessary level in research quality that allows universities to maintain their reputation and prestige in national and international rankings. At the same time, teaching is a key university function and constitutes a source of revenue. The main objective of this paper is to evaluate the feasibility of bridging the gap between academic and policy-/industry-oriented (hereafter referred to as policy-oriented) activities in higher education. I argue that these three types of university activities, taken together, are the three components of a (policy-research-teaching) trilemma in higher education; however, there are synergies across the different activities performed in universities that can be exploited to resolve this trilemma. This is illustrated in an augmented research value chain that introduces policy-oriented and teaching activities as important phases in the research process that add value to the organization (by generating new knowledge).

This paper highlights a long-running problem on the difficulty of balancing teaching, research, and policy-/industry-oriented activities. Previous research highlighted how the different agendas of the research community and practitioners generate a communication gap between research and policy-oriented activities, and pointed out the need for informed entrepreneurs in universities that both understand and appreciate research and can package it so that it can be used by practitioners (Hallinan 1996). Dunne and Rawlins (2000) claimed the existence of a gap between industry and higher education and underlined the need for a dual approach: top-down alongside bottom-up change in higher education institutions. More recently, Roudaut (2019) aimed to bridge the gap between teaching and research, recognizing that research-led teaching is challenging because of the difficulty of conveying to the students the uncertainty of scientific outcomes. The idea of bringing research into teaching is not new and researchers have already drawn attention to the benefits of such a practice. However, Marsh and Hattie (2002) tested the teaching-research hypothesis—namely, that there is a positive relation between the two types of activities—and found a near-zero correlation. According to their results, good researchers are neither more nor less likely to be effective lecturers than are poor researchers, and good lecturers are neither more nor less likely to be productive researchers than are good lecturers. This is consistent with Norton and Cherastidtham (2015), who highlighted that positive and negative theories explaining the teaching-research relationship could cancel each other out.

Regarding the relationship between academic and policy-/industry-oriented university activities, there is a growing number of initiatives aiming at increasing the science-industry knowledge exchange. Formal channels of interaction include collaborative and contract research, academic consultancy, intellectual property transactions, labor mobility, and academic spin-offs. Informal channels include conferencing and networking, facility sharing, and continuing education provided by universities to enterprises (Guimón and Paunov 2019; Paunov et al. 2019). The dynamics and complexity of collaborative research linkages between university and industry were analyzed by, e.g., Plewa et al. (2013). These authors stated that university researchers actively engage in research with commercialization potential and industry increasingly recognizes the value that university knowledge can add to commercial research and development. Other models of linkages are also possible, e.g., independent think-tanks that act as intermediaries between academic research and policy discussion.

To the best of my knowledge, the existing literature generally emphasizes the importance of a series of "dilemmas", while I conceptualize a trilemma. Indeed, previous studies are silent about the policy-research-teaching relationship. By relying on an application in an Australian university, I take a step in this direction and I repackage the difficulty of balancing teaching, research, and policy-/industry-oriented activities, which yields new perspectives and insights.

In Section 2, this paper briefly describes the evolution of the research function in universities and defines key concepts to contextualize the research function in the Australian higher education system. Section 3 formalizes a trilemma that includes the three types of university activities or components analyzed, and illustrates the interactions and potential synergies existing between its components. Section 4 presents a (traditional) research value chain, which is then modified to fit the reality Australian universities currently face. The potential synergies between research and other university activities are illustrated in an augmented research value chain that is helpful in identifying feasible ways to resolve the policy-research-teaching trilemma. Section 5 concludes.

2. The research context in the Australian higher education system

In the history of higher education in the US, Ford (2017) distinguished four phases that are characterized by their primary function: preserving Christian civilization, advancing the national interest, research, and growing the global economy. It was in the 19th century when a group of German philosophers and bureaucrats succeeded in establishing the world's first research university, the University of Berlin, which would go on to shape how we understand the functions of higher education. Its main objective was to conduct research, and the vision of the importance of academic research in German research-intensive universities has since been incorporated into public education worldwide. The research university places a greater

value on research than on teaching and while professors at a research university typically have some teaching responsibilities, this is not their primary activity (see Ford 2017). The shift in the US higher education system is a good illustration: leading US research universities added to the innovation by changing the nature of PhD training, paying less attention to undergraduate teaching; specialized high-fee colleges offering the best undergraduate teaching; and community colleges providing pathways for poorer students. Márquez-Ramos and Mourelle (2016, 2018), on the basis of potential responses to the societal trends of the knowledge economy (Castells 1996), recognized that the functions of higher education are shifting and the future of higher education is not entirely foreseeable. In a changing environment, Australia provides an interesting case study of how future directions and uses of higher education might be transformed (Nunan 2005) as Australian research-intensive universities are no longer evaluated purely in terms of their research quality, but also in terms of their transfer of knowledge and contributions beyond academic research. Interestingly, in a comparative study between two developed countries with similar levels of per capita expenditure on their higher education research and development, Australia and Germany, Plewa et al. (2013) state that "their funding systems differ: Germany offers strong core funding for universities, coupled with relatively low external funding opportunities, whereas in Australia, a highly competitive performance-driven funding model dominates" (page 25).

Nowadays, Australian universities are subject to an evaluation exercise at national level, in addition to the evaluation of their research quality in every field of research (the so-called ERA: Excellence in Research for Australia). Running alongside the ERA assessment, the Engagement and Impact (EI) assessment examines how universities are translating their research into economic, social and other benefits (see Appendix A for definitions in Australia). Both research and teaching are core functions in Australian universities. Regarding teaching, the difference between teaching revenue and costs (a teaching surplus) provides funds that can be used to pursue objectives that are not financially self-sustaining (e.g., research). Interestingly, research is supported by large surpluses from university teaching in Australia: one dollar in five spent on research comes from surpluses on teaching (this is based on conservative assumptions, see Norton and Cherastidtham 2015).

3. The policy-research-teaching trilemma

I analyze the relationship between policy-/industry-oriented and research activities together with the teaching-research relationship. I name these three key university components as follows: I) "policy", including a policy-/industry- and a consulting aspect; II) "research"; and III) "teaching", which also includes types of alternative teaching apart from teaching in university degree programs, such as capacity-building programs. Figure 1 illustrates the three different types of university activities (or components) considered in this research. It is worth considering that balancing the different policy-research-teaching activities in a university

context is challenging. The academic staff is under pressure to publish their research in esteemed publications, while still performing their teaching activities. Higher pressure on academic staff might reduce their incentives to invest their time in improving their teaching, as they seek to focus on their research outcomes. This, together with the fact that many universities are increasing their involvement in engagement and impact activities (e.g., transmitting new knowledge to research end-users beyond academia, catalyzing societal change, and creating direct benefits for the wider community) and pressure to secure more funding from applied, professional, and policy-/industry-projects, creates a trilemma.

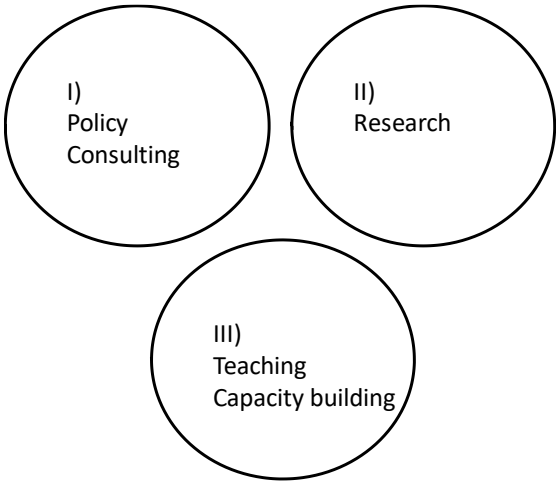

Figure 1. Three components in higher education institutions (policy-research-teaching).

In response to the existing challenges, Figure 2 presents the policy-research-teaching relationship in the form of a trilemma. According to this trilemma, engagement & impact, research quality, and teaching quality (as represented in the corners of the inverted triangle in Figure 2) are all desirable but cannot be easily balanced. There are three possible responses that balance the demands of two of the three elements of the trilemma, but which then jeopardize the achievement of a more effective and efficient higher education organizational unit. The first is to opt for a mix that prioritizes traditional university activities, i.e., research and teaching, to achieve high research and teaching quality. This option would not enable an optimal response to the fact that Australian universities not only need to involve in engagement and impact activities, but also to generate additional income beyond teaching. This is especially relevant in the present context, as Australian universities will, very likely, decrease significantly their number of international students due to the Coronavirus crisis. The second possible response is to pursue a business model that centers on revenue-generating activities (i.e., policy-oriented and teaching). However, to succeed at attracting students and funding from research end-users, a university not only requires high teaching

quality, but also high research quality, which is key for maintaining a good position in national and international higher education rankings; in turn, these positions are heavily influenced by research outcomes and performance. And the third and last possibility is to set less ambitious targets regarding teaching quality, thus limiting the potential for developing a teaching reputation and community worldwide (e.g., through alumni networks), and missing an important source of income.

I argue that the three components (policy-research-teaching) taken together constitute a trilemma in the higher education system, that is, once considered that these components are interrelated; however, synergies among the three components can be exploited to resolve the trilemma. Synergies are represented in Figure 2 with the overlapping areas between two components, including a smaller area representing the overlap where all three components present synergies (compare Figure 2 to Figure 1). The larger the overlapping areas, the more synergies exist in a given university organizational unit.

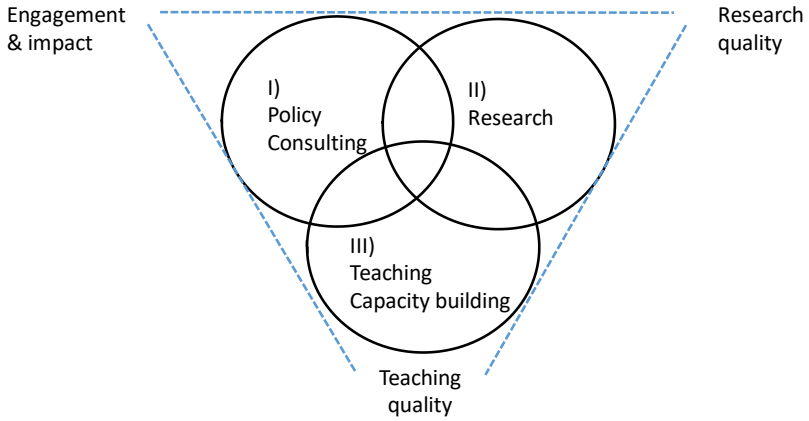

Figure 2. The policy-research-teaching trilemma in higher education institutions.

4. An augmented research value chain to resolve the trilemma

To provide a better understanding of how synergies arising from the different types of activities performed (or components of the trilemma) might be exploited to increase effectiveness and efficiency in university organizational structures, I start out from a research value chain that considers research to be the medium through which universities can transform inputs, i.e., labor (hours dedicated to research, number of researchers, etc.) and capital (laboratories, computers, technical equipment, etc.) into the generation of new knowledge. The blue arrow in Figure 3 represents the research process, while the grey area represents the value-added of research outputs to the organization. In addition, Figure 3 reflects the possibility that different university organizational units give different value to the

generation of new knowledge. Specifically, in Figure 3, "unit B" represents a "traditional" university unit that is in line with the idea of prioritizing academic research and gives more value than "unit A" does to high quality research outcomes and to the generation of new knowledge (as represented by a larger grey area—i.e., higher value-added of the research outputs—in "unit B" than in "unit A").

This illustration does not account for the restrictions that universities face. In addition to other environmental changes faced by Australian universities, such as government underfunding, one has to consider how universities are evaluated. To this end, university managers in Australia take into account several indicators, such as research income, high-quality publications, and impact, i.e., societal change brought about by research output. I focus on a type-A higher education organizational unit to augment the research value chain because this paper has emphasized the interconnections and synergies between the three components in the (policy-research-teaching) trilemma.

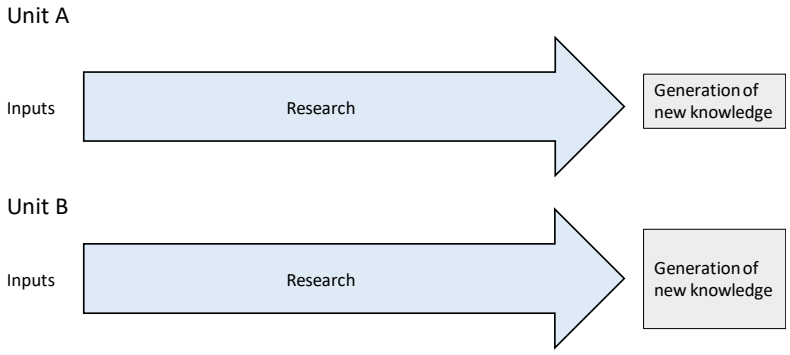

Figure 3. The research value chain.

I consider that the growing importance of university activities other than research constitute phases of the research value chain that might add value to the organization. Figure 4 shows that the components of "teaching" and "policy" can become complementary phases in the research value chain that enrich the research component by providing elements such as meaningful research questions that are relevant for policy makers or additional funding to hire new researchers, expanding the research community. By relying on experts' opinions in the field of international trade, the Appendix B provides two examples of complementarity in the augmented research value chain.

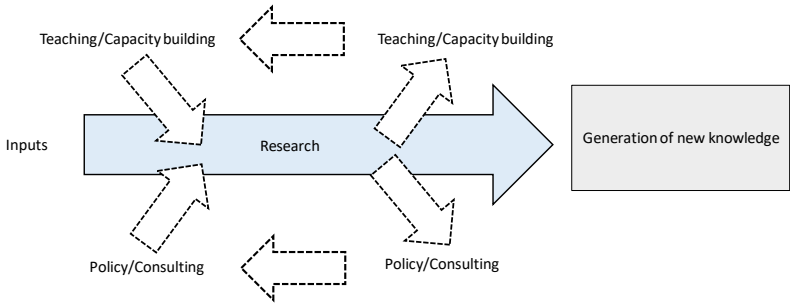

Figure 4. An augmented research value chain.

This evidence about complementarity between different phases of the research value chain relies on the field of international trade. Further analyses in alternative fields of research are needed so that they can be generalized to other areas. Further research might consider heterogeneity within and among the three components of the trilemma. For example, in Australia the government sees research as scientific research and there is a bias against humanities; the teaching-research relationship varies by higher education level, being very strong in PhD electives; and some research has immediate value, so it can be the basis of university-industry collaboration. Other research does not, however, it might be valuable for society or as basic knowledge on which more applied future research can be based.

5. Conclusion

This paper provides a new perspective and a meaningful starting point for the analysis of the policy-research-teaching relationship in higher education institutions. I have formalized a trilemma and I have illustrated the importance of potential synergies and the complementarity of research with other university activities (i.e., teaching and policy-/industry-oriented) in an augmented research value chain. This helps identify feasible ways to resolve the trilemma and to bridge the gap between academic and policy-oriented activities in higher education.

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Appendix A. Definitions in Australia

The Australian Research Council (ARC) defines *research* as "the creation of new knowledge and/or the use of existing knowledge in a new and creative way to generate new concepts, methodologies, inventions and understandings. This could include the synthesis and analysis of previous research to the extent that it is new and creative."

Research *engagement* is defined as "the interaction between researchers and research end-users outside of academia, for the mutually beneficial transfer of knowledge, technologies,

methods or resources;" while research *impact* is the "contribution that research makes to the economy, society, environment or culture, beyond the contribution to academic research."[1]

Appendix B. Two examples of complementarity in the augmented research value chain

Example 1: Phase 1 (teaching) --> phase 2 (research) --> phase 3 (teaching and policy-oriented activities) --> phase 4 (research). The organizational unit analyzed in this research provides education in international trade through capacity-building programs. On many occasions, these capacity-building programs have been delivered to policymakers and ministerial staff in developing countries. After completing these programs, some former students apply to become PhD students in the unit. If successful, these PhD students join a research group and collaborate with their research supervisors, bringing first-hand experience of policy-relevant research questions, which might lead to joint research papers with their supervisors. In addition, these PhD students might participate in the unit's teaching or capacity-building activities or collaborate with staff in policy- or industry-oriented projects, once they have achieved the necessary knowledge in the field. The teaching and policy-/industry-oriented phases equip the PhD students with additional knowledge that complements their research. Moreover, through participation in collaborative networks that are pertinent to their research topics, they can benefit from further relevant feedback.

Example 2: Phase 1 (policy) <--> phase 2 (research). Staff of the unit might work on a policy project aimed at providing a solution for a government's specific problem. This project might provide funding for hiring a specialized researcher who will collaborate with institute staff. The institute staff involved and the specialized researcher can mutually benefit from the networking and collaboration. Institute staff might gain a more profound knowledge of state-of-the-art methods and techniques through the researcher, and the researcher might benefit from applying her knowledge to a policy-relevant problem. Further joint research might emerge, which yield research papers or collaboration in future projects.

[1] See https://www.arc.gov.au/news-publications/media/presentations/standard-excellence-research-australia-era-and-engagement-and-impact-ei-2018-outcomes

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The Validation of a Quantitative Measure of Self-authorship among Chinese University Students

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Abstract

This paper presents the preliminary evidence for validating the Self-authorship Section of the Career Decision Making Survey (SA-CDMS; Creamer, Baxter Magolda, & Yue, 2010) among Chinese university students. Two samples of undergraduate students (Stage One, N= 263; Stage Two, N= 663) from three universities in the People's Republic of China participated in this study. In the first stage, the SA-CDMS was translated from English to Chinese, with the psychometric properties preliminarily examined by exploratory factor analysis and internal consistency test. The original 18-item SA-CDMS model failed to identify the theoretical structures as expected, however, several modifications could be identified from the results of Stage One. In the second stage, the modified SA-CDMS showed acceptable reliability and validity based on the results of confirmatory factor analysis and Cronbach's alpha coefficients. In addition, Pearson's correlation analysis was employed by Stage Two to examine the correlations among the demographic factors, three phases, and three dimensions of self-authorship framework. In general, the current study provided evidence for utilizing SA-CDMS in the Chinese higher education context. This study added to the literature of the research on self-authorship and offered practical implications to educators and policymakers in promoting self-authorship development among Chinese university students.

Keywords: Self-authorship; quantitative measure; higher education.

1. Introduction

Self-authorship, defined as "the internal capacity to define one's own beliefs, identity, and relationships" (Kegan, 1994; p.11), is considered as one of the key developmental capacities of university students in achieving a variety of university outcomes (Baxter Magolda, 2009). Little has been known for self-authorship development among Chinese university students (Zhang & Cen, 2017). Besides, the qualitative design was the dominant research methodology adopted by the existing research (Perez, 2017). Pizzolato (2007) argued that developing and utilizing a quantitative measure to assess self-authorship was important because it could provide insights into the subtle nuances that happened in/across stages of self-authorship development. Employed a two-stage design, the current study aimed at validating a quantitative measure, the Self-authorship Section of the Career Decision Making Survey (SA-CDMS; Creamer, Baxter Magolda, & Yue, 2010), among Chinese university students. To deepen the understanding of the theoretical structure of SA-CDMS, Stage Two of the current study also examined the correlations among the demographic factors, the three theoretical dimensions, and the first three phases in the development of self-authorship. Conducting such research is theoretically significant because it would enrich the literature by producing empirical evidence for validating SA-CDMS in the context of Chinese higher education. The current study is also significant on the practical level because it would have implications for the educators, administrators, and policymakers who are willing to enrich the knowledge of self-authorship and promote its development among Chinese university students. The remainder of this paper presents the related works, research methods, and results, respectively. Limitation, discussion, and conclusion are written at the end.

2. Related works

The conceptualization of self-authorship was based on Kegan's (1994) theory of Self-evolution that followed Piaget's (1950) constructivist-developmental tradition. The dimensions of self-authorship were related to three questions in the meaning-making process, including "How do I know?" (epistemological), "Who am I?" (intrapersonal), and "Who do I relate to?" (interpersonal) (Baxter Magolda, 2009). Based on the massive narratives collected from a longitudinal study in over 25 years' span, the trajectory of self-authorship development was framed by Baxter Magolda (2009) as a *journey* that traveled from fully relying on the external resources to the establishment of an inner voice. Later, as part of the research output of the Wabash National Study of Liberal Arts Education (Baxter Magolda & King, 2007), a four-stage model of self-authorship development was proposed, in an order of solely external, entering the crossroads, leaving the cross-roads, and solely internal. The existing research on self-authorship was mainly conducted among the U.S. university populations (e.g. Creamer & Laughlin, 2005; Wawrzynski & Pizzolato, 2006).

More recently, researchers started to explore self-authorship among Chinese students (see a detailed review in Xie, 2018). Despite the increasing research interest, there is still a lack of knowledge in the self-authorship development among Chinese university students. Furthermore, insufficient efforts were made in utilizing quantitative measures to understand either the relationships among dimensions of self-authorship or on the subtle nuances on different phases in the development of self-authorship (Creamer et al., 2010). Acknowledging the above research gaps, the current study was designed to validate a quantitative measure, the Self-authorship Section of the Career Decision Making Survey (SA-CDMS; Creamer et al., 2010) among Chinese university students. It is hypothesized that this measure would be suitable for assessing Chinese university students' self-authorship, however, the reliability and validity of this measure might be affected when it was applied in different cultural contexts.

3. Methods

3.1. Participants

Invited from three public comprehensive universities in the People's Republic of China, 263 participants (210 males, 51 females) whose ages ranged from 19 to 23 years joined Stage One, and 663 participants (513 males, 136 females) aged from 16 to 22 years joined Stage Two. As the data was collected in part of a research project designed to explore the university developmental outcomes among Chinese university students in science, technology, engineering, and mathematics majors, most participants were male students. The participation was entirely voluntary based.

3.2. Measurement

The quantitative measure adopted by this study first appeared in the section called 'Diverse Viewpoints and Decision Making' of the Career Decision Making Survey (CDMS) employed by the Woman and Information Technology (WIT) team to explore female students' career choices toward information technology. The original self-authorship section of CDMS consisted of 28 items in 4-point Likert-type scales. Based on Baxter Magolda's (2009) suggestion and results from the preliminary validation study (Yue, Creamer, & Wolfe, 2009), an 18-item SA-CDMS was derived (Creamer et al., 2010) to assess five prompts of career decision making and two prompts of epistemological development. Each item measured one of the first three phases of development in self-authorship (i.e. external formula, cross-roads, and early stage of self-authorship), as well as one of the three theoretical dimensions (i.e. epistemological, intrapersonal, and interpersonal). To date, only one study (Zhang & Cen, 2017) administrated SA-CDMS to Chinese university students. The reliability and validity of this quantitative measure in the

Chinese higher education context remain under-explored. The original English-version of SA-CDMS was derived from Creamer et al.'s (2010) journal article. Professional advice was sought in the process of translating SA-CDMS from English to Chinese, with the translation-back-translation procedure adopted.

3.3. Procedures

Prior to the data collection, this study had obtained research ethics approval from the Human Research Ethics Committee of the author's affiliation. In both stages of this study, paper-and-pen questionnaires were distributed to the volunteer participants during the class breaks. The participants firstly read through the descriptions of the research aims and procedures, then gave written consent. After completion, the questionnaires were returned to the researcher and be sealed in storing envelopes. Two statistical software, IBM SPSS (v.22) and IBM AMOS (v.24) were employed to analyze the data.

4. Results

4.1. Stage One

Stage One aimed at preliminarily examine the psychometric properties of the translated SA-CDMS. Internal consistency tests and exploratory factor analysis were employed to access the reliability and validity of this measure, respectively.

4.1.1. Stage One- internal consistency test

Internal consistency of each dimension, as well as each phase of self-authorship, was calculated separately. Cronbach's alpha coefficients for the three phases of self-authorship were 0.65 (external formula), 0.64 (cross-roads), and 0.27 (early stage of self-authorship); for the three theoretical dimensions were 0.72 (interpersonal), 0.10 (intrapersonal), and 0.71 (epistemological). It is worthy noted that the reliabilities of the early stage of self-authorship and the intrapersonal dimension were severely affected by Item 6. Also shown in the item-total statistics table from the consistency tests output, the Cronbach' alpha coefficients could be improved to 0.66 (for the early stage of self-authorship phase) and 0.5 (for the intrapersonal dimension) respectively, if Item 6 was deleted from the subscales.

4.1.2. Stage One- exploratory factor analysis

Exploratory factor analysis with principal component analysis and varimax rotation of the 18 items in SA-CDMS yielded four factors (eigenvalues being 5.09, 1.22, 1.12, and 1.05, respectively), explaining 47.14% of the variances in the data. Statistics of the Kaiser-Mayer-Olkin and Bartlett's Test were KMO= 0.89, Chi-Square χ^2= 975.83, df= 153, and $p < .000$, indicating that the current data was adequate for the factor analysis. The rotated

pattern matrix showed that Item 6 loaded solely on Factor 4. With factor loadings of less than 0.35 surpassed, four items (Item 11, 12, 13, and 15) still cross-loaded on two factors. Except for these obviously problematic items, the overall loading patterns also failed to support neither the three-dimension nor the three-phase structure as suggested by the self-authorship model.

4.1.3. Implications for the Stage Two

Although the item-level factor analysis of the original 18-item SA-CDMS failed to generate factors as expected while two subscales performed poorly in the internal consistency tests, possible modifications could be identified from the results of Stage One. First, Item 6 was considered as problematic due to the severe side effects it caused on the reliability of the subscales. In addition, Item 6 loaded on Factor 4 by itself with a factor loading of 0.902. Theoretically, this item should load on the epistemological dimension, as well as the cross-roads phase (see Table 1). Second, wording and sentence structure of some items need to be modified. For example, some items (i.e. Item 3,7,8,12) contained the concept of "career counselor" which was not familiar to the university students in China. Third, items were missed from the intrapersonal dimensions on the cross-roads and early stage of self-authorship phases under the prompt of making educational choices (i.e. choosing major for one's tertiary education) in the original SA-CDMS. Two additional items were designed based on Creamer et al.'s (2010) framework and the existing literature. Item distribution of the modified SA-CDMS was shown in a 3-dimension-by-3-phase chart (See Table 1). Fourth, the layout needed to be adjusted to make the SA-CDMS brief and easy to read. One solution would be clustering items under the same prompt into one sub-section, with each subsection started with the description sentence of the prompt.

Table 1. Item distributions in the 3×3 matrix of self-authorship framework.

	Interpersonal	**Intrapersonal**	**Epistemological**
External Formula	Item 1, 17	Item 2, 8	Item 4, 13
Cross-roads	Item 10, 19	Item 9, 14*	Item 3, 6
Early Stage of Self-authorship	Item 5, 12	Item 18, 20*	Item 7, 11,15, 16

Note: * Newly added items to the intrapersonal dimension.

4.2. Stage Two

Based on the results from Stage One, one problematic item (i.e. Item 6) was dropped from the original SA-CDMS while two new items were added to the intrapersonal dimension. At the same time, wording, sentence structure, and the layout of the inventory were adjusted. To further examine the psychometric properties of the modified 19-item SA-CDMS, Stage

Two of the current study conducted internal consistency tests and confirmatory factor analysis. In addition, the correlations among demographics (i.e. age, gender, father's educational attainment, and mother's educational attainment), three phases, and three dimensions of the self-authorship framework were examined, aiming at offering additional information for the theoretical propositions of the self-authorship model.

4.2.1. Stage Two- internal consistency test

Internal consistency test yielded moderate reliability of the modified SA-CDMS, with Cronbach's alpha coefficients of 0.61 (external formula phase), 0.64 (cross-roads phase), 0.7 (early stage of self-authorship phase), 0.6 (interpersonal dimension), 0.62 (intrapersonal dimension), and 0.6 (epistemological dimension).

4.2.2. Stage Two- confirmatory factor analysis

In the beginning, the model fit indices from the confirmatory factor analysis indicated an inadequate fit between the 19-item three-developmental-phase SA-CDMS model and the observed data. The modification indices also revealed high covariances between the errors of Item 12 and Item 16 (M.I.= 104.68), Item 8 and Item 17 (M.I.= 87.92), Item 4 and Item 17 (M.I.= 48.03), as well as Item 4 and Item 8 (M.I.= 42.279). Besides, factor loadings of Item 4, Item 15, and Item 17 were 0.29, 0.29, and 0.25, respectively, which were lower than the cut-off value of 0.32 (Tabachnick, Fidell, & Ullman, 2007). Item 8 and Item 17 also had side effects on the reliability of SA-CDMS. Bi-directional arrows were added in between the highly correlated errors. Computation after the modification produced good model fit indices: Chi-square χ^2 (df= 145) = 383, p< .000, RMSEA= .076, SRMR= .05, and CFI= .903 (Hu & Bentler, 1999).

4.2.3. Correlations among demographics, dimensions, and phases of self-authorship

As shown in Table 2, there was statistically significantly negative correlations found between age and the cross-roads phase (r = -0.095, p< 0.05), when statistically significantly positive correlations were found between gender and cross-roads phase(r = 0.087, p< 0.05), as well as parents' educational attainment and epistemological dimension($r_{father\_edu\text{-}epis}$=0.13, p< 0.01; $r_{mother\_edu\text{-}epis}$ = 0.119, p< 0.05). Also shown in Table 2, even when the potential confounding effects of demographics had been partialized out, moderate to strong positive correlations were still found among the three developmental phases and three dimensions of self-authorship. Regarded the three pairs of correlations among the three phases in the development of self-authorship, the weakest correlation was between the external formula phase and the cross-roads phase (r = 0.459, p< 0.001) while the strongest correlation was between the cross-roads phase and the early stage of self-authorship phase (r = 0.595, p< 0.001). Regarded the correlations among the three theoretical dimensions of self-authorship, the interpersonal dimension was more strongly related to the epistemological dimension (r

= 0.657, $p < 0.001$), than that of intrapersonal dimension to epistemological dimension (r = 0.628, $p < 0.001$).

Table 2. Correlations between demographics, dimensions, and phases of self-authorship

Measure	2	3	4	5	6	7	8	9	10
1.Age	**-.078***	.028	.064	-.002	**-.095***	-.007	-.026	-.052	-.018
2.Gender	-	.039	.035	.074	**.087***	.015	.05	.068	.051
3.Father_edu		-	**.71****	.076	.072	.074	.067	.031	**.13****
4.Mother_edu			-	.069	.062	.071	.078	.011	**.119***
5.External formula				-	**.459 *****	**.528* ****	**.74 *****	**.664 *****	**.677 *****
6.Cross-roads					-	**.595* ****	**.643 *****	**.771 *****	**.685 *****
7.Early-stage of self-authorship						-	**.795 *****	**.739 *****	**.803 *****
8.Interpersonal							-	**.68 *****	**.657 *****
9.Intrapersonal								-	**.628 *****
10.Epistemological									-

Notes: ***. Correlation is significant at the 0.001 level (2-tailed); **. Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed).

5. Conclusion

The current study was designed in exploratory nature with restrictions of at least three limitations. First, participants of this study were not selected by random sampling, instead, volunteers were recruited from a convenient sample. Second, given the complex structure of self-authorship (i.e. multidimensional and multiphase), it is reasonable to doubt that the self-reported questionnaire data collected by the current study might not be able to reflect all the details of students' orientations toward self-authorship. Third, except for the demographic factors considered by the current research, there still are other potentially influential factors. For example, the influence of the psychosocial aspect of the learning environment (e.g. teacher-student interaction, peer morale, etc.) was not included.

In summary, the current study provided empirical evidence in adapting the SA-CDMS to the Chinese higher educational context. The current study contributed to the theory on self-authorship that (1) The moderately positive correlations among the dimensions of self-

authorship indicated that the dimensions of self-authorship were intertwined with each other; (2) The strengths of correlations among the three dimensions also indicated that individual's concept of knowledge (epistemological) was more closely related to his or her perspectives on others (interpersonal) than the views of one's own role in the meaning-making process (intrapersonal). (3) Regarded the correlations among the three phases of self-authorship development, the results supported Meszaros, Creamer, and Lee's (2007) finding that individuals need to take a big leap from fully dependent on others to start noticing one's own voices. Finally, the practical implication can be offered to stakeholders in Chinese higher educational institutions that it is possible to use SA-CDMS as an assessment tool for the training courses or educational interventions that aim at promoting self-authorship development.

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A Student Workload Estimator Tool: Rethinking Modular Credit

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Abstract

This paper aims to develop a Student Workload Estimator tool for University students. Traditionally, modular credit has been used as a student workload indicator at a purely time-based stage. This needs rethinking keeping in view the changing educational settings. The paper presents a basic student workload model built to assess student workload in a more realistic and detailed manner taking into consideration objective factors as well as subjective factors for personalized model. It presents a mechanism for data collection of course workload as well as of the students' subjective perceptions for the workload estimator. The outcomes are expected to provide more insights than only estimated weekly working hours indicated by modular credit, thus allowing students to make more informed decisions for a suitable academic path and to help reduce the course dropping rate. Deliverables of the work include a data collection tool and a workload estimator tool.

Keywords: *Data Collection; Modular Credit; Objective Workload; Subjective Workload; Workload Estimator; Student Workload Model.*

1. Introduction: rethinking modular credit

One of the common scenarios in university life is that students may always complain about some modules having *a too high workload* (Kyndt et al., 2013). However, what is the truth behind the "too high workload"?

It has been recognized that workload is a major factor that has a great impact on the quality of study outcome in the studying environment (Kyndt et al., 2013). The current universities are generally following a modular credit system with modular credit (MC) as an indicator of estimated required time for a module. Although the basic modules are holding the same credit value, there are lots of other factors that have an impact on actual workloads objectively and subjectively, including syllabus, students' perceptions and other certain factors. Therefore, is this MC system enough for the workload schedule in higher education?

2. Rationale for the need of improvement of MC system

2.1. Heavy workload can cause bad academic performance

Singapore students show excellent performance in mathematics, science, and reading. However, it is exacting a heavy emotional price with experiencing high levels of anxiety with a terrible status of school-life balance on them from the high workload (Davie, 2019). Studies also show that around one-third of students choose to drop the modules before the complete in the Organization for Economic Co-operation and Development (OECD) countries, where student workload plays a significant role in this high module dropping rate (Bowyer, 2012). Meanwhile, overload could also result in surface learning rather than deep learning. Students gain the skills necessary for problem-solving during the deep-learning (Lockwood, 1998). The process from the measurement of the students' workload, to evaluation and the update of curricula, is essential for high-quality education and good student performance (Tuncay *et al* 2009, p. 136). Overall, the well-designed workload could actually benefit both students for better academic performance and higher education institutes for lower module dropping rates.

2.2. The measurement of workload is hard

The workload is more than a fixed number of the estimated weekly learning hours that MC indicates (Kember, 2004). Lots of factors can cause a significant challenge to the actual workload, including teaching methods and personal characteristics (Ruiz-Gallardo *et al*, 2011). Some common quantitative and qualitative workload measurements that have been using now include end-term feedback surveys, reports, online reviews, interviews, focus groups, etc. However, no matter what methodology has been chosen, it is still hard to measure significant accuracy. Individual students may encounter difficulties to record the actual hours devoted to the study (Ruiz-Gallardo *et al*, 2011). The subjective student's perception of their

own study work could also vary (Pogačnik *et al*, 2004, p. 255). Therefore, it is not easy to measure the accurate actual module workload as it could vary from individuals and hard to collect record actual time.

2.3. No workload estimator for Students

There is no other reference other than MC for students to sense the difficulty of the modules in our university. Students may look for online comments or seek help from seniors to find out the details about the module reviews. Few universities, like Rice University (*Figure 2.3-1*) and The Open University (*Figure 2.3-2*), have developed workload tools to help students calculate workload based on either research works or individual weekly activities. The tool could also help the teaching team to assign reasonable tasks during the syllabus design. We believe that students in our university will benefit from having a workload tool. This could help both students and the teaching team aiming at better academic performance.

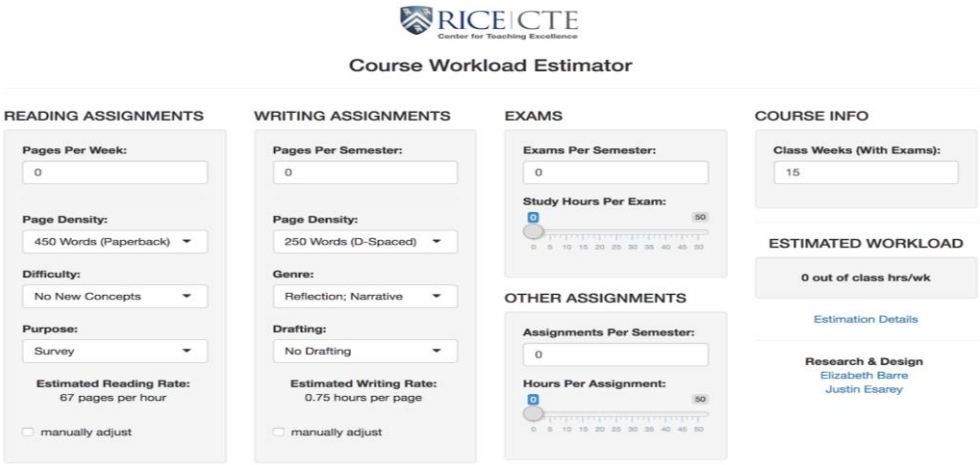

Figure 2.3-1. Rice University Course Workload Estimator.
Source: https://cte.rice.edu/workload

Figure 2.3-2. Massey University Workload Estimator.
Source: https://www.massey.ac.nz/massey/learning/programme-course/planning/workload-planning-tool/workload-planning-tool_home.cfm

3. Workload estimator tool structure and functionality

The proposed tool is developed as a time-tracking utility web application, aiming to help students improve study efficiency through time tracking and customize a workload balanced timetable according to individual preferences. When students leverage the app to keep track of task progress for better time management, the actual time data will be collected for each module and its various components. The data will benefit both students for better schedule management and curriculum designer to adjust the proper module workload accordingly.

3.1. User study

To identify the user base and possible market value of the workload estimator tool, a questionnaire was sent out to student groups via the messaging service Telegram around 500 students. The target audience is current undergraduate students including both local and exchange students. We have received 54 responses across faculties and years of study.

Findings:

1. The majority will be discouraged from using the app because of the inconvenience
2. Students have privacy concerns for using the app
3. The majority are looking forward to using the app plan the schedule better
4. The majority of the respondents are interested in knowing how much time their peers put into a module and they are willing to share their own data

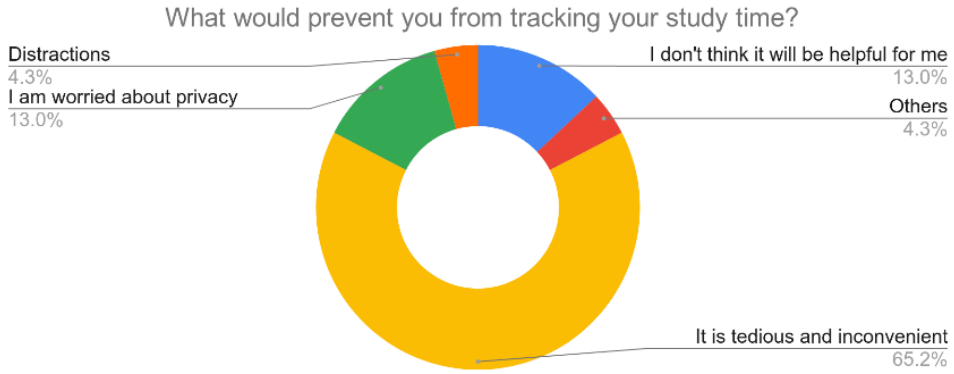

Figure 3.1-1

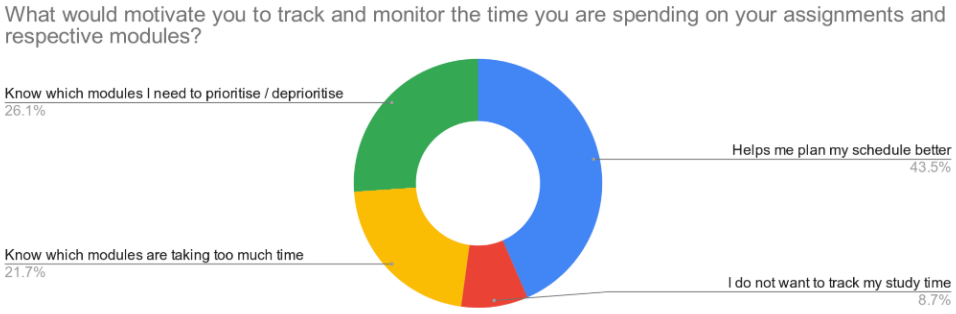

Figure 3.2-2

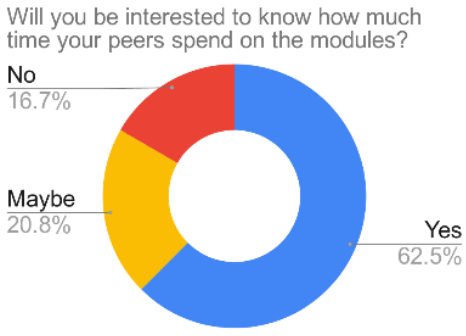

Figure 3.2-3

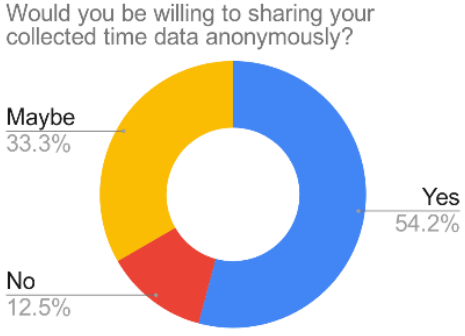

Figure 3.2-4

Synthesis:

1. The workload tool should be user-friendly to attract users
2. The private data should be kept to students own usage and the usage of data should be under students' consents
3. Social network on the app could attract students

In general, students are experiencing heavy workload and they are looking for a workload management tool with good user experience to design their academic path. Students are looking for the module reviews and are willing to share the data as reviews under the consent.

Students are positive about to- do list and block list to improve study efficiency. A social network could encourage the usage as students are curious about the performance of their peers. Therefore, adding a leaderboard or other gaming system could possibly attract students. Overall, the workload estimator tool should focus on time-tracking and timetable schedule.

3.2 Main functionality

Time tracking tool

The workload tool allows students to track and monitor the actual time they spend on a module's assignments, projects, and revision. In this way, students are able to distribute their time for studies and personal life. Compared with a traditional methodology to use end-term feedback to record workload, the actual time spent on the module could be recorded based on individual performance, rather than vague qualitative feedback and possible bias among students from various backgrounds.

Timetable schedule tool

The workload tool enables aggregation of all the time data of a particular module to be shared with future students as a reference. Based on the historical data from the modules and personal study performance, it allows students to have the ease of mind knowing that the modules they choose to enroll in would not take up excessive time. Module coordinators are able to review and modify a module's workload or allocated modular credits if necessary as well so that a holistic learning environment can be created and each module would transfer adequate knowledge and skills to warrant the module credits allocated. Students will be able to justify the actual workload according to personal preferences. Rather than seeking for seniors qualitative reviews, students could receive more personal justified suggestions as a reference to design their academic path.

3.3. Student Workload Model

In order to gain a degree successfully, students are registered under a programme of study engaged in academic learning activities with a certain minimum credit achieved. The

workload is the estimated time that students need to finish the learning assessments, including modes of instruction (teacher- directed) and learning activities (student-

directed) (Lockwood, 1999). The module credit value is recognized as an indicator of the estimated student workload. Besides, there is a tendency to distinguish the workload into two categories: objective and subjective workload (Kyndt et al., 2013).

Objective workload

The objective workload is referred to the objective time students spent on their work (Kyndt et al., 2013). However, it is not easy and also not enough. There is very little research about the amount of time it takes the average college students to complete the common assessments. Besides, although two modules may take around the same time to finish, students may still have different visions of the difficulty levels of these two modules. Therefore, MC is insufficient as a standard to represent the module workload.

Subjective workload

The subjective workload is derived from the combination of the workload required on students and the effects of these requirements on students (Kyndt et al., 2013). It can be divided into two categories: quantitative perceived and qualitative perceived workload. On the one hand, the quantitative perceived workload emphasizes the time aspects of the workload (Kyndt et al., 2013). It is significantly different from the objective workload as the individual perceptions of the available and required time could vary from the actually taken time. On the other hand, the qualitative perceived workload focus on the effects of demand placed upon students. There are various factors, including learning environments, assessment difficulty, personal characteristics, and social network, that could influence the qualitative perception. Students will sense the heavy workload from the feeling of pressure, stress or frustration (Kember, 2004). This will upset the students and directly decrease their learning motivation.

4. The future of the workload estimator tool

Student workload has been indicated as the most crucial factor affecting student engaging with the course activities. Overload is one of the main reasons that lead students to choose to drop the course (Lockwood, 1999) and result in surface learning. We should encourage deep learning which is usually inline with a reasonable workload. The workload tool as a time-tracking utility web application could help students adjust the proper module workload accordingly while MC is not enough.

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Coercive isomorphism in higher education: Direct pressures from the state to the Turkish universities

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Abstract

The universities maintain their continuity with the pressure of complying with the policies of the state and global policies. This study addresses the coercive pressure of the higher education policies of the state on the Turkish universities. The elective classes of Occupational Knowledge and Area Training to be taught at the universities may be opened when they are approved by the Higher Education Council (Yuksekogretim Kurulu, YOK) which is an institution having a public legal entity. On the other hand, the ability of the universities to determine the elective class of Liberal Education indicates a rare situation where the universities exercise their autonomy.

Keywords: *Isomorphism; coercive isomorphism; higher education policy, higher education, university*

1. Introduction

The policies of the state and global policies affect higher education as it is also the case in various other sectors, because it is unimaginable for a closed system to maintain its existence for a long time where no external impact exists. The economy, technology, legal regulations and agreements create pressures on the institutions. The institutions are unable to avoid the coercive pressures of the national and global policies. In this study, the direct pressures that the Turkish universities experience are elaborated through the example of the fact that the elective classes to be taught at the universities are subject to the approval of the Higher Education Council which is a supreme institution. In this regard, the titles of coercive isomorphism and coercive isomorphism in the Turkish universities are provided here respectively.

2. Coercive Isomorphism

2.1. Definition

The coercive isomorphism is a process which originates from both the formal and informal pressures that the organizations put on that particular organization with which it is tied to through the cultural expectations in the society where the organizations operate (DiMaggio & Powell, 1991). In other words, the regulatory processes include the establishment of the formal rules, monitoring, and approving actions. The individuals accept the validity and existence of institutionalized systems of rule regardless of the fairness, accurateness and appropriateness of the rules (Colbeck, 2002), because the state as the rule maker occupies the ruling position and exercises its power over these institutions (Gounko & Smale, 2007).

2.2. Need for Legitimation of Institutions

Meyer and Rowan (1977) argued that the organizational structures gradually reflect the rules that have been legitimized by the state and institutionalized at the state level as the hegemony of the rationalized states and other large rational organizations increase in the social life. Consequently, the organizations have gradually become more homogeneous in certain areas and get organized in a way to adapt to a higher structure. At the same time, the limits of the organizations are structurally drawn and their outputs are subjected to a control by the limitations created by the technical activities such as the policies and market (DiMaggio & Powell, 1991). The existence of a common legal environment affects many aspects of the behaviors and structure of an organization. Other legal and technical requirements of the state similarly shape the organizations (for instance, the changes in budget cycles, annual reports, requirements for financial reporting and the like) (DiMaggio & Powell, 1991). The power owned by the state or a large social system has to eliminate the difficulties that the organizations experience or to meet the needs of the organizations (Pfeffer & Salancik,

1978/2003). When an organization is subjected to an external auditing, evaluation or regulation, it has the tendency to react and resort to an isomorphous transformation by defending itself. As the external pressures increase, the organizations seek to eliminate or diffuse those pressures by changing their procedures. The easiest way of this transformation is to adopt the routines and structures that are legitimately defined by the laws or the state institutions (Frumkin & Galaskiewicz, 2004).

3. Coercive Isomorphism in the Turkish Universities

The universities experience pressures directly from the state and indirectly from international organizations. The competition between the universities for obtaining funds from the state budget (Fay & Zavattaro, 2016) and their obedience to the new legal regulations that the state has issued regarding the higher education sector (Gounko & Smale, 2007) may be provided as examples of the direct impact of the state on the universities. The impact of the World Bank may be provided as an example for the coercive pressures of the international organizations, because the dependency of the governments on the loans and technical assistance forces them to accept the agreed conditions or free market reforms and regulatory policies based on budget cuts (Gounko & Smale, 2007). Additionally, the World Bank provides project support for the higher education institutions in matters such as enrolment into higher education, improvement of teaching and research activities and of the quality of education (Cai, 2010). Another example that may be indicated for the coercive pressures of the international organizations is the Bologna Process (Seyfried, Ansmann, & Pohlenz, 2019).

Turkish universities experience pressures directly from the state. This situation originates from the centralist state structure in Turkey. The central government makes important decisions regarding the political, constitutional/legal matters and financial resources. Those decisions are under the inspection of the representatives of the central government (Bache, 1999). The Higher Education Council through which the central government manifests its power is a constitutional institution which brings all higher education institutions including the foundation universities under the same roof. The Higher Education Council is an institution having autonomy and public legal entity within the framework of the duties and authority given to itself by the 130th and the 131st Articles of the Turkish Constitution of 1982. The organization, duties, authority, responsibilities and the working principles of the institution are stipulated by the Higher Education Law Numbered 2547 (yok.gov.tr). The purpose of the Law Numbered 2547 is to determine the purposes and principles pertaining to higher education and to establish principles regarding the actions, duties, authority, and responsibilities along with the matters related to teaching and instruction, research, publications, teaching faculty, students and other personnel of institutions of higher education.

Based on the Law Numbered 2547, various regulations have been issued regarding student exchange programs, graduate teaching and education, principles regarding discipline of students at higher education institutions, higher education quality assurance, promotion and appointment for the position of assistant professorships and associate professorships, scientific research projects of higher education institutions, academic incentive payments, and foundation higher education institutions. While the Head of the Higher Education Council executes the terms of some of the regulations (for instance, Student Discipline of Higher Education Institutions), the Council of Ministers executes the terms of other regulations (for instance, Academic Incentive Payment). In Turkey, 129 state universities, 73 foundation universities and 5 foundation vocational school of higher education are responsible for implementation of these legal regulations (istatistik.yok.gov.tr). A particular higher education institution issues regulations and directives to provide its operations. The directives of the universities are primarily based on the Law of Higher Education Numbered 2547 and they are accepted by the Senate of that particular university and later they go into effect. The regulations of the university are published in the Official Gazette after being accepted in the University Senate. The stipulations of the regulations and directives of the universities are executed by the University Rector of that particular university. Out of those directives, the most well-known are the regulations and directives that are prepared regarding the examinations and the teaching and instruction of the compulsory and elective classes. Within the scope of the Bologna Process, elective classes must be included in the university curriculum at least by 25% (YOK, 2018). According to the legal regulations, the elective classes to be opened in the faculties, and vocational schools of higher education are submitted to the Office of the University Rector to be discussed in the University Senate after being approved in the Board of Directors. An explanation takes place regarding opening elective classes among the answers that the Higher Education Council provides for the frequently asked questions regarding the Implementation of Undergraduate Programs of Teaching that the Council has issued in September of 2018. Accordingly, it has become mandatory for the elective classes of Occupational Knowledge and Area Training to be proposed to and accepted by the Higher Education Council after providing their rationale and class description. There is no need for the approval of the Higher Education Council only for the elective class of Liberal Education (yok.gov.tr). In the interviews conducted with the faculty members of the Faculty of Education of Ahi Evran University, Faculty of Education of Kastamonu University and Faculty of Education of Gazi University, Ozturk Fidan (2018) found out that the university faculties were under the pressure of obeying the policies and standards set by the Higher Education Council in determining the classes taught. In this regard, the opinions of some of the faculty members are as follows:

We have a very fixed program dictated by the Higher Education Council. The program of the education faculties is substantially like that which is close to 80% of the classes (The interviewee refers to the mandatory classes determined by the Higher Education Council).

The Council already determines the essence of the elective classes. The council says "you may have a Liberal Education class here" "You may have an Occupational Knowledge class there" otherwise, I may not have any class based on my own opinion by saying "It would be nice to have this class" (The interviewee indicates that he/she is unable to have a class based on his/her wish) (Social Sciences Education, Ahi Evran University)

In the education faculties, a highly central impact is experienced. When we want to make an offer for a new class, it is said "No, you may not do that, this class is a basic class dictated by the Higher Education Council" or when you want to take out a class from the curriculum, it is said "These are the basic classes dictated by the Higher Education Council, they may not be removed". You may not indeed add a class if an instruction is not given by the Higher Education Council to the universities or the Office of the University Rector. We were unable to say "I would like to include and teach this class in the program." The approval of the Higher Education Council is definitely required. We were submitting even our elective classes first for the approval of the Office of the University Rector and the University Senate, and after the approval of the University Senate, we were submitting it again for the approval of the Higher Education Council (Science Education, Kastamonu University).

It is even beyond the university to open a non-elective class at the department. We have freedom within the department regarding the elective classes. However, in other classes, there is a hierarchical structure that goes up to the University Senate. Indeed, there is a hierarchical structure that goes to the Higher Education Council from the University Senate (Physics Education, Gazi University).

The findings regarding the pressure of compliance of the universities for the rules set by the Higher Education Council support the conceptualization in the literature regarding isomorphism. Tthe obedience of the universities to the rules that the Higher Education Council sets in the higher education sector, in other words, the existence of the organizational settings that are structured or limited by the Higher Education Council may mean that a limit has been drawn for the university administrations.

The excessive centralist structure of the Higher Education Council introduced the criticisms regarding that the Higher Education Council needed to be rendered as a coordination council. Criticisms have been made regarding that the centralist structure of the Higher Education Council negatively affected the characteristics of higher education, prevented the competitive capacity of the higher education institutions and failed to respond to the needs of the society. It is argued that the administrative, financial and scientific autonomy of the universities would be strengthened, and the universities would become more transparent, accountable and competitive by rendering the Higher Education Council having a structure that would carry out the long-term planning and coordination functions (DPT, 2000). Thus, it is clear that the failure to transform the Higher Education Council into a coordination council created a

pressure on the functioning of the higher education institutions. According to Bess and Dee (2008) the control of the external forces such as economy, market and technology on the organization is provided by the official arrangements of the state. The members of the organization know that they had limited right of choice, however they also follow-up external orders. Thus, under these circumstances, the organization largely obeys the requests of the environment. In this case, it is understood that the market forces and the political and social pressures create high deterministic settings. On the other hand, according to Scott (1991) in settings devoid of central authority, the organizational forms may show similarities due to the competitive and mimetic processes. The fact that the higher education institutions create their own educational programs and determine the elective Liberal Education classes to be taught at their faculties by themselves may mean that the universities have partially softened the central authority. In this case, in the higher education sector which is shaped by the market conditions, it may be argued that one of the topics where the higher education institutions would be in competition would be regarding attracting successful students to their own universities. It may be said that the universities which compete with each other would follow-up each other regarding the innovations that they have come up with, and model each other. Nowadays, innovations, changes and variations take place in the educational programs of the foundation universities for the purpose of attracting more students to the universities.

4. Conclusion

The universities are obligated to obey the legal regulations of the state. However, the universities also have the tendency to obey the global policies of the international organizations to benefit from their educational and financial support. The obligation of the universities to obey the legal regulations of the state and the global policies lead to the universities to resemble each other. Nowadays, the universities have the purposes of obtaining funds and increasing their number of students. This purpose leads to competition between universities so that the universities are able to survive. One way of being able to compete is to enrich the educational programs of the universities. Different university committees work on placing elective classes into their educational programs, because the elective classes allow the students to increase their chances of employment in the future and explore their potential by taking different classes from different fields instead of specializing only in one field (Toprak & Erdogan, 2013). However, the fact that the Higher Education Council, which is a supreme institution which gathers universities under its roof, is the final authority approving/disapproving the elective classes that the university committees plan to open, limits the autonomy of the universities.

Briefly, higher education institutions are unable to avoid the coercive pressures of the national and global policies. The competition between the universities for obtaining funds from the state budget and their obedience to the new legal regulations that the state has issued

regarding the higher education sector show a direct impact of the Turkish state on the universities.

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Factors That Shape University Students' Attitudes Towards Academic Research

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Abstract

Students almost always hold different attitudes toward academic research. In order to describe that phenomenon and find out the factors which affected and caused students' different attitudes toward academic research, the researchers investigated Wenzhou-Kean University (WKU) students' attitudes towards the support from the university, research training environment, and their future academic career directions. This descriptive-quantitative study also considered students' attitudes as a variable to measure respondents' understanding and knowledge of academic research, and personal experiences. The sample size of 227 undergraduates represented the cross sectional respondents of the four colleges. Based on data collected by online questionnaires, results showed that most WKU students held positive attitudes toward academic research and are aware of its significance. WKU students did not have enough personal experiences in undertaking research studies. Generally, WKU students realized and acknowledged the significance of academic research in cultivating their inquiry mind and gain better understanding of the research course content. All of the three factors could affect students' attitudes and motivations toward academic research. Faculty mentoring in the research training environment has the strongest influence while on-campus related activities in the support from the university has the lightest influence on WKU undergraduates' attitudes towards research.

Keywords: *academic research; undergraduate students; university support; future career plans; research training environment.*

1. Introduction

Research experiences and skills are crucial for students at any level of education and can benefit them in different perspectives (Ruchina et al., 2015). For researchers themselves, doing research can deepen the understanding of their professional fields and explore the unknown area of their interest, in the long run, it can foster the inquiring spirit and persistence, and improve critical thinking skills. As for a larger scope, research can also promote academic development, benefiting the society someday.

However, though it has a great benefit to take part in academic research for undergraduates, students still hold different attitudes towards research, varying from positive to negative. A study showed that most students are aware of the importance and necessity of research work as part of their university curriculum" (Kozlova & Atamanova, 2013), but meanwhile, do not recognize the role and significance of research work for their personal and professional development. Also, there is still a small number of students that have neutral or negative attitudes towards academic research (Kozlova & Atamanova, 2013). It is an interesting phenomenon, and this study tried to describe it and find out its causes.

There are some problems and limitations of our study though. Firstly, we randomly survey the samples of WKU students, the limited resources and costs determined that we cannot cover 100% students in WKU. Consequently, the results cannot approximately be precise, some deviation and bias might have appeared. Furthermore, some of the participants and the respondents of our questionnaire might provide some ineffective data due to their unserious response, which will affect the validity and reliability of the collected data.

1.1. Attitudes towards academic research

Academic research is a basic and important activity in academia (Otieno & Matoke, 2014) and it is important for undergraduate students to learn the research skills (Kinhead, 2003). Previous research has shown that there are different attitudes towards academic research among undergraduate students (Kozlova & Atamanova, 2013), which most undergraduate students hold positive attitudes towards research while there are still approximately 1/3 of them belonging to the rest. They analyzed the phenomenon partially caused by students' different understandings about research.

1.2. Research support from college

Beerkens points out that the universities' management of research programs will affect the production of academic research (2013). More intensive management can be regarded as a support that will have a positive effect on increasing the undergraduate students' interest in academic research. As a way for the college to support undergraduate research, on-campus academic activities have a positive impact on the attitudes of undergraduate students towards

research (John & Creighton, 2011), increasing students' confidence in undertaking research by enriching their research experiences and skills.

Furthermore, library services in college can help students develop their critical thinking skills which are vital in analyzing the information (Silk et al., 2015, p. 153). Different libraries in China have different capacity levels in supporting undergraduate students' academic activities (Xi et al., 2019), and varying levels of library services may lead to different attitudes toward research for undergraduate students.

Financial support from universities plays a crucial role in research (Helene & Ribeiro, 2011, p. 679). Lacking investments in academic studies and research will lead to the reduction of production and quality of research. Financial support seems like an important factor has an impact on students' attitudes toward research as well. According to Stanford et al., (2017), increasing financial support by universities would increase the number of freshman research participants, meaning that enough financial support from college would make students' attitudes toward research more positive.

1.3. Research training context

According to Chumwichan and Siriparp, 2016, the research training environment does not have any direct impact on research interest in graduate students but has a significant indirect influence. As the sub factors "research curriculum" and "student-faculty mentorship" both are instructional research training environments according to the study (Chumwichan & Siriparp, 2016), they have an indirect effect on students' attitudes toward academic research. It is studied that after taking a research course in the second year, students hold more positive attitudes toward research because they develop more positive opinions of the significance of research and better capability of research (Van der Linden et al., 2015). In addition, faculty mentoring, as a part of the research environment, also positively affects students' attitudes toward academic research, developing their research knowledge and skills (van der Linden et al., 2012, p. 415), as well as their interests on research (Dolan & Johnson, 2010).

1.4. Academic and career direction

Previous research investigated that students are aware of the significance and benefits of conducting academic research on their future careers (Murdoch-Eaton et al., 2010, p. 156). However, different professional fields have broadly different curriculum design, and the more curriculum embedded with research experiences, the more students actively participate in research, leading to students' different attitudes toward academic research (Zimbardi & Myatt, 2014). Likewise, Goetz et al.'s study (2017) recommended that "provide training as part of the curriculum" (p.16) will be useful to encourage undergraduates to engage in academic research. Furthermore, students who have different postgraduate plans hold different attitudes towards academic research (John & Creighton, 2011). It was pointed out

that if an undergraduate student intends to go to graduate school, he/she is more likely to participate in undergraduate research.

1.5. Conceptual Framework

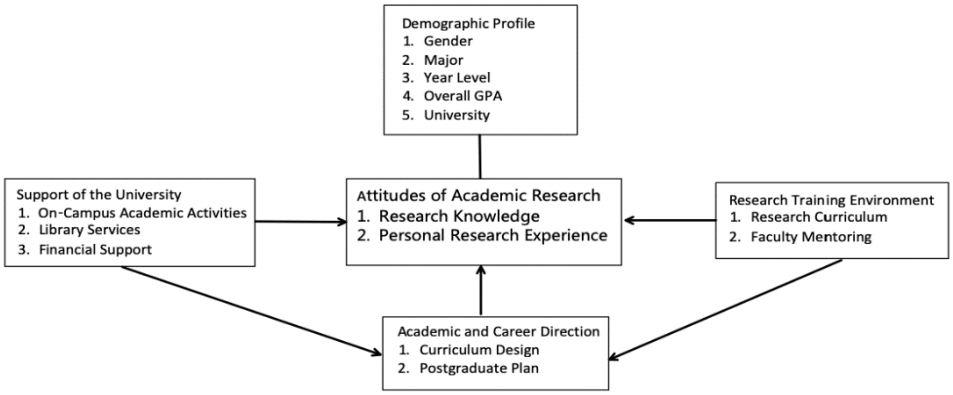

Figure 1. Factors Shaping Undergraduates' Attitudes towards Academic Research

2. Methodology

Descriptive-quantitative approach was used in the study to describe the factors that shape undergraduates' attitudes towards academic research. The study was conducted at Wenzhou-Kean University, a joint Chinese-American university in China, during the academic year 2018-2019. WKU students who are mostly composed of Chinese nationals adapt to the American educational system.

Cross-sectional design was used to represent gathered data collected from the four colleges. Returns from the distributed questionnaire were received from 227 respondents approximately representing 10.09% of the study population that consisted of WKU undergraduate students. Of the 227 respondents, 70 (30.84%) and 157 (69.16%) respondents were male and female respectively. Respondents' distribution as to year level were as follows: 11.01% (25) of respondents are freshmen; 44.49% (101) are sophomores; 27.75% (63) seniors and 16.74% (38) juniors.

This study used online questionnaires posted through the survey website named Wenjuanxing. The link was shared on social media such as QQ or Wechat for target respondents to access and respond. The questionnaire used the five-point attitudinal Likert scale to measure participants' attitudes towards academic research and the related factors shown on the conceptual framework (Figure 1). A 5-point Likert scale was used to indicate respondents'

attitudes. Numbers closer to 1 represented strong disagreement (SD).and numbers closer to 5 represented strong agreement.

3. Results and Discussions

3.1. Attitudes toward academic research

WKU students' *level of understanding and knowledge about academic research* is generally "Above Average" according to the total ($\overline{X}$=3.60) based on the 5-point Likert scale (Table 1). More specifically, 70.48% of respondents agreed that *conducting research is significant* ($\overline{X}$= 3.81), which can be described as "Above Average". Table 2 presents students' opinions on the significance of research in which "cultivate my inquiry spirit" (71.81%) ranked first and "help me understand the course content" (69.6%) ranked second. The 64.76% of the respondents agreed that "the significance of research would encourage them to conduct research". Furthermore, most of the participants (66.96%) responded that they had conducted research and had more or less research experiences, and those who have had research experience agreed that research experiences would encourage them to conduct research again.

Table 1. Level of understanding and knowledge about academic research.

	Opinions	**Mean of 5-point Likert Scale**	
Level of understanding and knowledge about academic research	I understand and know well about how to undertake a study.	3.28	3.60
	I believe that conducting academic research is significant.	3.81	
	Significance of research (Table2) will encourage me to undertake research.	3.70	

Table 2. Top 5 significance of research based on students' opinions.

Ranking	Students' Opinions on the Significance of Academic Research	Percentage of students' support
1	Research cultivates my inquiry spirit.	71.81%
2	Research can help me understand course content.	69.60%
3	Research fosters my persistence.	57.27%
4	Research can help me in my professional career.	56.83%
5	Research can show my professionalism in my research area.	55.95%

3.2. Research support from University

From the perspectives of WKU undergraduates, more than half (53.30%) of the respondents thought *on-campus academic research activities* of their university were effective ($\overline{X}$=3.59), and 59.03% agreed that the efficiency of on-campus academic research activities would more or less influence their attitudes towards research. In evaluating the *level of library services* of WKU, 61.98% of the evaluations were positive, and the majority of the respondents (61.23%) believed that the library services efficiency would significantly support them to undertake academic research ($\overline{X}$=3.67). The *level of financial support* for research was evaluated relatively less effective than that of on-campus research activities because less than half of the respondents (48.02%) thought it was supportive, but most respondents (63.43%) agreed that college support on research was significant and could influence their attitudes towards research ($\overline{X}$=3.67), which was interpreted as "Above Average".

3.3. Research training environment

As for the research training environment, respondents evaluated that the level of "an overall background and knowledge about research" the college research curriculum offered was "Above Average", and 74.89% of them consider *college research curriculum* as an important factor that influence their attitude towards research ($\overline{X}$=3.93). On another aspect, *"student-faculty research mentorship*" was a common relationship among researchers at WKU, which was also evaluated as "Above Average" ($\overline{X}$=3.99). The 75.78% respondents admitted that student-faculty mentorship can make them more confident in research.

3.4. Academic and career direction

In terms of academic and career direction, 71.81% respondents agreed that characteristics of their profession would impact their decision about whether to undertake research or not, which means that different academic directions will influence undergraduates' attitudes toward research. About 56.83% of the respondents who planned to apply for a graduate program either domestic or abroad after graduation from WKU held more positive attitudes. Also, 71.8% of respondents thought their post-graduate plans would influence their attitudes towards research.

3.5. Overview of the three factors that shape undergraduates' attitudes towards research

Generally, the results showed that among the three factors that contributed to shaping undergraduates' attitudes towards research, the research training environment ranked most significant ($\overline{X}$=3.96), while the factor of research support from university ranked least significant ($\overline{X}$=3.64). In addition, faculty mentoring in the factor of the research training environment has the highest mean ($\overline{X}$=3.99) among all the sub factors.

Table 3. Means Factors shaping undergraduates' attitudes towards academic research

Factors	Sub factors	Mean of 5-point Likert Scale	
Research support from University	On-campus research activities	3.59	3.64
	Library services	3.67	
	Financial support	3.67	
Academic and career direction	Curriculum design	3.81	3.81
	Postgraduate plans	3.81	
Research training environment	Research curriculum	3.93	3.96
	Faculty mentoring	3.99	

3.6. Implications and Conclusion

Research reported that faculty mentoring in the research training environment has the strongest influence on WKU undergraduates' attitudes towards research. The implication of this finding suggests the strengthening of faculty mentoring to enhance not only students' confidence in conducting research but also promote students' research experiential learning.

Research support from university on shaping students' attitudes is the lightest amongst the three factors. WKU is advised to organize more on-campus research activities, offer efficient library services and expand financial support on students' research related experiences.

WKU students widely recognize the merits of research that heighten to cultivate students' inquiry spirit and gain deeper understanding of the research course content. Hence, the conglomeration of these factors contribute to the shaping of their positive attitudes towards academic research with a clear perception of the significance of research and relatively above average knowledge about conducting research.

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Student Engagement in the Co-designing and Co-teaching a Cornerstone EECS Design and Implementation Course at National Taiwan University

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Abstract

International higher education policies and literature have called for students and faculty to collaborate effectively in the co-designing and co-teaching of curricula. In the fall of 2017, the Department of Electrical Engineering of National Taiwan University launched the "Creative Cornerstone Course Design for ICT[1] and Engineering Education" course, which is a co-design course, to engage higher division and graduate students in co-creating and co-teaching the curriculum of a "Cornerstone EECS Design and Implementation" freshman course, which was a cornerstone course to be conducted in the spring of 2018. This paper presents the educational practice and learning outcomes of the co-design course. The implementation of the co-design course involved the following activities: (a) project- and team-based learning approaches, (b) active student partnership with teachers for designing the cornerstone course curriculum, and (c) preparatory cultivation of the students as teaching assistants for co-teaching. Learning outcome analysis indicated that freshman students significantly benefited in terms of their self-exploration of ICT-related subjects, basic professional knowledge, operational techniques, and confidence in self-learning when the cornerstone course was developed through co-designing.

Keywords: *cornerstone course; curriculum co-design; electrical engineering education; project-based learning; student partnership.*

[1] ICT: Information and Communication Technology.

1. Introduction

Student-centered course design and student participation have long been the key themes of higher education reforms worldwide. Although educational institutions rarely make students substantive partners in designing courses and providing advice on teaching content, the idea of students becoming teaching assistants (TAs) and co-creators of their own learning has received increasing attention in recent years (Mihans et al., 2008). Many studies have indicated that close interaction between students and instructors is one of the most important factors for students' self-learning, positive development, active engagement, and high satisfaction in higher education (Kuh et al., 2005). Teachers and students can co-create courses on university campuses by using two common models (Bovill & Felten, 2016): one model involves hiring students as consultants to advise on teaching content and methods (Curra & Millard, 2016), whereas the other method involves forming a team of students, course instructors, and educational developers to create a curriculum design (Mihans et al., 2008; Delpish et al., 2010). Both students and teachers can benefit from partnerships. Collaboration between students and teachers enables better understanding of the perspectives held by people at different positions in the teaching and learning field. Notably, the potential changes in the power of teaching in the educational practice improve the teaching and classroom experience, which promotes equal interaction between teachers and students at university campuses (Delpish et al., 2010).

Since 2016, the Department of Electrical Engineering at National Taiwan University (NTUEE) has initiated undergraduate curriculum reform to achieve the university's goal of advancing with the times and cultivating excellence, which is in line with the international trend of innovation in engineering education (Dym, 2013; Johri, 2014). In specific, there have been a strong dirve to motivate freshman students through engineering design, implementation and team work for their later study of the basics and project-based exploration of the rich subjects in the field of EECS. In the fall of 2017, the NTUEE launched the "Creative Cornerstone Course Design for ICT and Engineering Education" course to engage students in co-creating the curriculum of the "Cornerstone EECS Design and Implementation" freshman course that was to be taught in the spring of 2018. The department also invited one senior professional from the Center for Teaching and Learning Development to assist in the evaluation of curriculum development and the corresponding learning outcomes. This paper reports the first-stage of the development and implementation of the aforementioned two innovative courses in the 2017–2018 academic year.

2. Background of Freshman Course Reform

Most graduates of the NTUEE, who were from the top 0.5% of high school students, have achieved success in their careers and have made substantial contributions to industries and society. However, on a review of their university education, some alumni have lamented that most classes conducted by the NTUEE are unidirectional and teacher-centered. Many NTUEE faculty members have also advocated the need for curriculum overhaul to not only catch up with the fast pace of global development but also nurture future leaders. Teachers and students in the NTUEE are suggested to initiate changes in traditional teaching and learning patterns as well as collaborate for addressing the challenges caused by new teaching and learning trends to achieve innovation.

Since the 2016-2017 academic year, the NTUEE has initiated compulsory curriculum planning with the restructuring and transformation of teaching models. At the invitation of the department chairman and two professor leaders, 13 professors joined the innovative curriculum development team in January 2017. Referring to the effective methodologies and successful practices of cornerstone engineering courses reported in the literature (Vallim et al., 2006; Whitfield et al., 2011; Thompson, 2012) and considering the specific needs of NTUEE freshman students, the team conducted a series of brainstorming sessions to discuss the development and planning direction of new innovative courses. In June 2017, the department's curriculum committee approved the introduction of two new elective courses during the 2017–2018 academic year. The "Creative Cornerstone Course Design for ICT and Engineering Education" course (referred to as the co-design course) was open to junior college students and above. The main goal of this course is to guide students in creating teaching materials related to engineering introductory design that can be used as the teaching content and learning activity basis in the "Cornerstone EECS Design and Implementation" course (referred to as the freshman cornerstone course).

3. Action Research Framework of Course Development and Practice

The developmental processes of the aforementioned two innovation courses involved a continuous cycle of introspection, which included focusing on problem areas, developing action plans, seeking partners, implementing action plans, and conducting introspection evaluations and improvements.

The process of action research in the course development is displayed in Figure 1. The process involved the following steps:

1. Defining the Education Problem: A first-year electrical engineering course that can become a cornerstone course in the department was developed.
2. Planning the Iterative Development of the Courses: Two innovative courses were

offered. In the winter of 2017, the senior co-design course was introduced for students to jointly develop the teaching content and materials of the new freshman course. The teaching materials created by the students and teachers were implemented and evaluated in the freshman cornerstone course conducted in the spring of 2018.

3. Seeking Educational Expert Cooperation: The assistance of the Center for Teaching and Learning Development of NTU was sought for evaluating the teaching effectiveness and learning outcomes of the freshman cornerstone course.
4. Taking Action for Research and Course Implementation: Collaboration was conducted with education researchers to collect quantitative and qualitative data on student learning outcomes in the freshman cornerstone course conducted in the spring of 2018.
5. Evaluation Analysis and Reflection: Quantitative and qualitative data and the feedback from teachers and students were analyzed; the teaching effectiveness of the course was evaluated and reflected on, and the overall results were reported to the department.
6. Redefining the Problem and Strengthening PBL: The senior co-design course was continuously offered in the winter of 2018 to implement the course development plan as well as to improve the co-designed lesson plans and project-based learning (PBL) activities for the freshman cornerstone course conducted in the spring of 2019.

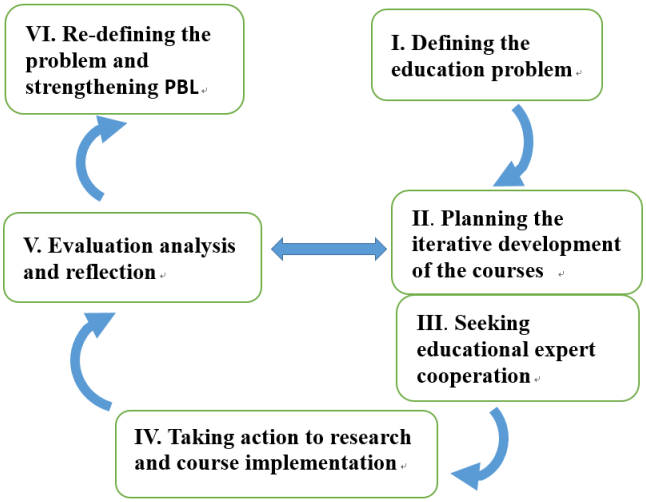

Figure 1. Process of action research in course development

4. Practices in the Senior Co-Design Course

The NTUEE developed a new course titled "Creative Cornerstone Course Design for ICT Engineering Education," first offered in the winter of 2017.

4.1. Teaching and Learning Objectives

The teaching and learning objectives were as follows:

- Reading and analyzing the curriculum concepts and practices of Taiwanese and foreign engineering cornerstone courses.
- Co-designing a curriculum suitable for freshman students through the PBL approach.
- Enhancing students' PBL experience, executive management, and team communication skills to cultivate TAs for the freshman cornerstone course.

4.2. Course Progress

The course progressed as follows:

- Review of student-centered curriculum design and teaching method, analysis of literature and case studies, and performance of group briefings and discussions.
- Group-specific thematic concept design and key planning, including outlining thematic concepts, estimating resource requirements, and planning detailed design schedules.
- Group custom project design, practical verification, and presentation (5 weeks), including thematic detail design, feasibility verification, integration of design and presentation, and writing development reports.
- Design and display of an introductory workshop unit and thematic lesson plan division (5 weeks), including designing detailed software, hardware, system platform, and unit introductory lesson plans; industry teacher sharing (Songhan and Microsoft); feasibility verification and demonstration cross-group integration of design norms; and writing reports of lesson plans.
- Teachers' group guidance during the winter vocation, used to revise and supplement the group teaching plans.

4.3. Learning Assessment

Assignments for the first half of the semester included reading materials before class, oral and written presentation about unit topics in class, and completing hands-on tasks after class. Each teacher conducted the first evaluation and provided written comments and suggestions. The project assignment in the second half of the semester involved designing and verifying

the topic and relevant teaching materials for the freshman cornerstone course to be conducted in the following semester. The students reported the group work progress weekly in the classroom. Moreover, through interactive discussions with the teacher group, they strengthened the design and practical verification of the curriculum plans. At the end of the semester, the group teaching material design projects were demonstrated. The teacher group provided a ranking and comments for the teaching plan design of each group according to the grading criteria of fun, completeness, and creativity. The group-written reports of the students on the teaching design, such as the experimental design ppts, lesson plans, and implementation results, were read and graded in detail by the teachers. Furthermore, the coordinating faculty member called for the students to collaborate with the teacher group for modifying and strengthening the teaching material during the winter vacation.

4.4. PBL Products

The 2017 co-design course comprised 16 uper division undergraduate and eight graduate students. The students were guided by eight teachers to explore and develop practical topics and teaching materials suitable for the freshman students of the NTUEE. The students formed groups and cooperated in designing various teaching units, including those related to wireless communications, control technology, machine learning, optoelectronics, electronics, and mechanical design. Through collaborations among the students and teachers, a five-unit material and a few group project teaching plans were designed on the theme of "path-following and treasure-hunting robots." These materials were implemented during the first half of 2018 in the freshman cornerstone course.

5. Analysis and Discussion

5.1. Implementation of Co-Design Curriculum

The cornerstone course was first offered in the spring of 2018. The teaching team comprised six faculty and one industry teacher and nine TAs, who participated in teaching material design. A total of 57 freshman students were enrolled and divided into three classes. Unit workshops were conducted in the first 7 weeks. Each workshop comprised a 50-minute lecture and 100-minute group practice. The students then had six weeks to discuss and implement their group projects that integrate the ICT knowledge learned in unit workshops for constructing autonomous path-following cars, developing functional algorithms, coding and solving deisgn bugs. At the end of the semester, the students demonstrated their designs that could complete the required tasks and some additional self-selected tasks.

Table 1. Summary of self-perception scores regarding unit learning

Domain	Number of questions	Pre-score (mean±SD,)	Post-score (mean±SD)	P-value	Effect size
Basic knowledge	6	2.92±1.97	6.29±1.87	All P<0.001	1.52
Operational techniques	9	3.40±1.94	6.90±1.94	All P<0.001	1.65
Independent learning	4	5.34±2.34	6.76±1.86	All P<0.001	0.71

The scores represent the self-perception scores (1–10) in the questionnaires filled before and after the unit workshops. A total of 19 questions related to the five-unit teaching material for the workshops were asked. The response rates of all the 57 students were >75%.

The overall learning perception by the freshman students indicated that the teaching materials and learning activities related to the track-based self-driving car project produced suitable learning outcomes. After the unit workshops, the self-evaluation scores of the freshman students significantly increased, including the scores for questions about basic professional knowledge, knowledge of operational techniques, and confidence in independent learning (all $P < 0.001$, Table I). However, compared with basic professional knowledge and operational techniques, which exhibited a large effect size (average score increase = 3.37 and 3.40, respectively, and effect size = 1.52 and 1.65, respectively), the confidence in independent learning exhibited a considerably smaller increase in scores and moderate effect size (average score increase = 1.42 and effect size = 0.71).

5.2. Self-Evaluation of Co-Teaching Performance

One special feature of the freshman cornerstone course was that the teaching team invited the students with excellent performance in the senior co-design course to serve as TAs. In other words, the NTUEE provided an opportunity to junior students and above to become TAs who used the teaching materials that they contributed in designing to guide freshmen in the cornerstone course. In the weekly classes, the TAs assisted the instructors to dynamically fine-tune the content and implementation progress of the lesson plan according to the learning responses of the freshman students and the difficulties raised by them. In many situations, the TAs were more familiar with the implementation details than the faculty and thus identified students' learning problems more efficiently. This type of co-teaching is a completely new method of cooperation between faculty members and TAs at NTUEE.

According to the results of the TA work experience questionnaire, the average self-evaluated score of teaching ability and performance was approximately 80 points. A higher score was observed for the question related to the ability of performing TA work (82.5). A marginally lower score was observed for the question related to guiding students to solve problems independently instead of directly answering questions (76.7). The main skills acquired by the TAs included skills related to teaching, curriculum and project design, deepening the course expertise, and team organization and cooperation. Some difficulties encountered were (1) unfamiliarity of TAs with the content not designed by themselves and inability to efficiently answer questions related to this content and (2) insufficient instructional guidance and curriculum design for implementing teaching smoothly.

5.3. Observation Analysis

According to the findings for the interaction mode between the teaching team and the students as well as for the overall course operation, some student and TA learning outcomes may be marginally unfavorable due to two factors. First, the teaching team focused on providing well-planned professional knowledge and skill instruction as well as sufficient problem-solving assistance in the classroom; however, they paid less attention toward guiding students to establish effective team operations. The students taking the course did not have many opportunities to experience the learning process of team-based learning (TBL) and PBL. Therefore, the benefit of mutual growth among members with various skills within and across the group was not obtained. Second, the course TAs lacked sufficient knowledge and skills on how to play an active role in improving the effectiveness of team learning. Thus, some classroom interactions between the TAs and students were similar to senior students providing personal consultation instead of timely viewing the group's PBL work dynamics.

6. Conclusions

The NTUEE at NTU initiated two practical-oriented courses in the 2017–2018 academic year, namely the “Creative Cornerstone Course Design for ICT Engineering Education” junior-and-above-level course and the “Cornerstone EECS Design and Implementation” freshman-level course. The implementation characteristics of the co-designing course included (a) PBL and TBL approaches to develop and strengthen students’ core abilities, such as problem solving, team communication, and cooperation, independently, (b) active student partnership with teachers to design and create feasible lesson plans for the freshman cornerstone course in following semester, and (c) preparatory cultivation of the students as TAs for co-teaching in the cornerstone course. Learning outcome analysis indicated that the freshman students significantly benefited in their self-exploration of ICT-related subjects, basic professional knowledge, operational techniques, and self-confidence in helping teams complete tasks when the freshman course was co-designed. With the professional assistance

by an education expert from the Center for Teaching and Learning Development, the teaching team has been continuously enhancing the curriculum development model and PBL instructional skills for the cornerstone course.

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The world of fractals

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Abstract

Fractals are fascinating geometric structures of nature which appear in more and more field of science, ranging from heartbeat characterization through, cancer research, stock exchange trends, meteorology, and computer graphics, up to digital image processing. Fractals can be created by simple algorithms that can be manifested with also simple computer programs. The necessary programs are available in the literature and they are easy to understand and manage for first-year undergraduate students too. Therefore fractals are suitable to attract student interest and improve their attitudes toward learning physics. In this paper, a teaching material that is freely available on the internet is described. In addition to reading the article, we strongly recommend that the reader download and try out the teaching material, as this is the best way to get a real picture of its usability. (csodafizika.hu/fractals.zip) Our main goal was that students work independently and gain experience on fractals with applying simple algorithms and providing pictures of the weird formations of fractals. However, the material has been planned for engineering students, besides its versatility, it was focused on the connection between chaos and fractals. Our intention was to make our student's interest arise by the simple geometry of fractals, and from this, we try to lead them to the study of simple nonlinear chaotic mechanical systems helping them to understand deeper the Newtonian mechanics. Various versions (in Hungarian) of the material were used in secondary school teaching and in the postgraduate teacher training of ELTE so we believe it is suitable for almost anyone who would like to become familiar with fractals.

Keywords: *fractals; downable interactive teaching material.*

"I believe in Spinoza's God, who reveals Himself in the lawful harmony of the world." (A. Einstein)

1. Introduction

The discovery of fractals shook our approach to the geometric nature of the world to the bottom: we suddenly realised that the 'customary' regular forms featured in the former image of geometry are, in fact, only a negligibly tiny segment of the living and non-living material objects, while fractals grasp the genuine geometry and fundamental harmony of nature much deeper [Mandelbrot (1982)] Fractals provide not only the deeper understanding and simulation possibilities for the forms of nature, but revive the childish affection in us towards the miracles and wonder of the world. Since their discovery, fractals are used in more and more field, ranging from heart beat characterisation through investigating equilibrium, cancer research, stock exchange trends, meteorology, and computer graphics, up to digital image processing.

In this paper the teaching material can only be briefly described, so we strongly recommend that the reader download the zip file from our website [csodafizika], unzip it, look through the illustrations and try out computer simulations. The original material found on our website is much richer and show better our intention than this shortened version presented in this study. The teaching material has been made for didactic purposes and relies heavily on internet based materials, available to anybody.

1.1. The use of the material

This material fits the curriculum of an optional course "Concepts of Modern Physics" which was introduced at Neumann János University about a decade and a half ago. (Four major areas have been discussed: relativity, quantum theory, chaos theory and fractals, and statistical physics.) Each student can freely choose one area from the four for the oral exam (in agreement with the lecturer). In previous years, only about 10-15% of the students chose "chaos theory and fractals", whereas, after the interactive teaching material has become available this proportion increased to over 30%. Besides this material, other interactive e-learning materials joining closely this one are offered for the students e.g. "The use of dynamics solver", "Chaotic motions" etc. The chaotic attractors often show fractal structure so the two materials can foster each other. One of the most important goals of the introductory physics courses is the use of calculus in Newtonian mechanics. However, according to our experiences students are reluctantly using differential equations at this time. Therefore we encourage them to use computer programs (e.g. Dynamics Solver) to solve differential equations. We have experienced, that students who used the teaching material on fractals more easily overcame their aversion to solving equations of motion and they understood deeper the Newtonian mechanics too.

Based on the experience of the course, we have developed several versions of the e-learning material presented here. In the autumn term of MSc engineering education of Neumann University a new course "Applied Physics" was launched which involves a slightly modified version of this material too. In the postgraduate teacher training of the Eötvös University, a Hungarian version of this material is used that focuses on the secondary school level teaching of fractals. [fiztan]

2. The teaching material

We have attempted to make students understood the essence of fractals and to present their significance in nature and in sciences through a number of examples. Our main goal was that students work independently and gain experience in fractals by applying simple algorithms and providing pictures of the weird formations of fractals. We have also tried to make the mathematics used as simple as possible. Therefore the exact mathematical background of fractals sometimes remains hidden. The material consists of four parts. In the first part, basic concepts concerning fractals are introduced through the detailed discussion of well-known examples. In the second part, simple real-life procedures are shown that lead to fractal formations. In the third and fourth parts, computer-simulated fractals are shown. Firstly some well-known algorithm is discussed and after the fractal dimension of some chaotic attractor is demonstrated.

2.1. What is fractal?

As a vivid example the well-known series of pictures taken with different magnification about the English seacoast is shown [fractalfoundation]. When looking at one or another picture, you are not able to decide whether you see the entire coastline or only a small detail of it, and hence, you do not have any reliable visual reference point to estimate the scale of the picture. The coastline is a so-called self-similar form. If you magnify a detail of a self-similar phenomenon or of a material object, it is indistinguishably similar to the whole, or any other detail, therefore, if something is self-similar, its scale can't be determined.

After all, it should be recognized that England is an extremely weird geometric form: its perimeter is infinite, while its area is finite. Such formations are called fractals. For the purposes of their characterisation fractal dimension D_0 is introduced which is an extension of the customary concept of dimension. Fractal dimension can be defined practically through measuring instructions. The fractal configuration embedded in a geometric space of dimension d is measured by covering it with 'cubes' of dimension d and size of r (scale) then counting the number $N(r)$ of 'cubes' necessary for the cover (box-counting method), finally, the $lnN(r)$ values are plotted as a function of $ln(1/r)$ where a line should be got the steepness

of which is the fractal dimension of the formation D_0 The dimension D_0 of the fractal is the following: $D_0 = \frac{\ln N(r)}{\ln \frac{1}{r}}$.

Based on the foregoing, you can state that fractals:

- are infinitely complex, complicated geometric configurations, which are self-similar in an exact or approximate (statistical) way across several orders of magnitude (range) scale,
- when any of their characteristics are plotted on a log-log scale (such as surface, volume or mass) as a function of their size, then they provide a line the steepness of which is the (typically fractional) fractal dimension.Fractals surround us everywhere, especially in nature. Among other, the mountains, the trees, the lightning bolts, leaves, fjords, snowflakes and clouds are all fractal forms View the [csodafizika] downloadable material, the video entitled *fractals_in_nature.mp4*.

2.2. Fractals of daily life

Fractals can be created even in other simple ways. Bakers (or anybody) keep on folding and stretching dough when kneading it, since the best mixing procedure is achieved by the recursive algorithm of stretching and folding, resulting in a typical fractal nature. Various colour plasticine rods can also be folded and stretched in a similar way to obtain spectacular patterns (Figure 1).

Figure 1: Fractal generation by stretching-bending algorithm (dough kneading and plasticine).

People are pleased when shaping wonderful fractal structures by their own hands, stirring paint pots or using the so-called marbling technique (see downloadable materials [csodafizika] marble.mp4, fractal_burning_art.mp4 and fractal_digital_art.mp4 videos). In spite of their irregularities, fractals have been incorporated into the arts quickly, giving birth to a branch of art working with novel means [authenticationinart.org].

2.3. Deterministic fractals

It follows from the self-similarity property that the simplest way of creating fractals is the application of *recursive algorithms* since in such cases generation takes place according to clear rules and the configurations obtained this way are called therefore *deterministic fractals*.

A practical and widely used way to specify and generate regular fractals with computers and recursive algorithms is the so-called *L-system declarative language* method. The method can be used easily with *turtle graphics* which provides an excellent opportunity to create several of well-known and spectacular fractal shapes.

As an example, it is worth taking the generation of the so-called *Cantor-set* fractal that is shown in Figure 2. The iterative steps are the following. From the internal part of a segment of the length of L delete a segment of length rL ($r < 1/2$), and repeat this procedure with the remaining parts of the segments ad infinitum. (of course, the length of the deleted part is r times of the length of the segment from which it is deleted).

.

Figure 2: The first four steps of Cantor-set generation at r = 2/5.

Based on the definition given above it can be easily realised that the fractal dimension of the Cantor-set is: $D_0 = \frac{\ln 2}{\ln\left(\frac{1}{r}\right)}$ that is, for instance in the case seen in Figure 4 $D_0 = 0.756$.

An important method of fractal generation is the *'projection'* of fractals, that is their *direct (Cartesian) product*. In Figure 3 the first four steps of creating a *Cantor-thread* fractal are shown. In the horizontal direction, the Cantor-set recursion described earlier takes place, while perpendicular to it, in the vertical direction, it is continuous and therefore a linear (fibrous) structure is created.

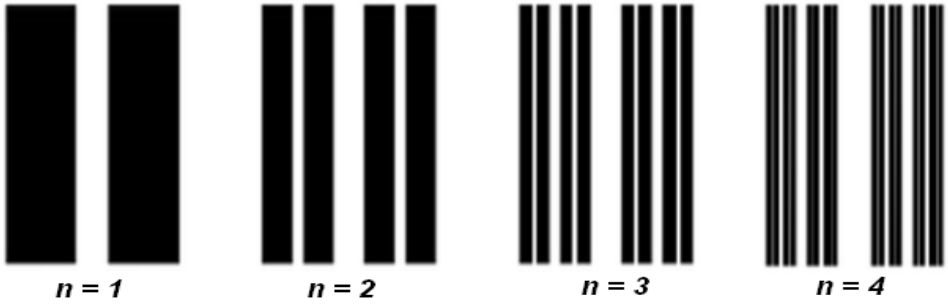

Figure 3: Cantor-thread fractal generation using direct product construction.

In Fig. 4 another well-known fractal, the *Sierpinski-triangle* (as well as the picture of a shell with similar patterns) can be seen. During the construction of the *Sierpinski-triangle in each step, the central (white) triangles are deleted.*

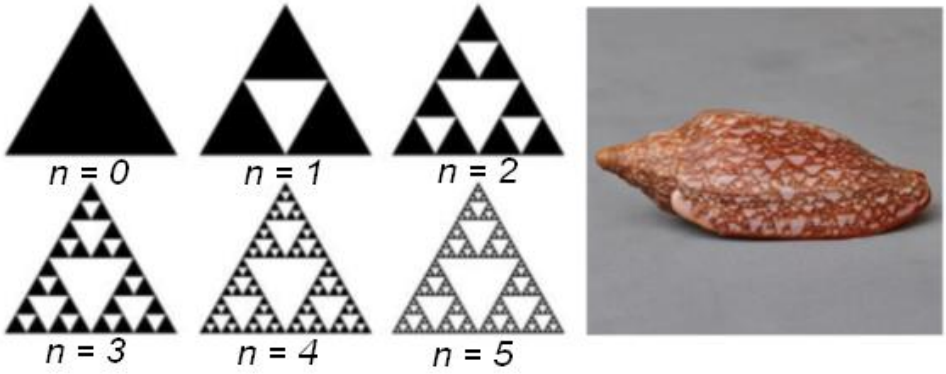

Figure 4: Generation of the Sierpinski-triangle and a shell with similar patterns.

2.4. Stochastic fractals

Take a so-called *chaos game* played using the random recursive algorithm below.

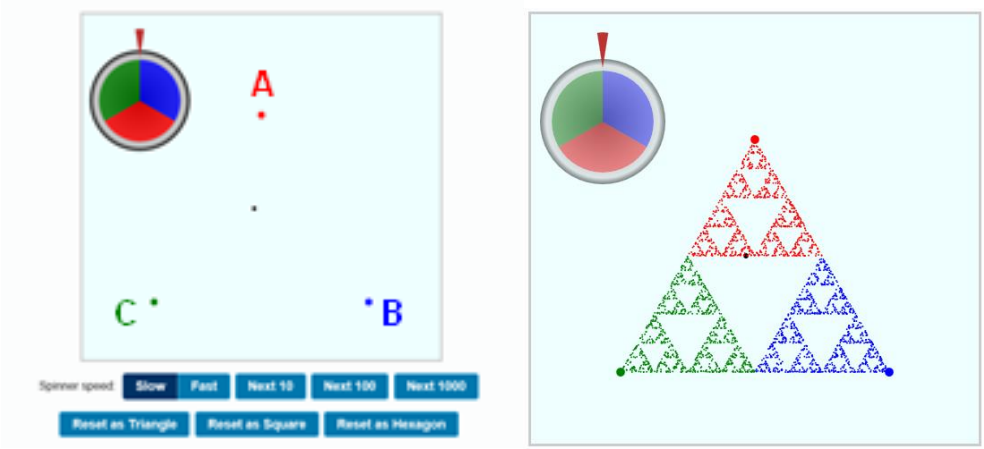

Figure 5: Screenshot of the computer aided implementation of the chaos game(left). The dots obtained in the course of the chaos game (right).

Select randomly a point in the inside of the (regular or nonregular) **ABC** triangle.

(*) Roll a dice.

Connect the selected point with

- corner **A**, when the 1 or 2 comes out on the dice,
- corner **B** when the 3 or 4 comes out on the dice,
- corner **C**, when the 5 or 6 comes out on the dice,

the new current point will be the bisecting point of the connecting segment, jump to (*).

The algorithm is found in the *chaosgame* folder of the downloadable materials [csodafizika], it is recommended to try it. (it can be started using the *index.html* file).

It can be experienced with great surprise that the set of points obtained (Fig. 5) will be quite similar all the times to the well-known Sierpinski fractal (Figure 4), which is generated by a deterministic algorithm, while this game is based on a random (stochastic) algorithm. To put it more formally, the Sierpinski fractal contains with a probability of 1 the series of points obtained over any runs in the game, or, in the terms of chaos theory, the attractor to which the motion and colour of the current point belong is itself the Sierpinski-fractal.

2.5. Chaos and Fractals

There are several simple systems of low degrees of freedom the motion of which can be described using simple deterministic principles (in fact, by some non-linear dynamic equations) but their motion is complex and exhibit irregular (non-periodical, complicated) behavior [Nagy, Tasnádi (2014), Tél, Gruiz (2006)]. The motion is chaotic that is:

- due to the extreme sensitivity to the initial conditions the errors in the initial state are exponentially growing, therefore the behaviour of the system is practically is unpredictable for a longer-term (thus only a probability description can be provided),
- in phase space, the long term behaviour of the system can be characterized by special geometric structure and order which often exhibit fractal structure.

Chaotic movement is ubiquitous in the world, so it often appears in our environment, (view the chaotic_motions.mp4 among the materials [csodafizika]). To study the fractals connected with chaotic motion the use of the phase space is unavoidable. Though it is not more difficult than using the time-dependent representations, students find it more intricate and hardly understandable; therefore, we offer some activities to strengthen its conceptual basis and to illustrate it in practice. The construction of the phase space is illustrated by the run of the file entitled phase_space.html found among the downloadable materials [csodafizika]. The attracting set of the phase space, towards which the trajectories are heading on the long run is called an attractor. The attractor of chaotic systems is of fractal nature that was shown detailedly with the example of Duffing oscillator in another of our papers [Csernovszky, Nagy, Tasnádi (2019)].

Figure 6. Our Zeeman attractor in glass and its 3D-printed realization.

Finally some words about the visualisation technics. Human beings are visual creatures in nature therefore every aid and procedure that is a visible demonstration of an abstract idea is of great value from a didactic point of view. The images of the 2D projection of the strange attractors are very well known and common; however, their 3D visualizations give a real sensation for the human brain, so they are much more suitable for capturing the students'interest. Glass engraving, also called laser engraving, is a method for the preparation and presentation of 3D images materialized inside of a transparent solid such as glass or

crystals which were made about real objects. The pictures in Figure 6 show some illustration of the 3D realizations of our Zeeman-attractor [Nagy, Tasnádi (2019)].

3. Summary

The teaching material presented was suitable to help students learning independently the basic concepts of fractals. The material is a versatile summary of the appearance of the fractals in various fields of sciences and it is freely available on the internet. This material fits the curriculum of an optional course "Concepts of Modern Physics" and also that of the postgraduate course of ELTE teacher training. Our experiences show that the material facilitates a deeper understanding of the Newtonian mechanics for students.

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Critical Thinking and Culturally Sustaining Teaching: Developing the Historical Literacy of Māori and Pasifika Undergraduates in Aotearoa/New Zealand

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Abstract

In this paper, we explore critical thinking in the context of developing culturally sustaining historical literacy in Māori (New Zealand Indigenous) and Pasifika (Pacific Island) students at a large, multicultural university in Aotearoa/New Zealand. Critical thinking and culturally sustaining historical literacy might seem like an odd couple insofar as critical thinking tends to be associated with liberal Western (academic) culture. Such students can resist developing their critical thinking because culturally sustaining 'critical being' is a threshold concept and requires a flexible, yet clearly structured pedagogical approach from teachers. But the development of critical being is vital to culturally sustaining teaching because of the role that the associated skills and dispositions play in supporting cultural autonomy and voice. We conducted research talanoa *(Tongan, 'conversations') with nineteen teachers of a range of ethnicities from across the historical disciplines at the University of Auckland to document the pedagogical strategies that they used to develop the critical thinking skills of their Māori and Pasifika students in a culturally sustaining way: fostering peer dialogue that draws on personal experience; practising perspective-taking; drawing on popular culture for its contemporary and cultural relevance; drawing on one's culture in choosing relevant topics; and creating learning spaces conducive to critical being.*

Keywords: *Historical literacy; critical thinking; culturally sustaining pedagogy.*

1. Introduction

Critical thinking and culturally sustaining teaching can seem like an odd couple. After all, critique emerged from élite Western universities and might seem to contradict the respect for tradition and authority shown by many non-Western cultural and intellectual traditions (Chakrabarty, 2008). And yet critical thinking is vital for culturally sustaining education precisely because it can foster cultural autonomy and voice. It can enable students to understand and articulate their ways of being and knowing through developing a sense of belonging to a community of learners; using knowledge from the past to shape their futures; and leading the struggle for Western recognition of indigenous ways of being and knowing.

Recent research suggests that teachers in historical disciplines need to rethink how they enable students to become 'critical beings': individuals who, in Ron Barnett's (1997, p. 109) words, 'exert some unity of critical power over their experiences in relation to knowledge, themselves and the world.' But current research into, and definitions of, historical literacy do not adequately acknowledge the cultural backgrounds of indigenous learners across the historical disciplines and levels, let alone sustain them culturally (Paris, 2012; Paris & Alim, 2014). Nor do they recognise the vital role of historical literacy in empowering indigenous students (Leonard & McLaren, 2002). These shortcomings exist in mainstream educational institutions at all levels in Aotearoa/New Zealand, despite ground-breaking research on critical literacy, by Māori teachers in particular (see, for example, Cooper, 2008; Edwards, 2010), and a policy environment that advocates cultural competency for teachers of Māori and Pasifika students from early childhood to secondary level (Ministry of Education, 2011; Ministry of Education, 2018). In this paper, we explore how teachers foster culturally sustaining critical historical literacy in Māori and Pasifika students at a multicultural comprehensive university in Aotearoa/New Zealand.

1.1. Critical Thinking for Critical Being

We adopt a threefold definition of critical thinking that encompasses (1) *attitudes* such as openness to (others') ideas and their sharing; (2) *actions* such as collaboration, synthesis and evaluation of ideas, and reflection; and (3) *outcomes* such as seeing others' perspectives, shifting one's attitudes, and having new insights. We hold that teachers need to think about how to develop the *dispositions* that foster such critical attitudes, actions and outcomes (Perkins, Jay, & Tishman, 1993). But the more capacious criticality implied in Barnett's term 'critical being' also implies that teachers should consider ways to promote critical thinking in and about the discipline and, we would argue, ways to ensure that their concept of critical thinking is 'culturally sustaining' (Paris & Alim, 2014). The message that teachers send students through 'traditional' pedagogy in the disciplines can inhibit students' development of culturally sustaining critical thinking. For example, teachers can more readily foster students' perspective-taking, and thus their reflexivity about their discipline and culture, if

they incorporate in their teaching well-structured opportunities for active and/or collaborative learning that recognises cultural practices and preferences for learning, rather than relying on lecturing, which can promote a view of the lecturer as 'oracle.'

1.2. Culturally Sustaining Teaching

Of course, to foster their students' critical being, teachers might take up one of the existing international models of critical historical literacy. For example, the History Learning Project at Indiana University advocates teaching students to 'decode' the discipline by learning the steps an expert might take to overcome 'bottlenecks' in their understanding (Middendorf & Pace, 2004, p. 1213). For history, that involves interpreting sources, maintaining appropriate emotional distance, understanding the limited knowledge of historical actors, identifying appropriately with people of the past, making good arguments and contextualising events (Middendorf, Pace, Shopkow, & Diaz, 2007). Or they might take up the model of the Historical Thinking Project (2014), which identifies the 'big six' threshold concepts of critical historical literacy: historical significance, the use of primary source evidence, continuity and change, cause and consequence, the acknowledgement of different historical perspectives (or world-views), and the ethical dimension of historical interpretation—and provides teaching strategies for working with these concepts at various levels (Seixas & Morton, 2012).

However, while such existing international models of critical historical literacy are useful, they offer a one-size-fits-all solution, emerge from a single historical discipline (History), and largely ignore the cultural background of the learners they seek to engage. The exceptions are studies of 'content-area literacy' (historical literacy in particular disciplines; see, for example, Broomhead [2005] in Music). And, although such studies explore *what* we are teaching when we teach historical literacy, for the most part, they fail to address *how* we might best teach it. The same is true of most studies of history teaching from Aotearoa/New Zealand, which have tended to focus on pre-tertiary education (see, for example, Sheehan, Hunter & Howson, 2013). Further, both the international models of historical literacy and local practitioners in the historical disciplines at tertiary level have tended to privilege Pākehā/Pālagi (European) notions of what historical literacy is and how it ought to be taught, not to mention Pākehā/Pālagi interpretations of the shared history of Aotearoa/New Zealand.

2. Critical Thinking and Culturally Sustaining Teaching: An Odd Couple?

In our study, our research group of one Pākehā New Zealander, one New Zealander of Pākehā and Māori descent, and one New Zealander of Pasifika descent undertook research conversations, or *talanoa* (Vaioleti, 2006), at our university with nineteen teachers from a range of ethnicities and historical disciplines (including Anthropology, Architecture, Classics and Ancient History, Education, English, History, Māori Studies and Music) who aimed to

develop the critical literacy of their students in a culturally sustaining way. We undertook to document how teachers in the historical disciplines in a large comprehensive university in Aotearoa/New Zealand might teach to foster the 'critical being' of Māori and Pasifika tertiary students across the historical disciplines. We adopted *talanoa*, rather than traditional research interviews, because we were focused less on eliciting knowledge or information from the participants than on cultivating relationships and 'reach[ing] a state of understanding' between us and the participants as fellow teachers with similar aims and challenges in their teaching (Prescott, 2008, p. 132). Thus, we did not rely on a schedule of questions and allowed the conversation to take its own course, led by the common concern of the participants and us in sharing aspects of our teaching that we had found to help and hinder the process of fostering critical being in 'our' undergraduate Māori and Pasifika students. In what follows, we present a descriptive summary of what the teachers shared with us. (We have shared our reflections on the process of the *talanoa* elsewhere [see Hindley, November, Sturm, & Wolfgramm-Foliaki, 2020].)

The teachers offered three main reasons why critical thinking in the historical disciplines is challenging for undergraduate students, Māori and Pasifika students in particular. Firstly, students can find perspective-taking foreign. One teacher whose students encounter religious texts summarised the problem of personal or cultural 'interference.' Students can appreciate that other people hold different beliefs:

> [Teacher A:] Often when we're looking at [a] religious text, a person's faith will stop them being critical, analytical. I was telling students, if you want to … bring your own faith perspective, that's fine, but just to be honest about that at the start. […] I don't think they get that often….

But they can find it challenging to be similarly reflexive about their beliefs: '[Teacher A:] when I try to say… to an extent … we interpret things, … in a way that suits us. I'm not sure if they quite get that….'

Students can be anxious about presenting their ideas, let alone about taking a position on someone else's ideas in an essay or presentation:

> [Teacher B:] In the past, [… students] had to give oral presentation … and I graded them on these presentations. But then some people said, 'it makes me anxious and I can't do it.'

This teacher noted that this was especially the case with Māori and Pasifika students, who were more likely than Pākehā/Pālagi students to be the first in their family to attend university.

One teacher, from a non-Pākehā/ Pālagi cultural background, thematised the problem: critical thinking can imply disrespect for one's elders and is associated with Western liberal thinking:

> [Teacher C:] I went to university, and I would always sit in the back, and I would always be quiet, and I would never say anything in my whole undergrad because for me, it was: I respect my elders, and my professor is my elder. […T]hat's a liberal kind of idea to be open[, meaning,] you can talk back to me, if you will; back it up with evidence. […] I think that was … very difficult for me … because of my cultural background [and is for] a lot of Pacific Islanders.

3. Critical Thinking and Culturally Sustaining Teaching: Bridging the Gap

To address these challenges in developing students' critical thinking, with Māori and Pasifika students in particular, the teachers we talked with offered six pedagogical strategies.

3.1. Use peer-to-peer dialogue that draws on personal experience

Teacher C noted that indigenous students were more inclined to 'open up' with him than with older or European professors. So one strategy might be to employ tutors of similar age and cultural background to the students; or, better, to engage students in peer-to-peer dialogue that can draw on their personal cultural experience as a gateway to critical thinking. To do so, teachers will have to address students' reluctance to use personal experience as evidence.

> [Teacher C:] They open up to me like a sibling, but … sometimes I see them a bit more open with their peers than with me. But … it doesn't have to be me if … they are willing to have a critical conversation about the topic … with each other.

A strategy that Teacher C uses is to set 'ground rules' for the critical conversation that include using one's personal cultural experience as evidence:

> [Teacher C:] I kind of remind them, don't forget about, 'in your opinion.' And I will try and be an example of that and say 'look I have experienced this, I've read this, and this is how I'm drawing this conclusion' [– …] you know the experience as evidence…. I hail from Utah; highly conservative[,] ... heavily religious kind of a community. So … I … over-emphasise my disclaimer….

3.2. Assist students with perspective-taking so they can move beyond their perspective

While students might find it challenging to present their ideas, some find perspective-taking with others' ideas even more difficult. Teachers can offer advice about how to do so:

> [Teacher A:] Within religious studies and theology, we do have students who have a strong faith commitment and some of them just avoid the difficult questions about those that hurt them just to make their point. [T]here's a Tongan student, he's writing about some debate … and his initial idea … was,

> like, I'm going to show why the [other 'side'] are so wrong. And I said, don't start from that premise because that makes your argument sound … biased. Start with, I'm going to look at both sides of the argument, and sure, you can see which argument seems a bit stronger, but show them both.

One teacher hosts a weekly office hour in 'interactive reading,' when they and the students engage actively with a written text without formal assessment. The session has proved especially popular with Māori and Pasifika students.

3.3. Make the topics contemporary and culturally relevant

Understanding and making critical arguments about a text or topic can be easier if one already has an opinion on the topic or a related one. To this end, in one Australasian history course, the teacher allows students to select contemporary and culturally relevant topics:

> [Teacher D:] The students seem to really get that there can be different types of interpretation within history through looking at something like the Australian context. They really get how this historian who might be writing about a fairly traditional conserving history of the education of children in New South Wales from 1850s to 1950s. They get how he is doing what he does, which is just going into the archives, find evidence relating to arts and policies and all of that sort of things. They get how that's very different from an oral history project which just ask people involved what their experiences were like. And I can see how each have something to offer, and we need that to balance our view of the past with that.

3.4. Use popular culture to achieve contemporaneity and cultural relevance

Drawing on popular culture is a short cut to finding contemporary and culturally relevant topics. But teachers must ensure that students retain critical distance on an 'owned' or their own culture. Teacher E gave an example of a student writing effectively about their favourite boy band, but countered it with an example of another student limited by cultural ownership:

> [O]ne of my research areas is gender-based violence in religion…. I find a few students have said they are Pasifika themselves and … they say [that] before colonisation there was complete gender equality in the Pacific Islands. How do I engage in this conversation with someone who is from that culture? I don't want to … say they're completely wrong. But [my response] was quite hard to frame: something like colonising myself.…

3.5. Help students draw on their culture in choosing relevant topics

Teacher D gave students the (popular) option to write about oral history and its contribution to history education, which occasioned some critical thinking about historiography: 'some argue that it's actually the point that instead of traditional history using written sources, oral history can work together….' A Pasifika student agreed, as the teacher attested: 'in that moment of the essay was quite clear that she was thinking, "I can relate to this. This is what I know being Tongan. And thinking about my family and how the story is told."'

3.6. Create learning environments conducive to holistic 'critical being'

Several teachers acknowledged the challenge of encouraging critical thinking in spaces that are designed for 'oracular' teaching. They created a physical space and groups that were conducive to interaction and communication:

> [Teacher F:] I think the university should have more spaces where students can eat and congregate because in the past I did 'directive reading' in lunchtime and it was very successful....
>
> [Teacher G:]: [S]mall groups have been the most successful … for [students] becoming vulnerable and having them think about their historical achievements that relates to the topic … or try to make a connection to it they want to share. The more I get [students] to share, the more the people feel more comfortable to share….

4. Conclusion

To open historical narratives to critical reflection can empower students to make history their own. But to do so in a culturally sustaining way requires that teachers not take for granted that students know how to critique and feel comfortable doing it, or that there is one way to practise critique. The pedagogical strategies offered by the teachers from the historical disciplines at our university with whom we talked represent a modest endeavour to foster culturally sustaining critical historical literacy in Māori and Pasifika students. It remains ro be seen how they also support the students, as Django Paris (2012, p. 95) argues that culturally sustaining pedagogy does, 'in sustaining the cultural and linguistic competence of their communities while simultaneously offering access to dominant cultural competence.'

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Creating a project-based degree at a new university in Africa

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Abstract

African Leadership University (ALU), a network of higher education institutions, opened its second campus in Rwanda in September of 2017. In order to achieve the institutional vision to educate three million young African Leaders before 2050, the University has made efforts to embrace 'innovative pedagogy,' designing curricula and training its teaching staff in active learning and student-centered pedagogy. This paper provides an account of the design and inital delivery of a new degree that ALU offers to its students in Rwanda, called "Global Challenges," a project-based degree that requires students to structure their learning around a project that they self-design that addresses a challenge facing the continent of Africa. The paper is authored by a member of the faculty of the new degree and uses qualitative practitioner-based research to describe the degree and analyse its alignment with the innovative practice of Project-Based Learning (PBL). Analysis of the degree design shows strong adherence to the principles of PBL; however, more research is needed to evaluate the effectiveness and broader impact of this new educational program.

Keywords: *Project-Based Learning; Self-directed Learning; Innovative Higher Education; Curriculum Design; Tertiary Education in Africa; Teacher-Based Research.*

1. Introduction

Higher education has faced several critical challenges in recent years. An undergraduate degree no longer guarantees employment upon completion (Hersh & Merrow, 2015). On the continent of Africa, the concern of the ability of graduates to secure employment is particularly pressing, with high levels of unemployment and underemployment among graduates (Bassey & Atan, 2012). Therefore, many universities have revisited curricula and pedagogy to better equip graduates for the needs of the current and future job markets in order to address a perceived gap between the skills that students receive and the needs of employers (Pauw et al., 2008; Ponge, 2013). Scholars have also pointed to the legacies of colonial education systems across the continent of Africa that stifled critical thinking amongst students, and call for higher education to decolonize both curricula and pedagogical strategies so that African students are equipped with the knowledge and skills to solve problems relevant to their own contexts (Nyamnjoh, 2012). It is important that higher education institutions who are united in their goal to respond to these critical needs of students and their broader societies commit to sharing their innovative strategies that they are implementing to address these challenges.

African Leadership University (ALU) opened its first campus in Mauritius in 2015 and its second campus in Rwanda in September of 2017 (Gwaambuka, 2016). The institutional mission is to develop leaders for the African continent, and its existence is a direct response to issues of graduate unemployment and the skills gap on the continent, with its emphasis on 21st-century skills, career development, and entrepreneurial thinking (ALU, 2020). ALU has made innovative pedagogy a critical part of the method that it uses to develop and create leaders, with the rationale that this will equip students with the knowledge and skills needed to not only find employment, but also become leaders who will address important challenges facing the continent of Africa.[1] In order to achieve this, ALU has created its own unique curricula and trains its teaching staff to use student-centered pedagogical strategies (Baker, 2019). A key example of this innovative pedagogy is the Global Challenges degree that is accredited and offered at the ALU Rwanda campus. It is designed as a project-based degree in which students 'declare a mission' and design their own project that works to solve or address a challenge that is facing the continent of Africa, providing students with an innovative learning experience that equips them to solve problems related to their own contexts and communities (Faraj, 2019).

[1] While there are many contested definitions for what constitutes 'innovative pedagogy," (and innovation more broadly), for the purpose of this paper I will use the term to indicate instructional methods and curricula that (1) incorporate recent research in how people learn and (2) provide students with knowledge and skills that equip them to be responsive to the dynamic current and future needs of their society.

As a faculty member who participated in both the design and subsequent delivery of the Global Challenges degree, my analysis of the Global Challenges degree at ALU explores a primary research question: how does ALU's Global Challenges Degree adhere to the key aspects of Project Based Learning? This paper adds to the body of research that discusses the complexity of implementing quality innovative educational strategies. It offers the unique perspective of implementing these strategies at an institutional level in a newly established higher education institution in Africa, responding to the call for more examples of practitioner based research in education (Campbell, 2013).

2. Literature Review

2.1. Grounding PBL in Learning Theory

In order to discuss the implementation of a project-based degree, it is important to examine the existing body of research about the practice of PBL and its links to learning theory. PBL has earned its place in the catalogue of innovative educational practices due to its ability to foster inquiry, practical application of knowledge and skills, and create engaging opportunities for students to learn and demonstrate their learning (DeFillippi, 2001; Thomas, 2000). For PBL to be properly implemented, student choice and autonomy should drive an inquiry-based process in which students construct their own meaning through creative processes. This practice is grounded in Seymour Papert's theory of Constructionism, where students learn and create meaning by linking new concepts to prior knowledge and concrete artifacts that they already understand (Ackermann, 2001; Papert, 1980).

2.2. Implementing PBL

While PBL offers much potential as a pedagogical strategy grounded in progressive educational theory, there is also an important body of research that discusses the challenges of implementing PBL. It requires a system that provides students with autonomy and choice, an assessment strategy that can properly evaluate student learning beyond traditional examinations, and skilled teachers who understand both the purpose of PBL and the best ways to implement it in order to support students in their learning (Barron et al., 1998; Blumenfeld et al., 1991). The Cognition and Technology Group and Vanderbilt identified both important principles that educators should enact to support project-based learning and provide support to students transitioning to PBL, including having "learning-appropriate goals, scaffolds that support both student and teacher learning, frequent opportunities for formative self-assessment and revision, and social organizations that promote participation and result in a sense of agency" (Barron et al., 1998). These changes to traditional systems prove challenging to create and maintain both for institutions, and can present challenges for students who are not accustomed to working with high levels of autonomy and choice.

2.3. PBL in Higher Education

Progressive primary and secondary school teachers have worked to implement PBL in their instruction, but there are fewer examples of higher education embracing this practice where the lecture based model remains prevalent. However, the process of inquiry-based research conducted at higher education institutions is well-suited to align with PBL (Lee et al., 2014). Due to the need for high levels of student autonomy and self-direction needed for PBL, practitioners and researchers have highlighted the effectiveness of implementing PBL in higher education as adult learners are often better equipped to embrace autonomy and flexible structures (De Bruin, 2007; Donnelly & Fitzmaurice, 2005). Indeed, efforts at implementing constructionist PBL in more technical and STEM related fields has led to promising results (De los Ríos-Carmenado et al., 2015).

3. Methods and Data

3.1. Practitioner Methodology

As a faculty member of the Global Challenges degree who has been involved in both the design and the delivery of the degree, using a qualitative practitioner method of inquiry is called for in order to investigate questions directly pertaining to my work (Anderson et al., 2007; Creswell, 2002). In line with participatory research and action research, the findings of this research can be applied to my practice in order to improve my students' learning and overall experience of the degree (Anderson et al., 2007; Foreman-Peck, 2010).

3.2. Description of Data

Data used for this paper includes curriculum design documentation and initial documents created by staff of ALU and program and module retrospective documentation created by faculty of the degree at the end of each term. Data was purposefully selected as an extreme case sample due to the unique nature of a newly established degree.

3.3. Research Limitations

Due to the subjective nature of the practitioner method of research, any conclusions drawn from the data are preliminary and not to be considered more broadly generalisable outside of the particular program. The results and discussion are meant to share insights related to the implementation of a new PBL degree so that other practitioners can learn from these perspectives; however, they are by no means a full representation of all staff and students perspectives.

4. Results

4.1. Conception of the Degree

The initial idea for the Global Challenges degree came from the institution's founder, who worked with 'learning experience designers' to articulate four foundational principles of the degree:

"Students are at the center of the learning experience.

Each student's individual passion is the starting point for their journey at ALU. With the goal of the impact they hope to make on the world in mind, students pursue personalized learning experiences to enable them to maximize their potential and achieve their intended impact.

Global Challenges gives direction, meaning, and purpose to our pursuits

One's chosen challenge, and the individual mission that they set out to accomplish within it, guide students to devote our talents to shaping a better world. It is often bemoaned that the greatest minds of the current generation are devoted to figuring out how to compel someone to click on online advertisements (Google, Facebook, etc). By framing students' education around the seven grand challenges facing the world, we will ensure the greatest minds of the next generation are devoted to solving the world's greatest problems.

Missions are aimed at authentic, relevant, and comprehensible problems

Students declare a 'mission' for their life to solve a specific problem within one of the grand challenges. These problems should be authentic, relevant, and comprehensible. By "authentic" we mean problems that have scientific evidence demonstrating their existence, by "relevant" we mean the problem has importance to the world beyond academia, and by "comprehensible" we mean that it can be studied, analyzed and potentially solved using the tools of science and entrepreneurship.

Projects connect us to the real world, grounding and focusing our work

In order to ensure that students are connected to the leading work happening in each global challenge, students will regularly pursue real projects with partner organizations. These opportunities for application of knowledge will make the learning more enduring while keeping them firmly planted in daily realities of the field" (ALU, 2018).

ALU identified 'Seven Grand Challenges' facing the continent of Africa and the broader world that students may choose to focus their studies around. They are Education, Urbanization, Healthcare, Climate Change, Governance, Job Creation, and Infrastructure. ALU subsequently expanded the list to include 'Seven Great Opportunities' that exist on the continent of Africa, which are Agriculture, Natural Resource Management, Wildlife

Conservation, Regional Integration, Arts, Design, and Culture, Tourism, and Empowerment of Women.

4.2. Description of the Degree

The degree centers around students reflecting on their passions and interests, declaring a 'mission' related to one or more of the Grand Challenges and Opportunities, and designing their own project that works to address a problem related to their mission, culminating in a final capstone project. Students take two series of modules to equip them with the skills necessary to create their project. The first is a series of research methods classes where they learn qualitative, quantitative, and mixed methods that allows them to conduct in depth research related to their missions and projects. The second is the 'mission' series, in which students identify their mission, use human-centered design to articulate a problem and refine a potential solution, and create a project that puts their solution into action. Students also choose from a series of electives related to their missions and the 'Seven Grand Challenges and Seven Great Opportunities' in order to gain greater understanding of the contexts of their missions and projects.

5. Discussion and Conclusion

The initial conception of the degree is strongly aligned with the theory and practice of PBL. ALU's emphasis on student-centered agency through their ability to choose and design their own mission and related project is key to the degree's adherence to the PBL methodology (Barron et al., 1998; Thomas, 2000). Additionally, the creation of a menu of 'Grand Challenges and Opportunities' provides students with scaffolded supported choices with which to shape their projects, while providing them the opportunity to explore topics that are practical and relevant to their own contexts (Barron et al., 1998). While the original vision for the degree did not require that students take traditional modules, regulatory requirements necessitated a more traditional module structure which led to the design of the key 'streams' of research modules and mission modules.

There are, however, key challenges that have emerged in the implementation of the degree. One challenge is the transition that students face from a more traditional education system that is highly structured to one with high levels of autonomy and responsibility. For many students, this can be overwhelming, and while some students thrive with this level of autonomy, others struggle to manage their time and work. Another is a concern that both faculty and students express regarding depth of study. Because students are encouraged to choose unique projects that they are passionate about, they often find themselves researching topics outside of any area of expertise of the existing faculty. In theory students become highly skilled at research so that they can pursue their own depth of knowledge; however, in

practice, this can be quite challenging for undergraduate students pursuing new fields that they have little frame of reference for.

Additionally, this degree is in very early stages of implementation, and the first cohort has yet to graduate. More research is needed to draw any conclusions about the effectiveness of this degree on student achievement, life outcomes, and the broader impact that graduates have on society.

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The digitalization of universities from a students' perspective

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Abstract

The digitalization of higher education institutions is progressing significantly. Though the use of digital assets enhances the students' learning experience and offers new opportunities for administration, there are no uniform standards for the use of digital media in teaching and student services. As educational service providers, universities are dependent on students being able to cope with the structures offered. Thus it is essential to ascertain students' attitudes of the technologies used. We asked students from three blended learning courses about their perceptions. We further asked the students what should be done and by whom. Our results show that students see structural changes occurring not only in themselves but also at the level of the university management. Our research contributes to the actual discussion about the digitalization of higher education by offering suggestions for development from a students' view. The results are valuable for lecturers and faculty managers who want to advance the digitalization of services and learning.

Keywords: *higher education; organization; digitalization; learning; technology.*

1. Introduction

Digitalization is changing our daily lives. As a result of digitalization, teaching and learning at universities are changing in revolutionary ways (Castro, 2019). Amongst other things, knowledge transfer and assessment are digitalized, as are student assistance and administration processes. Digitalization aims to provide enhanced opportunities for constructive learning. Digital structures change access to learning materials, communication, and cooperation between different interest groups. For many universities, digitalization is a trend to follow. Nevertheless, universities are having difficulties adopting technologies (Carver, 2016; Reid, 2014). The various stakeholder groups have very different demands for a digitalized university. These obstacles hinder the digitalization of the universities (Reid, 2014).

This paper contributes to research aiming to solve existing digitalization problems. From the students' point of view, we examine how they perceive the digitalization of the university. We assess their perception by employing dimensions such as trust, learning, and organizational culture. Additionally, we ask students to suggest courses of action and responsibilities. Our research question is two-folded: How do students perceive the current digitalization of universities, and what further possibilities for the development do they suggest?

We have chosen an environment where students experience digitalization as users. They represent a particular (critical) stakeholder group in the universities, especially as they grew up as digital natives (Crittenden, Biel, & Lovely, 2019). Moreover, digitalization will affect their later professional lives (Friga, Bettis, & Sullivan, 2003).

In the next section, we present the theoretical foundations of our work and explain the influence of digitalization in higher education. Thereafter, we then introduce the research approach, followed by a presentation of the results. We conclude the paper with short deductions and explain the implications and limitations of our work.

2. Digitalization of Higher Education Institutions

Technologies in education motivate lecturers, enrich learning resources, and assist the evaluation of learning goals (Vogelsang, Droit, & Liere-Netheler, 2019). Further, digitalized processes accelerate service support. When technology merges lecturers with the administration, teaching and student results become more transparent and transferrable. Furthermore, technology has the potential to interweave the universities' competencies of teaching and administration. Because universities operate in a more and more competitive environment, they have to seek efficient processes (Adler & Harzing, 2017). With the

ubiquitously digital availability, issues for faculty and administrative staff arise (Proserpio & Gioia, 2007).

The use and diffusion of digital assets in higher education are very heterogeneous. So far, research has often focused on the evaluation of learning settings. Studies concentrate on the effects of the individual learning success of students (Janson, Söllner, Bitzer, & Leimeister, 2014) or measure the acceptance of systems (Tselios, Daskalakis, & Papadopoulou, 2011). Besides drivers and barriers (Gregory & Lodge, 2015), the studies provide suggestions for the didactic design of blended learning events (Talley & Scherer, 2013). Only a small branch of research deals with questions of organizational anchoring and adoption (Porter & Graham, 2016). Problems of organizational integration are often based on resistance to change within institutions (Al-Senaidi, Lin, & Poirot, 2009). In higher education, research on digitalization is often directly linked to a particular teaching scenario; a generalization of the current results is only possible to a limited extent. There is still a lack of an approach that provides an instrument to address challenges and show solution paths.

3. Research Method and Sample

We surveyed during August/September 2019. As a sample, we chose students from digitalized management courses: a) "Business Process Management" (Bachelor in Management/Information Systems) and (b) "Industry 4.0 and Digital Transformation" (Master in Management). The students were invited to fill out a paper-based questionnaire. Additionally, we reached out to students from earlier terms of these courses and the course in "Project Management" (Master in Management/Information Systems) to participate in an online survey. These courses were chosen because they instruct with a high digital component and a supplementary attendance part. In addition, they included progressively digitalized administrative processes such as course subscriptions, exam registrations, and communication supported by technology.

We received 97 completed questionnaires, of which 58.5% of the respondents were male and 41.5% female. None indicated a third gender. To examine the influence of gender, we conduct a t-test with a significance rate of 0.92. The test shows no significant influence of gender on the students' perceptions.

The questionnaire was created based on the existing theory of barriers to digital transformation (Vogelsang, Liere-Netheler, Packmohr, & Hoppe, 2019) and adjusted to the setting in higher education. We used further existing research to complement the survey questions. The questionnaire included 16 statements related to major fields where problems with digitalization may occur: changed learning, changed services, cultural changes, need for new resources, strategy, and trust. To prevent bias, we did not introduce the statements in the questionnaire to the major fields. We formulated positive and negative questions as a

means to not influence the students' opinions through choice of words. The students registered their self-reported measures using a five-point Likert-scale, with the scale ranging from "I do not agree at all" (1) to "I do strongly agree" (5). Further, we asked the students to suggest first approaches to overcome these barriers. The last questions were open-text. A pilot test with a focus group of 12 respondents was conducted to uncover comprehension questions and to test the understandability.

4. Results and Discussion

The results of the study are presented by showing the means of the statements and standard deviation (std. dev.). Table 1 shows the analysis of the statements about the current situation. The mean values for changed learning show that the students feel no disadvantages from the new learning methods. However, they also do not emphasize a clear progressive continuity in digitally improving the teaching by the university. The students realize digital support and emphasize changed services. Nevertheless, they do not overall highlight a digitalization of service processes. The standard deviation for this statement is relatively high. Students in the digitally transformed courses see a change of the learning culture and emphasize an openness for new teaching concepts. Many of them feel that the learning culture is affected by digitalization. The students agree with the statement that there are new jobs created to handle the digitalization. Nevertheless, the mean value shows that there is still a need for more staff in this field.

Although the students see the university moving forward in terms of digitalization, the majority of them do not think it has a clear digital vision. The mean value for data control is the lowest among the positively formulated questions. At the same time, its standard deviation is the highest. The results show relatively high insecurity about what is happening with the data. In sum, the students are not aware of the increased transparency. The two remaining trust-statements show that the students' transparency does not affect the use of the learning systems. The trust in the university is the highest value of this analysis.

In sum, the students agree there has been an increase in technical support, and they enjoy the advantages of a new learning culture. Our results show that digitalization is equated with modernity and reflected learning conditions. Digitalized teaching concepts are regarded as new and open progressions. Further, the respondents show a high level of trust in the university. Nevertheless, digital service structures can be enhanced. A clear vision is still missing. Furthermore, the staff could trigger the digitalization of services and teaching.

Table 1. Mean Values and Standard Deviation.

Characteristic	Statement	Mean	Std. Dev.
Changed Learning	The changed form of the course harms my learning success.	1,05	1,054
	I don't see any advantages of the technical support provided by the digital learning platform in the course.	0,89	1,019
	My university continues using existing methods for teaching and services.	2,04	0,720
Changes Services	My university offers digital services that support me in my studies.	3,40	1,037
	I have the impression that the university's internal processes have been digitized.	2,92	1,067
Cultural Change	The learning culture at the university has not changed due to digitalization.	2,10	1,015
	The university strives to constantly learn and get better in how to transform digitally.	3,26	0,950
	In my university, there is openness to new ideas in teaching.	3,36	1,012
Resources	The university has created specific jobs/projects for the digitalization.	3,29	0,790
	I have the impression that there are not enough resources (time, money, IT staff) for the digital learning platform.	2,51	1,091
Strategy	My university is moving forward in terms of digitalization.	3,33	0,943
	The university management supports the digital transformation at the university.	3,25	0,830
	In my university, we have a clear vision or DT strategy.	2,94	0,839
Trust	I have the impression that I control the data that is stored about me.	2,55	1,155
	I trust the university in handling the data I generate when using the platform.	3,86	0,989
	The transparency of the data (to which the lecturer has access) does not affect my use of the digital learning platform.	3,66	1,019

After the analysis of the statistical values, we will discuss first development-paths suggested by the students. The proposed solutions are each addressed to a specific stakeholder group, the universities' management, the administration, the lectures, and the students themselves.

The university management plays a crucial role in defining a digitalization strategy. Institutional support, openness to innovation, and change (Reid, 2014) are essential. The management should actively support projects and lecturers who promote digitalization. Students request guidelines that regulate the use of digital media in university teaching and demand that the university encourages lecturers to transform teaching. As a support, the universities should provide funds to create new positions for digital experts.

On the administration level, many students see a necessary condition for the digitalization of services and teaching in a further and faster development of adequate learning management systems. In particular, the aspects of interactivity, integration of chat-based forums, the possibility to access all content without a permanent internet connection, and the compatibility with all end devices were emphasized. Students also request more computer rooms to be independent of their private technical equipment.

In order to fully benefit from all technical possibilities not only the pure provision of online systems is of importance. The lack of institutional support (Porter & Graham, 2016) has to be overcome. Students report that lecturers are currently not exploiting the full potential. To overcome these barriers, universities are required to create service centers that help lectures to digitize courses into blended learning scenarios.

In the literature, there is an additional aspect of alliances that can help to overcome organizational barriers (Ngwenyama & Nielsen, 2014). Well-trained technical support staff should be available to learners and lectures. As a consequence, teachers can concentrate on the content rather than focus on the medium. A good exchange will lead to well-trained staff with a clear focus on media competence and content creation in the long term, which will increase media richness at universities.

The surveyed students demand that there is a greater sense of willingness amongst the lectures to change to digitalized courses and seminars. However, digitalization requires a considerable additional effort that may overstrain the capacity of the lecturers in terms of time and competence. Even if lecturers are willing to try more digitalized forms of instruction, a lack of knowledge and considerable uncertainty about how digital media can be effectively integrated into courses can add to their ambivalence. As a response, students see a bundling of resources as necessary. Digital structures should be linked across departments or even across universities. The above-mentioned service centers can help to stop the silo mentality.

Students welcome the digitalization of teaching and the increased availability of online content. However, they fear the loss of social contact when face-to-face classes are removed. Students are aware of the required increased self-discipline when lectures and exercises are available online and when attendance is no longer mandatory. To address this, they seek further expansion of blended learning concepts. In their view, blended learning should offer a space for creative exchange combined with the advantages of digitalized content. Interaction with lecturers and fellow students in face-to-face classes should not fall short.

For the future, the students desire an expansion of blended learning concepts, online platforms, and administrative processes, which they see as the most promising forms of and uses for digitalization in higher education.

5. Limitations and Further Research

This study concerns students' perception of the digitalization of higher education institutions. We tested our model among a group of management students in different courses with a blended design.

Our results are suitable for lecturers and faculty managers. We aim at those who want to build a blended learning environment and who want to promote the digitalization of services and learning. The lack of a clear vision for digitalization is a problem that is perceived down to the student level. Often, there is a lack of support from university management. The use of blended learning courses ensures that the university is regarded as modern and open to new ideas. Universities can promote blended learning concepts and thus advance their digitalization image. Such change requires training for students, for lecturers, and for administrative support, all of whom can significantly influence digitalization.

Digitalization enables new teaching methods with a focus on higher levels of interaction. The online availability of content does not necessarily mean that students will stay away from the courses. Rather, it is a chance to use the time spent in class more effectively to reach higher levels of knowledge transfer. Though students still seek direct exchange with lecturers, they demand higher added value. The lecturer's role changes to that of a learning coach in face-to-face settings as students prepare themselves with online content.

Our research is also not entirely free of limitations. The study was conducted with a sample from management studies, that is, a group of students who are positively biased towards digitalization. Therefore, it would be interesting to compare the findings not only with a different subject culture but also with students without a blended learning experience.

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Contributing factors to academic achievements: from community college to university in Hong Kong

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Abstract

Academic achievement of students transferring from community colleges to 4-year institutions has been a topic of interest to educational researchers globally. However, local empirical evidence remains limited on how transfer students' learning approaches and the teaching-learning environment relate to their academic achievement in Hong Kong's universities. The study aims at exploring the relationship between transfer students' approaches to learning, their perceptions of the teaching-learning environment and academic achievement. The participants were 617 undergraduate students transferring from community colleges to an university in Hong Kong. Students' approaches to learning and perceptions of the teaching-learning environment were measured using the HowULearn questionnaire. Analyses were carried out using factor analysis, Pearson correlation and linear regression. The results confirmed positive relations between students' perceptions, approaches and achievement. Students studying in an organised manner achieved better academic performance, whereas those using a surface approach poor performance. Others might also adopt an intermediate approach to learning. The results indicate that promoting awarenesses of choosing and using appropriate learning approaches is important for fostering academic success among students.

Keywords: *Approaches to learning; Perceptions of the teaching-learning environment; academic achievement; Community college transfers.*

1. Introduction

Community colleges, in addition to a direct admission to universities after the completion of secondary education, have been a second pathway to an undergraduate degree. In Hong Kong, students with two-year associate degrees or higher diploma levels (which are collectively known as "sub-degree") can transfer from community colleges to universities based on a credit unit transfer system. They are admitted to the third-year study of a degree programme and will receive the degree in two years (Yung, 2002). The number of sub-degree graduates transferring to four-year institution is recorded growing annualy in recent years, which warrants closer attention and comprehensive study on their post-transfer learning experiences and academic achievement. Sub-degree students may often encounter difficulties in adjusting to a new learning environment, which is referred to as "transfer shock" (Hill, 1965). Some studies reported that transfer students had a lower academic achievement than non-transfer students (e.g. Cameron, 2005). On the other hand, some reported that transfer students were academically more successful compared to non-transfer students (e.g. Martinello & Stewart, 2013). Despite the mixed results in the literature, the academic performance of transfer students has long been of considerable interest to researchers, and thus identifying factors that will facilitate transfer students' educational attainment remains an important goal.

The relationships between students' approaches to learning (SAL), perceptions of the teaching-learning environment (TLE) and academic achievement have been widely examined in higher education contexts (e.g. Asikainen et al., 2014; Rytkönen et al., 2012). Approaches to learning, referring to the nature of students' study processes, have been classified into three approaches: a deep approach refers to the ability to understand, to relate and to construct meaning in the learning material; a surface approach is related to memorising without aiming at understanding; and, a strategic approach, labeled as an organised studying, refers to the ability to manage time and effort (Entwistle & McCune, 2004). Previous studies indicate that the deep approach and organised studying are positively related to academic achievement, and the surface approach negatively related (e.g. Tuononen et al., 2019), although contradictory results have also been found (Lizzio et al., 2002). SAL have been found to depend greatly on their perceptions of the teaching–learning environment. Evidence showed that effective teaching, which is relevant, interesting, constructively aligned, and supports students' understanding, along with constructive feedback and support from staff and peers, could facilitate the use of a deep approach and an organised studying (Postareff et al., 2018).

Although a number of studies have also examined how transfer students' perceptions of the academic environment is related to academic adjustment (Flaga, 2006), little effort involving quantitative measures has been documented in the literature on their correlations with SAL. Acai and Newton (2015) have compared transfer students and those via direct-

entry from high schools in Ontario, and found no significant difference in their learning approaches or academic achievements. To better understand how transfer students' learning could be more effectively accommodated under the higher education system in Hong Kong, this study aims at exploring the relationships between perceptions of the TLE, SAL and academic achievement.

2. Method

2.1. Instrument

We designed a questionnaire based on two validated inventories: Experiences of Teaching and Learning Questionnaire (ETLQ; Entwistle et al., 2003) and the Approaches to Learning and Studying Inventory (ALSI; Entwistle & McCune, 2004). Items are scored on a five-point Likert scale (1= totally disagree, 5 = totally agree). The instrument has been validated across contexts (Parpala et al., 2013). Our questionnaire for this study contained a part of demographic information such as gender and age, followed by two sections from the HowULearn Questionnaire (Parpala & Lindblom-Ylänne, 2012), which measures students' perceptions of the TLE (22 items) and SAL (12 items). Revision was made on on some region-applicable items to fit the local use. The whole questionnaire was then reviewed by a panel of nine overseas and local experts in the education field to determine the content validity index (CVI). A CVI of 0.99 was found, which was higher than the acceptable level of 0.75. Eleven undergraduate students were invited to fill in the questionnaire to test its readability and appropriateness. Minor changes in the wording were then made on some items. Students' academic achievement was measured by calculating a grade point average (GPA) at the time of data collection.

2.2. Participants and Data Collection

The questionnaire was posted online to collect data from September 2018 to November 2019, using convenience sampling. All full-time transfer students in government-funded degree programmes in X University in Hong Kong were inivited electronically to participate in the study. A total of 617 responses were obtained. The participants were from 27 departments involving all faculties and schools in the university. The sample consisted of 59.3% female and 40.7% male students, aged 18 to 41 years (M=22.31, SD=1.78).

2.3. Data Analysis

SPSS analytical software version 25 was used for the data analysis. We conducted exploratory factor analyses (EFA) for each construct by using the general rule of an eigenvalue > 1 (Kaiser, 1960), and used the maximum likelihood extraction method and oblimin rotation. The Kaiser-Meyer-Olkin (KMO) test was conducted to measure the

sampling adequacy. Cronbach's alpha statistics were computed to test the scales' internal consistency. The presence of multicollinearity among the independent variables was examined by the tolerance values and the variance inflation factor (VIF) for the data included in the analysis. Confirmatory factor analyses (CFA) using SPSS AMOS 25 were conducted on thenew factors emerged from EFA. The fit of the model was assessed using the chi-square test of model fit, the goodness-of-fit index (GFI), the Tucker-Lewis index (TLI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Pearson's correlation test was used to test the correlations between the scales of the TLE, SAL, and academic achievement. Variables with statistically significant correlations with academic achievement were selected for the linear regression analysis (forward) to explore its strongest predictor.

3. Results

3.1. Factor Analyses

The factor structures of the items measuring students' perceptions of the teaching and learning environment were different from the original study by Parpala et al. (2012), as shown in Table 1. Three factors were labelled as *teaching for understanding & encouraging learning* (FE1), *peer support* (FE2), and *alignment & constructive feedback* (FE3). The factor loadings ranged between 0.34 and 0.90, which explained 50.0% of the total variance. Table 1 shows the main descriptive statistics. In line with the original study, three factors measuring SAL were loaded, ranging between 0.31 and 0.81 (see Table 2). They were labelled as *organised studying* (FA1), *deep approach* (FA2) and *surface approach* (FA3), which explained 44.5% of the total variance.

Table 1. Descriptive statistics for subscales of Teaching and Learning Environment (22 items).

	Items	M	SD	α
FE1	1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 16	3.59	0.55	0.92
FE2	8, 11, 15	3.65	0.72	0.77
FE3	17, 18, 19, 20, 21, 22	3.43	0.66	0.88

Table 2. Descriptive statistics for subscales of Students' Approaches to Learning (12 items).

Items		M	SD	α
FA1	2, 4, 8, 10	3.49	0.60	0.73
FA2	5, 6, 11, 12	3.52	0.57	0.75
FA3	1, 3, 7, 9	3.13	0.65	0.74

The tolerance values ranged from 0.311 to 0.808, and the VIF values ranged from 1.238 to 3.213. Since the VIF values were between 1 and 10, we concluded that no instance of excessive collinearity among the independent variables was evident in the data. From the results of CFA on SAL, the chi-square test ($\chi 2$=219.9, df=51, p<.001) indicated a poor fit; however, this was expected due to the large sample. The fit indices (GFI=.944, CFI=.914, TLI=.888, RMSEA=.073) were acceptable. For the CFA on students' perceptions of the teaching and learning environment, the chi-square test indicated a poor fit ($\chi 2$=871.3, df=206, p<.001), while the fit indices (GFI=.881, CFI=.905, TLI=.893, RMSEA=.072) were reasonable. This suggested that the factor structures of the subscales fitted the data reasonably well.

3.2. The relationships between academic achievement, SAL and perceptions of the TLE

Statistical results are listed in Table 3, which shows correlations between academic achievement, perceptions of the TLE and SAL. Positive correlations were observed between all teaching–learning environment factors and between all SAL factors. In addition, the perceptions correlated positively with deep approach and organised studying, but not significantly correlated with surface approach. The results showed statistically significant positive correlations between academic achievement and teaching for understanding & encouraging learning, deep approach and organised studying, and a statistically significant negative correlation between academic achievement and surface approach. In other words, peer support and alignment & constructive feedback were the only factors that were unrelated to academic achievement.

In addition, regression analyses were conducted to explore which factors had the strongest relationship with academic achievement. The results showed that surface approach to learning (β = -.15, p < .001) and organised studying (β = .13, p < .01) were the predictors of academic achievement.

Table 3. Relation between students' perceptions of the TLE, SAL and academic achievement

Factor	1	2	3	4	5	6	7
1. FE1	1						
2. FE2	**.595****	1					
3. FE3	**.736****	**.483****	1				
4. FA1	**.404****	**.330****	**.352****	1			
5. FA2	**.515****	**.335****	**.394****	**.549****	1		
6. FA3	-.038	.024	-.005	**.236****	**.186****	1	
7. Academic achievement	**.121****	.031	.053	**.154****	**.121****	**-.139****	1

**p < 0.01, statistically significant correlations shown in bold

4. Discussion

The present study explored how students' perceptions of their TLE and SAL are related to their academic achievement. The results showed that positive perceptions of the TLE are related to the use of a deep learning approach and an organised studying, which is in line with earlier research (e.g. Entwistle et al., 2003 ; Rytkönen et al., 2012; Postareff et al., 2018). Similarly, the results resonated with previous studies in which the deep approach and organised studying were related to a better academic performace and the surface approach to a poor performace (e.g. Lizzio et al., 2002). This confirms the widely accepted idea that students' perceptions of the TLE and SAL are important factors for academic success.

Our analysis of what predicts students' academic achievement supports the findings in Rytkönen et al. (2012) that organised studying had stronger relations with academic achievement than deep approach to learning. This may be partly due to the nature of deep approach, as grade point average is not necessarily the best way to measure the quality of the learning outcomes related to deep approach (Rytkönen et al. 2012). On the other hand, time management and organised studying are important for transfer students' successful studying at university. They are often faced with heavy study loads due to a poor subject alignment between sub-degree and degree programmmes and inadequate support for transitioning (Cheung et al., 2015), and the needs to balance study with non-academic activities such as paid work or family commitments (e.g. Briggs et al., 2012). Therefore, they have to pay special attention on how to schedule their time well to fufil their study requirements.

Interstingly, although transfer students scored slightly higher on the deep learning and organised studying than the surface learning, a significant and positive correlation between surface learning and deep learning with organised studying was found, differing from the results of previous studies (e.g. Rytkönen et al., 2012) that surface approach was negatively related to the other two approaches. The inconsistence may be explained by the intermediate approaches used by the students (Kember, 2016). Contrary to the commonly held belief that the characterisation of deep and surface approaches to learning was dichotomous, there is evidence of Chinese students using mixed approaches to learning, intermediate between pure surface and deep approaches, which combine memorising and understanding (see Kember, 2016 for a review). This indicates that students tended to understand the concepts in their learning process, and at the same time recognized the role of memorisation played in their examinations. Nevertheless, it should be noted that there are distinct forms of memorisation (Kember, 2016). Although both intermediate and pure surface approaches involve memorisation, rote learning or mechanical memorization only in a pure surface approach to learning should lead to poor learning outcomes, which is supported by the results of regression analyses in the present study.

The present study and findings underline the importance of transfer students' awarenesses and development of effective skills for successful learning in universities. A supportive mechanism from universities is most desirable to facilitate students to achieve these goals and to develop habits in autonomous leanring. Institutional supports could include enhancement on pedagogical relevance and interests in learning, as well as on constructive feedback and assessment. These supportive means could help students articulate individual learning needs and self-evaluate their learning outcomes against a programme's objectives. Workshops could also be provided on fostering skills for organized studying such as time management skills, and activities be organized on promoting awareness of strategies and approaches to effective learning. These pedagogical measures are crucial and facilitative for transfer students to successfully adapt to university study and to obtain academic achievements.

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Becoming an Expert, Ambassador or Doing Project Work: Three Paths to Excellence for Students at Artevelde University of Applied Sciences

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Abstract

Apart from the regular curricula in higher education, institutions increasingly offer additional initiatives or honours programmes for students to excel. Artevelde UAS wants to provide similar additional learning opportunities, in which the notion of excellence is based on reflection, self-direction and 'giving back' to stakeholders. This paper will provide an elaboration of these opportunities, based on three research questions: (1) What project or initiative can be considered as a valid and well-defined form of excelling, (2) How do we formally structure and organize this initiative or project, and (3) How can we evaluate and validate students' experiences of excelling? Students of (International) Business Management at Artevelde UAS can excel in three different ways: by professionalizing and becoming an expert in a certain topic or area, by becoming an ambassador for one particular 21st century skill that has been put forward and highlighted by Artevelde UAS in its mission (global citizenship, entrepreneurship or sustainability), or by cooperating with professional business partners in order to develop and implement a real-life project.

Keywords: *excellence; higher education; innovation; business student; self-direction; reflection.*

1. Introduction

Apart from the regular curricula in higher education, institutions increasingly offer additional initiatives or honours programmes for students who want to develop and elaborate their knowledge, skills and talents outside of the standard study programme of courses needed to obtain a diploma. In this context, universities and colleges want to provide a challenging and rewarding learning environment so that high-performing students can become high-performing professionals. Providing this kind of environment is also a key concern for the Department of Education in Flanders (Weyts, 2019). Being introduced in the US, the concept of honours programmes was also developed over time in the UK and the Netherlands (Wolfensberger, 2012). Moreover, this concept, together with the notion of 'excellence' programmes has become increasingly apparent in European education (Wolfensberger, p.16); Of course, the term 'excellence' proves to be multifaceted, and even ambiguous, and can be linked to a negative connotation of 'exclusivity' or 'elitism', as opposed to inclusive and democratic values. However, in this paper we would like to propose a concept of excellence initiatives that aspire to provide accessible opportunities to a varied group of students to grow, develop and excel.

Artevelde UAS offers graduate, bachelor and postgraduate study programmes in a variety of topics, ranging from business management and communication to nursery and graphic media. Apart from providing regular courses within the curriculum, it also aims to create learning initiatives that go beyond the curriculum. In its educational vision, Artevelde UAS implements two complementary approaches or objectives to excellence. As a first objective, Artevelde UAS (Vanoverberghe, Slock & Van Puyenbroeck, 2014) seeks to encourage and stimulate *all students* to become the best version of themselves as professionals and as global citizens. The personal and professional development of the student within the curriculum is the main focus in this regard. The second way in which our school wants to promote excellence, is by providing extra opportunities to excel to students who demonstrate a higher level of competencies, motivation, and drive. The framework that will be explained further on in this paper, is an illustration of this second approach to excellence.

With this 'framework for excellence', Artevelde UAS wants to provide additional learning opportunities that cater to the needs of students who pursue a more in-depth study of their area of expertise, a more profound development of their professional behavior, and further and more complex challenges with social relevance. This paper will provide an exploration and elaboration of this framework, based on three research questions: (1) What project, initiative or seminar can be considered as a valid and well-defined form of excelling, (2) How do we formally structure and organize this initiative or project, and (3) How can we evaluate and validate students' experiences of excelling?

2. Methodology and theoretical background

The development of this framework, and, consequently, the answer to the three research questions mentioned above, is based on initial research into the topic at hand. A first step of this research project consisted of extensive desk research into the use of excellence programmes in higher education. In addition, we conducted national and international benchmarking with other institutions of higher education on the topic of excellence programmes, the integration of 21st century skills, and the different ways of validating. Finally, this was complemented by elaborate qualitative research with various stakeholders: external and internal experts on excellence initiatives, various internal policy makers and officers, lecturers, programme managers and coordinators, students, alumni and professionals. Based on this research, we developed a set of guidelines and conditions, and an evaluation grid that is used as a tool for giving efficient feedback during the process and for evaluating and testing students at the end of the excellence project.

The framework is embedded in a number of theoretical concepts that we regard as key to the establishment of an approach to excellence. To start, it is important that students are genuinely motivated to take on an extra project. Ryan and Deci (2000) state that motivation is connected to "innate psychological needs that are the basis for their self-motivation and personality integration, as well as for the conditions that foster those positive processes" (p. 68). These needs are then identified as "needs for competence […], relatedness […] and autonomy" (p.68). Lecturers and pedagogical approaches that respond to the combination of these three needs, contribute to the autonomous motivation of their students (figure 1). Autonomous motivation is motivation that arises from a personal stake, from interest or a passion for something. Students with autonomous motivation study because they value the study material, or because they find the study content interesting. Consequently, autonomous motivation has a positive influence on learning (Vansteenkiste, Sierens, Soenens & Lens, 2007): it is associated with higher success and achievement in learning, more self-directed learning, a higher conceptual understanding, a stronger sense of perseverance, less drop-outs and an increase in psychological wellbeing of the student. It is therefore crucial that the concept of autonomous motivation is integrated in all initiatives, or 'pathways', to excel.

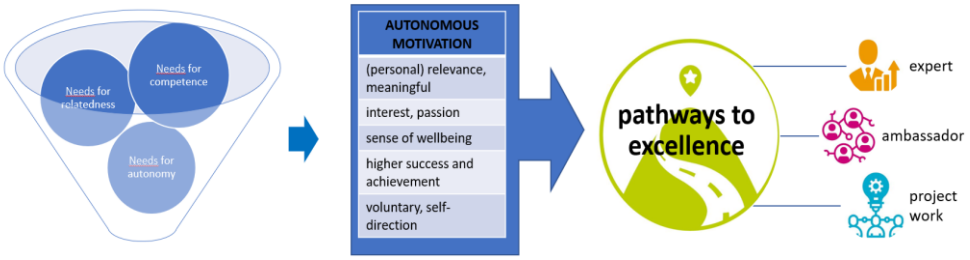

Figure 1. Connection between motivation and autonomy and the pathways to excellence.

Other research (Hornstra, Weijers, van der Veen & Peetsma, 2016) asserts that the need for autonomy is somewhat stronger with students who perform well, or who excel. In addition, the need for structure is lower for students who perform well, or who excel.

3. A valid and well-defined form of excelling

Inevitably, a general concept such as 'excellence' is difficult to define. To avoid confusion, it is important to note that the Artevelde UAS Framework for excellence excludes certain forms of excelling. For example, students can excel when they obtain a score of 16/20 or more on a certain specific course. Moreover, excelling is significantly different from distinguishing oneself by choosing a certain study programme, course or internship location (Artevelde, 2017). Artevelde UAS does acknowledge and validate these kinds of excelling within the curriculum structure, but it is not the focus of this research project.

In general, students excel when they differentiate themselves from a certain standard. At Artevelde UAS, students can excel on a professional bachelor level, not a master level which is a higher qualification level in the European Qualifications Framework (EQF). Keeping this, and the objectives of this research project, in mind, the definition of excellence as used in the department of business management of Artevelde UAS is as follows:

A student excels if he or she successfully succeeds in an extra-curricular learning opportunity that offers more comprehensive expertise in a particular study topic, or puts the business topic in a broader perspective. This learning opportunity must comply with certain specific characteristics (explained in the next chapter):

1. In the course of the learning opportunity, there is a consistent element of **self-regulation and personal process management.** Aspects of self-regulation can include, for example: students taking charge of the creation of SMART objectives (Specific, Measurable, Acceptable, Realistic and Time-Bound) and the planning of the initiative, communicating with stakeholders, and adjusting the process when this is deemed necessary.
2. Students constantly have to **reflect** on the process and on their professional development throughout the learning opportunity
3. After the learning opportunity, students have to commit themselves to **giving back** their knowledge and experiences to various stakeholders, such as fellow students, potential students, lecturers, or internal services and policy offices within the school. Additionally, this also provides an added value to the school: when students 'give back' their knowledge, the school gains new insights and this might offer possibilities to stay up-to-date and innovative as an institution of higher education.

The student's effort and commitment to excellence is explicitly acknowledged and rewarded when the student successfully demonstrates that he or she has performed on a bachelor's level of excellence. Students are tested and coached throughout the process, based on an evaluation grid that lists specific learning outcomes linked to three characteristics listed above. The evaluation grid also functions as a tool to assess the student's final achievements.

4. A Formal Structure: three Pathways to Excellence

Students can excel in three different ways: by professionalizing and becoming an expert in a certain topic or area, by becoming an ambassador for one particular 21st century skill that has been put forward and highlighted by Artevelde UAS in its mission (global citizenship, entrepreneurship or sustainability), or by cooperating with professional business partners in order to develop and implement a real-life project. In the following sections, each "path" will be explained in more detail.

The information about the three paths to excellence is communicated to the students on an internal information platform, and in several specific courses related to professional development. For each path to excellence, a description of the initiative is provided, as well as abundant practical information, and a 'job ad' that specifies what kind of person is wanted for each path (detailing the content of the initiative, the skills needed, the procedure, the time period, the evaluation and reward, and the call to apply for this 'position'). Subsequently, students who are motivated to participate can apply for one of the three initiatives, by writing a specific motivation letter. If necessary, the motivation letter is complemented by an additional interview, to select the final participants for the excellence initiative. In both letter and interview, students need to illustrate their interest to participate, by explaining their motivation, and describing the personal and professional objectives they want to integrate in the project. The complete selection procedure is explained in the guidelines provided to coaches and lecturers.

4.1. Professionalizing / becoming an expert

In this first pathway to excel, students can distinguish themselves by expanding knowledge and skills related to their area of expertise, their major, which gives them extra qualifications. From the second year of the Bachelor of Business Management, students can specialize and select a "major". The different majors are SME Management, International Entrepreneurship, Law Practice, Logistic Management, Accountancy-Taxation, Finance and Insurance, Marketing and International Business Management.

Examples of this path may include: students of Logistic Management participating in a 24-hour hackathon in which a real-life business case is discussed and developed within a diverse and multidisciplinary team, in close cooperation with professionals; Students of Marketing

looking into the concept of online data analytics and Adwords to create an online marketing plan for an NGO. In all these examples, students focus on the content related to their major. The initiatives in which students can participate can also be organized by external organizations or educational institutions.

Initiatives from this first approach must incorporate the three key features of opportunities for excellence. The initiative itself can often be divided into three separate phases. First, there is a preparatory phase, in which the students make necessary preparation by researching a specific topic and by listing objectives – professional and personal – they want to reach during the process. Next, the focus is on the initiative itself (for example, a series of lectures or a hackathon). To conclude, the students end the process by reflecting on their role, and by "giving back" their knowledge to certain stakeholders.

4.2. Becoming an ambassador

The second opportunity for students to excel outside the curriculum entails becoming an active ambassador for certain key 21st century skills in the mission and vision of Artevelde UAS. Artevelde UAS focuses on five pillars: Sustainability, Entrepreneurship, Global Citizenship, IT Literacy, and Analytical Skills and Critical Thinking. Students can choose a project of excellence with a focus on these learning outcomes.

In contrast to the first "path" to excellence, students do not focus that much on the area of expertise of their major. In the second path, students become an ambassador for one of the five 21st century skills, or a combination thereof. The main way in which students do this is by creating awareness around this topic, and by establishing an active and diverse community that can include students, staff members, and external professionals. In addition, students create, develop and promote initiatives that contribute to the awareness and integration of the selected theme. Self-direction and autonomy are again important conditions that have to be fulfilled, so students are to a great extent responsible for their own track, and for the initiatives they create.

As an example, students at Artevelde were given the opportunity to commit themselves to the topic of sustainability and were responsible for creating a community of students around this topic. In this context, they physically created an SDG classroom with recycled materials and the community of students and lecturers worked on the awareness about the topic of sustainability together. This room has become a hub for promoting other student and staff initiatives towards sustainability.

4.3. Doing Project Work

In the third path to excellence, students can differentiate themselves and offer proof of excellence based on a combination of various 21st century skills. In co-creation with professional partners of Artevelde, students are responsible for developing a project to

address a 'wicked' problem. As such, the learning environment becomes more complex and varied, and can include multicultural and multidisciplinary aspects. In addition, in-depth and elaborated knowledge about certain business topics is essential. Projects in this category can be divided into different steps: a briefing with the professional client, a preparatory phase in which the necessary knowledge and information is collected, extensive collaboration and communication – both online and offline – throughout the project, creation and implementation of a specific plan or project (for example, the creation of a business plan, a marketing plan, social media strategy …) for a specific enterprise or NGO, and, finally, the end evaluation and analysis of the project. The projects in this category ideally have a social relevance and are developed in a sustainable way: it is not a one-off initiative, but should be developed over different years, in cooperation with the same professional partner. The students who are involved in such a project are evaluated by both Artevelde and the professional partner.

As an example, a specific project in this category gave students the opportunity to work in cooperation with companies and social organisations in South Africa. After a preparatory phase, students needed to develop a detailed plan on how to tackle certain problems, ranging from purely business procedures, to more societal issues. In this context, the focus is on (intercultural) collaboration and communication, problem-solving and hands-on implementation of solutions.

5. The Evaluation and Validation of Excellence Experiences

Throughout the initiative, students can illustrate their work and professional growth in a digital portfolio, that is also used for feedback by the coaches. At the end of the process, the students are evaluated and rewarded. After an oral defense and/or written report, students obtain a reward, and they are put in the spotlight in an award ceremony that brings together students, lecturers, and professional partners. The way in which students are rewarded for their efforts can take different shapes, such as a personal recommendation letter, an endorsement on LinkedIn or a digital badge. In addition, the achievements of the students are highlighted on various public platforms. Students are also encouraged to reach out to a next generation of students to share experiences and inspire other students to also follow a path to excellence.

6. Conclusion

To conclude, we considered several factors for the development of excellence opportunities for students. First, a well-defined and legitimate excellence initiative should be an extracurricular initiative in which students demonstrate the skills of self-direction, reflection and 'giving back' and perform on a professional bachelor level of excellence. Secondly,

excellence activities can be formally divided into three categories: students can excel by elaborating an area of expertise, by becoming an active ambassador for a specific 21st century skill, or by doing project work in close collaboration with the professional work field. Finally, students get explicitly recognized for their work by the academic and professional field. With this composition, Artevelde UAS provides several opportunities to excel to a variety of bachelor students.

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Employability Through Experiential Delivery of Intercultural Communication Skills Online

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Abstract

International trade, enabled by rapid technological advances, has had a profound effect on the way employees work and communicate in a borderless, virtual environment. Within this context, classroom collaboration through online virtual teams can be an effective strategy to enhance intercultural and employability skills. Research in this area advocates that using digital media to connect students with international classrooms is an easy and efficient way to develop intercultural competence. In this paper we describe and present the results of one such initiative. The authors have designed and implemented virtual and experiential intercultural communications assignments across four countries: Germany, Portugal, Scotland, and the United States. By creating virtual teams and then simulating a real-world team project, we have been able to study how students work with, and react to, teammates from other cultures. We explored students' views and opinions on the expected outcomes of their international experience in virtual teams and the potential impact of online intercultural learning experiences on their future employability. The findings suggest that collaborative online international learning (COIL) can help to develop the kind of soft skills that employers value and need in the globalized workplace.

Keywords: *intercultural communication; curriculum design; collaboration online.*

1. Introduction

Globalization is an economic reality for organizations of all shapes and sizes. According to Fortune Global 500 (https://fortune.com/global500/2019/), "The world's 500 largest companies generated $32.7 trillion in revenues and $2.15 trillion in profits in 2018. Together, this year's Fortune Global 500 companies employ 69.3 million people worldwide and are represented by 34 countries." The importance of globalization is echoed by the World Bank (https://www.worldbank.org/en/topic/smefinance) who state that "SMEs account for the majority of businesses worldwide and are important contributors to job creation and global economic development. They represent about 90% of businesses and more than 50% of employment worldwide."

Hence, acquiring and developing adequate soft skills to work in multicultural teams is essential for students to become employable in today's workplace. Gibb (2014) stressed the relationship between soft skills and employment success, and Balcar (2016) recommended that education systems pay more attention to the development of skills according to employers' needs. In fact, as O' Brien et al. (2016) explained, soft skills are the ones that create competitive advantage and are therefore necessary for success in the implementation of technical (hard) skills. One of the reasons is that these skills are more transferable and thus relevant to the highly flexible contexts employees work within nowadays (Albandea, 2018). As Robles (2012) noted, "soft skills are employability skills that are transferrable in many jobs" (p. 458).

Communication, collaboration, teamwork, leadership, responsibility, and interpersonal skills are among the most cited soft skills. In fact, the literature presents several listings of soft skills, many of them based on the opinions and evaluations of managers and executives (e.g., Crawford et al., 2011; Robles, 2012). However, we argue that due to the dominant globalized economy, intercultural skills are of utmost importance for professionals and consequently for students, and teaching and learning strategies. According to ESCO (https://ec.europa.eu/esco/portal/browse?type=Skill), transversal competences include social interaction skills, which, in turn, encompass intercultural competence, defined as to "understand and respect people who are perceived to have different cultural affinities, and respond effectively and respectfully to them". Diamond et al. (2011) asserted that it is imperative that managers know how to work collaboratively in multi-cultural teams and are able to manage complex interpersonal relationships. Then, international experience is expected to be particularly valuable for students, especially the ones in management areas, as employers need professionals that can compete in global marketplaces (Diamond et al, 2011).

2. Experiential learning online and intercultural competence

Since today's businesses operate globally, with locations and offices worldwide, the days of being fairly confident that employees within a division will share one's culture appear to be over. Without the ability to understand and work within the framework of each other's cultural communication, an employee's career may falter.

Although universities are placing an increasing emphasis on providing theoretical education in intercultural competence, which Deardorff (2009) defined as possessing the necessary attitudes and reflective behavioral skills; studies from the workplace show that this increase in emphasis has not yielded desired results. In fact, the U.S. National Association of Colleges and Employers 2018 Jobs Outlook Survey found, among other results, that the percentage of graduating seniors and young employees who believed that they were proficient in global/intercultural fluency was much higher than the percentage view of employers (Bauer-Wolff, 2018). Therefore, in order to increase employability, students need to go beyond theory and utilize intercultural skills to behave effectively and appropriately in intercultural situations.

As teachers and researchers, the authors believe that part of the disconnect lies in the difference between learning about intercultural differences and actually experiencing those differences. One of the strongest arguments in defense of internationalization at home is democratizing the benefits of mobility. Indeed, not all students are able to travel overseas, and the programs that foster student mobility are able to support only a small percentage of them. Therefore, the continuous development and spread of technology opens opportunities for many more students to engage in intercultural experiential learning (Bhat and McMahon, 2016).

3. A Virtual Teams Project Spanning Four Countries

An example of one such COIL project was conducted by the authors in the fall 2018. Four instructors from universities in the United States, Germany, Scotland and Portugal engaged their students in a six-week virtual team project. The participants were undergraduate and graduate students of varying disciplines from Business Administration, Marketing and Public Relations to Applied Computer Sciences, ranging in age from 20 to 40, coming from diverse ethnic backgrounds and possessing various levels of English knowledge. While there are conflicting opinions concerning the effectivity of heterogeneous groups, the authors agree with Gorgônio et.al. (2017) that they are more effective, share more knowledge and improve mutual learning as well as more accurately reflect the diverse workforce graduates must navigate today.

During the launch of the project, the instructors tested out the collaborative software students were to utilize themselves and introduced them to the class, illustrating some of the technological challenges and how they can be overcome. According to Starke-Meyerring and Andrews (2006) the importance of instructors as role models through the intensity of and interest in their own collaborations cannot be underestimated. To this end, the instructors met once a month for a virtual conference and kept each other abreast of difficulties students were experiencing.

The first phase of the project involved students building rapport. The importance of building relationships and developing trust for successful virtual multicultural team collaborations is supported by Molinsky and Gundling (2016). Students were asked to provide personal information and create an animated film about their team using the tool Powtoon. The second phase of the project focused on a mutual assignment involving the research and analysis of the online presence of a global company. SLACK was a useful platform for coordinating information, and the audio/video software of ZOOM provided a reliable communication platform. The synchronization of the assignment goals and deadlines across all classes was fundamental to the virtual teams' project. This was also imperative in the third phase of the project where students presented their findings and made recommendations as to how their companies could improve their use of social media and presence online. These were presented using the online platform Prezi and papers were written collaboratively through the use of Google Docs. The requirements and expectations for the presentations and final papers needed to be the same for all classes in order to ensure quality and fair treatment. Using the same grading rosters and carrying out a grading session where all instructors evaluated the submitted work, had a "gelling" effect and lent cohesion and credibility to the virtual teams experience from the students' and the instructors' perspective (Bégin-Caouette, 2013).

4. Student Perceptions of Collaborative Online International Learning and Employability

The project was evaluated via an online intercultural competency survey based on the Intercultural Sensitivity Scale created by Guo-Ming Chen and William J. Starosta for the University of Rhode Island (2000). Out of 44 items which Chen and Starosta developed as indicators for the measurement of intercultural sensitivity, we selected 24 items divided into five factors: Interaction Engagement, Respect of Cultural Differences, Interaction Confidence, Interaction Enjoyment and Interaction Attentiveness and asked students to respond to each item on a five-point Likert scale (5 = strongly agree, 4 = agree, 3 = uncertain, 2 = disagree and 1 = strongly disagree).

Students were asked to complete this survey before the project began. At the end of the project, students were again asked to complete the survey but this time we included qualitative questions concerning their personal feelings towards the project, what they found most difficult, their satisfaction with the project, and what they would do differently next time. In addition, they were asked to rate the activity and evaluate both their own and their team members, both at home and abroad, concerning commitment and active participation .

The research demonstrated that there were more positive than negative perceptions of the experience overall and it was almost universally regarded as something which employers would value. Participants cited the development of their own soft skills as one of the most significant outcomes of the project, including improved time management skills, willingness to take the lead, active listening and greater empathy for non-native English speakers: *"I learned to be more tolerant towards others work dynamics."*

They also said the project had challenged their preconceptions about other cultures and in many cases completely negated them. However, in other instances participants observed differences in ways of working which they attributed to a combination of culture and individual personalities: *"I enjoy working with people from different cultures because it affords me the opportunity to step outside myself and see a different way of doing things."*

Some felt that trying something new and out-with their comfort zone was a simultaneously exciting and scary prospect. Where the team bonded in a friendly, supportive and safe environment they enjoyed the experience more and were sorry when it came to an end: *"We exchanged social media contacts after the project and are still in touch."* Many teams functioned better as time went on and familiarity with the context, challenges, tools and personalities grew.

Participants believed that the project had inspired creativity, innovation and 'thinking outside the box' because it forced them in to a new, unfamiliar situation with people they did not know and with limited tutor intervention: *"I've learned to adapt to the different mindsets and challenges inherent to people from different cultures."*

They regarded effective communication as central to the success of the intercultural project and were able to deconstruct the strengths and weaknesses of their own communications as well as that of their team-mates: *"Accents and speech emphasised cultural differences, however I was surprised I could follow and communicate with them."*

Despite some initial challenges related to IT reliability and access problems, they enjoyed learning new virtual communication applications and said they would use these online tools more confidently in future as well as being more open to trying new software: *"I learned how to work with Slack, Prezi and Zoom – I feel very confident using this in future for work or school."*

The participants experienced significant issues related to time differences, conflicting study, work and personal schedules, varying levels of motivation and language barriers: *"I now know how hard it is to manage time frames across time zones, we all had to work round different schedules, work, families as well – time zones just made it more challenging."* This sometimes resulted in high levels of frustration, fear of failure and delays.

5. Conclusion

As mentioned earlier, employees require greater levels of awareness and understanding of other cultures to operate effectively within a multinational, global context (Diamond et al, 2011). Positive working relationships (often marked by the presence of effective soft skills) with international partners, investors, suppliers, customers, employees and other stakeholders are critical to the sustainability and success of many organisations. Participants frequently cited the development of their own soft skills as one of the most significant outcomes of the COIL project. These soft skills which are tested and cultivated through virtual, experiential learning are highly valued by employers because they are transferable to any workplace context (Albandea, 2018; Robles, 2012). This is also important for employees in an era where portfolio careers are becoming more prevalent and lifelong positions working for the same employer are less common (IMF, 2017). Intercultural projects can also help participants to develop tolerance and respect (Parker, 1999), because participants are likely to encounter a wider range of communication challenges than they would in a local project. The participants in this project experienced significant challenges related to geography, culture, age, experience, time differences, IT reliability, conflicting study, work and personal schedules, personality differences, varying levels of motivation and language barriers.

Despite the challenges, many participants felt the experience was interesting, worthwhile and provided a fresh perspective that they may not have considered otherwise. They felt they had learned a lot about themselves and others: *"The project gave me an informative view of the world of operations for a global company – I have a newfound respect for these companies because they have to overcome substantial barriers to be successful."* This ability to self-reflect and adapt to new communication environments and situations is something that employers are likely to value as globalization and digitisation continue to accelerate and advance.

Many participants believed that COIL projects are relevant and highly beneficial practice for future employment in the global, digital era and should be more common in the curriculum. *"Employers will be keen to have professionals with this specific skill of intercultural communication as it is a real skill."* They could see how increased awareness of other cultures, increased confidence in working with people from other countries, greater self-awareness and self-monitoring of individual communication styles, and higher levels of

tolerance when working in virtual international teams, might help to enhance their own and others' employability.

The survey findings combined with anecdotal evidence obtained through informal discussions between students and staff involved in the project, suggested that overall the project had been worthwhile. However a number of enhancements were identified for future delivery including: evolving and refining the evaluation methods; improving the co-ordination, timing, composition and support for student teams; incorporating more student touch points to promote engagement; developing more consistent, integrated assessment criteria; and including more frequent multi-way tutor communication. According to Deardorff (2016) a profound intercultural competence assessment must go beyond self-reports, as only the others' perspectives will effectively assess the appropriateness of communication and behaviour. Clearly, assessing the effectiveness of virtual internationalization initiatives is a topic that deserves further attention by academics and researchers, and that will benefit from additional approaches, innovation, and replication to attest what, how, and how much are students developing their intercultural skills by collaborating with their international peers.

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The Lecture-Performance: Implementing Performative Pedagogy in Literature Class

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Abstract

In recent years the performative has gained importance within the pedagogical field and has opened new perspectives in educational research. Experience has shown that the integration of performative elements in the learning process allow teachers to involve learners emotionally and cognitively. The present paper deals with a learning experience performed with students in the course "German Literature (2nd language)" at the University of Valencia. From the perspective of Performative Pedagogy, students are asked to carry out a research project and then transfer the acquired knowledge to the theatrical format that must be didactic: a Lecture-Performance. This activity highlights the benefits of students' autonomous and cooperative learning, as well as the development of students' performative competence, with which they achieved deeper levels of understanding and improved their retention of what was studied. The teacher evaluation and a questionnaire carried out by the students at the end of the activity confirm the achievement of the initial objectives.

Keywords: *Lecture-Performance; Performative Pedagogy; Literature Class; Applied Theatre.*

1. Introduction

The need to implement innovative methodologies in the university environment has opened a new path in the acquisition of communication skills for university students. At the same time recent research has explored the benefits of integrating body and movement in cognitive processes (Wilson 2002: 625). In this paper we analyse a teaching and learning experience based on the pedagogical concept that results from applying performative approaches in educational contexts. Our proposal is an example of the so-called applied theatre (Prentki & Preston 2009: 12) as it explores a possible application of the performing arts to pedagogy, particularly to the teaching and learning of literature. Specifically, the paper presents how to integrate the practice of Lecture-Performance in the classroom, a relatively new phenomenon that can be used as an alternative for any situation that requires an oral presentation. The activity was carried out with a group of students in the course "German Literature (2nd language)" at the University of Valencia, where students had to do research in groups on specific content from the subject matter and then transfer the results of their research to the theatrical format of a Lecture-Performance.

2. Theoretical Framework: The Lecture-Performance as part of Performative Pedagogy

The term "performative" refers to a complex concept that has been applied heavily in a variety of disciplines over the years in both humanities and social sciences. First used in linguistics, with Austin's speech act theory, the concept has also become a key term in arts and theatre science ("performance)" as well as in gender studies ("performativity"). In recent years the performative has gained importance within the pedagogical field and has opened new perspectives in educational research. In their introduction to the anthology *Performative teaching, learning, research*, Susanne Even and Manfred Schewe define performative pedagogy with the following characteristics: it is action-oriented, so that verbal transmission is an action in itself, and it focuses on the processes of teaching (Even & Schewe 2016: 176). According to an action-oriented concept of teaching, students are not passive recipients of the contents transferred to them by teachers. Knowledge is not transmitted unidirectionally, but rather produced among all the agents involved in the learning process. Moreover, as Christoph Wulf and Jörg Zirfas already pointed out in *Pedagogy of the Performative*, the perspective of the performative in educational contexts emphasizes the "reality-constituting processes" that are part of pedagogical behaviour, as well as "the correlation of body and language, power and creativity" (Wulf & Zirfas 2007: 10). Performative Pedagogy puts into practice the results of recent studies in neuroscience that have investigated the effects of movement-based learning in contrast to learning without movement (Sambanis 2016: 208). In his proposal for the integration of performative elements into foreign language education, Manfred Schewe proposes using

the body in a conscious way as part of the learning process (Schewe 2011). Certain voice exercises as well as space relation exercises are necessary so that both teachers and students improve their performative competence and become aware of their physical presence.

A very specific and interesting manifestation of performative didactics is the Lecture-Performance, a relatively new phenomenon that could be characterized as a hybrid between art and science/research. Its origins lie in Conceptual Art and the criticism of institutions of the 1960s and 1970s.[1] Since the beginning of the 21st century there has been a renaissance of the Lecture-Performance as a result of the widespread belief among artists that "consciousness stemming from teaching and learning can lead to a new way to live in society" (Milder 2011: 13).

The Lecture-Performance as such can be found in the artistic, but also in other cultural, social, political or even scientific fields. This diversity shows the richness of the format, as it can be an alternative for any situation that requires an oral presentation (Brandau 2015: 7). As the term itself implies, such an alternative presentation combines traditional elements of oral presentation ("lecture") with other more creative elements of theatrical representation ("performance"). In other words, as in a lecture, specific content is transmitted, but this didactic process is achieved by integrating performative elements, like body, voice and physical presence.

3. A classroom experience: The Lecture-Performance as presentation of a research project

The following experience was carried out with a group of students in the course "German Literature (2nd language)" at the University of Valencia. Our course is one of the subjects involved in the INNOVA-TEA project, which since the 2015-2016 academic year has been financed by the *Servei de Formació Permanent i Innovació Educativa* (Centre for Continuing Education and Innovation) of the University of Valencia. The project brings together different methodological innovation actions with a common denominator: the application of dramatic techniques in the classroom. The INNOVA-TEA project, which started in 2015 with six subjects involved taught by professors from the University of Valencia, has managed to increase its scope by incorporating a much larger number of professors from other Spanish and foreign universities, as well as high school teachers (21 members at present).

[1] Robert Morris is regarded as the forerunner of the Lecture-Performance with his Art Ready Made "21,3" created in 1964. See Peters 2011: 180.

3.1. Characteristics of the course and planning of objectives

The course "German Literature (2nd language)" is taught in the second semester of the second year in different degrees at the Faculty of Philology at the University of Valencia: Degree in English Studies, Degree in Catalan Studies, Degree in Classical Studies, Degree in Hispanic Studies and Degree in Modern Languages and Literatures (with German as a second language). In the seminar, authors and works of German language literature from the late 19th century to the present day are studied, paying special attention to the historical, social and cultural context.

For a part of the final grade of the course, students had to carry out in groups a research project that culminated with the representation of a Lecture-Performance.[2] In order to do so, students formed small research teams (between 3 or 5 students) at the beginning of the seminar and chose a topic from the subject matter on which they wanted to investigate further. At the end of the academic year they presented the results of their research to their classmates with a Lecture-Performance. The evaluation of their Lecture-Performances took into account the originality of the format (the application of dramatic techniques) as well as the didactic potential of the performance. At the end, students were able to benefit not only from their own research, but also from the research carried out by their classmates.

For the design of this activity, which students carried out as a work in progress throughout the course, the following learning objectives were determined:

1. To acquire more knowledge about the chosen subject and learn to do research independently.
2. To improve performative competence and creativity.
3. To learn to work cooperatively.
4. To become an active part of the learning process.

3.2. The activity

The work done by the students consisted in distinct phases:

First of all, each research group had to go deeper into the topic they had chosen. Following the premises of cooperative learning, each member of the group assumed a role in the research process, so that, as a result of the positive interdependence among the students, only the effective work of all the group members could ensure the final product.[3] After

[2] The students of the subject were given the choice between the Lecture-Performance and the Radio-Podcast as two different formats for their research projects, but in this paper we will only focus on the groups that opted for the Lecture-Performance.

[3] Barbara J. Millis describes positive interdependence as follows:"Positive interdependence means that teachers give students a vested reason to work together on a task, usually through the nature and structure of a task that has been designed to encourage cooperation and provide challenges a single student could not meet". Millis 2010: 5.

having shared the research each of them had carried out independently, the group had sufficient information on the subject to start with the writing of the Lecture-Performance script.

In a second phase, students had to transfer the acquired knowledge to a theatrical format that had to be didactic. The application of dramatic techniques becomes a central point of reference. Therefore, students attended a workshop outside of the scheduled class hours, which intended to help them in designing their Lecture -Performance. In this workshop the teacher helped students to train the learners' performative competence and to integrate elements such as body, voice, physical presence and space into their presentations.

At the end of the course students performed their Lecture-Performances, which were recorded by the faculty's audio-visual technician. The evaluation of the Lecture-Performances was done following a series of criteria that had been available from the beginning of the course on the class Moodle-Platform. These criteria took into account the following elements: 1) the research phase (depth of treatment of the subject matter) 2) the Lecture-Performance's creation (text structure, originality, creativity and dynamism) and 3) the final result (the Lecture-Performance), taking into account aspects such as performance, stage props, costumes, gestures, movement and space management.

Finally, to complete the project, students had to submit a report (5-7 pages) that had to include: 1) the most important ideas of the research they had wanted to convey and 2) a reflection on the functioning of teamwork. In this part the group had to describe the meetings, the distribution of tasks, possible conflicts as well as conflict resolution and negotiation processes. These reports are of great importance, as they allow students to reflect not only on the final product, but on the whole research and learning process (Calero 2019: 379).

3.3. Analysis of the Lecture-Performances

The students enrolled in the course formed twelve groups. Six of them opted for the Radio-Podcast and six for the Lecture-Performance as the format to present the results of their research. We will now focus on the groups that chose the Lecture-Performance.

Although there are certain similarities between the groups (the occasional use of German, as well as subject-specific vocabulary, such as names of literary movements or related to the portrayed historical and cultural context), the format chosen by each of the groups is quite varied: from the television interview with the author Erika Mann about her experience in exile (group one) to a television report about Büchner's influence on Paul Celan's work, with a large number of archive images (group two), or the theatrical representation of Irmgard Keun's literary works with a voiceover that reflects on them (group three). In addition, other groups opted for completely fictional scenes that allowed the groups to

present the chosen works and authors in a didactic way. In these cases, the students were able to present more complex or abstract concepts in a clearer way, as they had more freedom to create the context that best suited their educational objectives and interests. Other elements shared by the last three groups are the use of humour, as well as attempts to introduce elements of everyday situations that would allow a greater identification among the spectators. Thus, one of the groups (group four) staged Bertolt Brecht writing a letter to the editor of a newspaper to show his disagreement with the criticism received and to explain, as a way of claim, his concept of epic theatre. The fifth group, meanwhile, staged the visit of two young people to a retirement home to visit their grandparents, who happen to be Ernst Jünger and Erich Maria Remarque. The different conceptions about the First World War that these two authors reflected in their works are approached from a transgenerational perspective, which brings the subject studied closer to the current context of the students. Finally, the sixth group was transformed into a theatre group that wanted to perform Frank Wedekind's "Lulu Plays". As in the other groups, the play was placed in a context known to the students and full of references to their daily experiences. Moreover, the situation made it possible to integrate interesting meta-theatrical reflections.

3.4. Analysis of results

After evaluating the students' Lecture-Performances and collecting the results of a questionnaire to evaluate the students' satisfaction, we consider that the following objectives were achieved:

1. To acquire more knowledge about the chosen subject and learn to do research independently.

The students' Lecture-Performances show the research work carried out, which was also presented in an explicit way in the group reports. In the questionnaire, students valued the first phase of the project positively: fundamentally, the need to work cooperatively in the research phase. By adopting the role of researchers, students consider the learning process more engaging and their discoveries and conclusions more significant.

2. To improve the performative competence and get creative.

What students valued most was the opportunity to develop creative work and to see how they had been able to transfer the results of their research into a format such as a Lecture-Performance. In view of the final outcome of their projects, that is, the Lecture-Performances, the learners improved their performative competence. By integrating performative elements, like body and voice in the learning process, the students improved their retention of what was studied. Compared to a more traditional approach of HEI teaching, the bodily-kinaesthetic action helped them to achieve deeper levels of understanding. Moreover, such a creative activity brought variety and enjoyment to the

learning process, what increased motivation and improved the students' awareness and focus.

3. To learn to work cooperatively.

The benefits of classroom-based cooperative approaches are well documented (e.g. Millis 2010). The complexity of the discussed activity is so high that it must be addressed jointly by the research group, and not individually. For both the research and the creative phase students had to work together. In their questionnaires, students appreciated the challenges of the cooperative work and the mechanisms they used to solve their problems. However, some of them acknowledged that not all members of the group had worked the same way and that it was not fair that they should all have the same grade. To avoid this problem, students had to reflect in the final reports how the research had been distributed, which allowed the teacher to take into account the contribution of the individual students.

4. To become an active part of the learning process.

The activity enabled students to become an active part of the learning process. In the questionnaire students valued very positively a methodology that promotes the active and autonomous participation of the student. The students felt that they were not passive recipients of knowledge, but rather, that they had collaborated in the production of the content of the subject. As they never lost sight of the need for their performances to be didactic, their Lecture-Performances helped their classmates to learn more about the subject matter. Thus, students' learning is not limited to the topic they have researched, as they can also learn through their classmates' Lecture-Performances.

4. Conclusions

In this paper we have discussed a teaching experience that integrates the Lecture-Performance into the classroom, as it was the format chosen by several students of the course "German Literature (2nd language)" to present the results of their research project. We consider that the initially proposed objectives were achieved with this activity. This assessment is based on our experience as teachers in the classroom, but also on a questionnaire carried out by the students at the end of the activity. The positive feedback on the activity reinforces the conviction of the teachers involved in the INNOVA-TEA project that this performative methodology is much closer to the needs and expectations of students. In future research we plan to implement more complex quantitative analyses and continue the study with more validation and testing instruments.

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Addressing engineering threshold concepts in an African university of technology

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Abstract

Learning new skills isn't only for the benefit of passing the exam but being able to apply those skills in a productive way. One cannot learn before one understands which is why student understanding is a priority for facilitators. This becomes especially important in threshold concepts where a student will be unable to progress to the next stage before the threshold concept is mastered, but facilitators do not focus on pedagogy as they rely on the support of instructional designers. This explorative paper looks at student perceptions of their understanding of the threshold concept in electrical engineering, logic gates, after completing a lesson designed using the proposed ten-step activity plan. The activity plan is derived from the learning theories of Gagne, Biggs, Vygotsky and Gibson. A sample of 18 students completed an online survey that focused on their acquiring of skills relating to logic gates, truth tables and Boolean algebra. Results showed a positive experience with 88.89% of participants indicating that they left the lesson with a good understanding of the threshold concept. This ten-step activity plan can assist to close the gap between instructional designer and facilitator to design threshold concept lessons based on sound learning theory.

Keywords: *threshold concepts; learning theory; instructional design; student comprehension.*

1. Introduction

Those who study the philosophy of pedagogy, believe that understanding precedes learning (Peel, 2017). These philosophers understand that *comprehension* and *learning* are not synonyms, but rather two forces working together for the acquisition of knowledge. Those who devote their lives to the study of pedagogy are always looking for new and better ways of instilling a passion for learning in others. Higher Education institutions devote whole departments to support facilitators in this regard.

The issue with these support/facilitator relationships is that the parties involved often do not speak the same language. Very little of the facilitator's time is allocated for topics like adult learning, memory or transfer of learning (Halpern & Hakel, 2003) so if not assisted they must find their own way. This is truer for addressing threshold concepts that need more care in the planning phase. For the instructional designer this causes a new dilemma. To assist every facilitator from scratch is a heavy burden and to pick up and intervene in existing planning can be equally frustrating.

This paper proposes a template activity plan for the use of facilitators when designing threshold concept learning activities. The activity plan is derived from sound learning theories and will assist the facilitator and instructional designer in speaking the same language when it comes to designing threshold concept learning activities.

This paper will firstly underpin the research with a literature review on threshold concepts, the nature of understanding and learning theories. The activity plan will then be discussed followed by the methods and results. Finally, a conclusion will be drawn with implications and possibilities for further research.

2. Literature review

A threshold concept is a notion within a discipline that, when mastered, lets a student experience a shift in their understanding of the subject matter. It is difficult for a student to move forward with new material if the preceding threshold concept is not comprehended. Students find threshold concepts frightening or intimidating and the experience will vary from student to student (Rattray, 2016). Students are not the only ones who find these concepts intimidating as the facilitators share responsibility in the journey to understanding.

Understanding of any concept in higher education requires a degree of reading and listening comprehension skills. According to Durrell (1969) "a weakness in either ability is detrimental to learning in most subject areas." So, when dealing with a more complex threshold concept the facilitator must be vigilant for comprehension in their student. Testing is one way of seeing who did not grasp the concept, but by then they may have already fallen behind a great deal as understanding of threshold concepts is needed to achieve the next outcome. Therefore,

facilitators underpin their lessons with sound theories that encourage learning to enable students to reach intended goals.

There are a great many theoretical approaches and constructions for learning and facilitators mainly select an approach based on subject matter and learning environment. In essence, learning is a process that permanently changes the adeptness of a certain skill that is not prompted by normal biological maturation (Illeris, 2018), instead it is prompted by intervention in this case from the facilitator. As facilitators are often subject specialists and have not necessarily tested their teaching practices using a systematic approach (Halpern & Hakel, 2003), they may need to source assistance from support departments in the university equipped to deal with their needs.

3. Context

e-Learning support for academic staff at the CUT falls to the e-Learning and Educational Technology unit which includes instructional design assistance. There are two learning designers who not only support academia with the interface design of their blended courses – 1477 registered on the LMS in 2018 – but also the instructional design using tried and tested learning theories.

Logic gates are one of the concepts in electrical engineering that needs to be mastered early on to be able to progress to subsequent concepts. One might call this the building block of integrated circuit design which is why the authors identified it for this paper.

4. Ten-step activity plan

The proposed activity plan follows 10 steps and is derived from the learning theories; Constructive Alignment (Biggs, 2003), Social Constructivism (Vygotsky, 1962), Gagne's Events of Instruction (Gagne, 1985) and Affordance (Gibson, 1966) .

4.1. The steps

Following are the steps for this activity plan:

1. Hook challenge – Derived from Gagne's Events of Instruction where the first step is to gain the student's attention, the Hook challenge is a quick and fun activity related to the content of the learning unit. It must use skills students already have or can teach themselves with relative ease.

2. Inform students of the outcomes – Derived from Gagne and Biggs, by letting the students know early on where they are headed, they can not only better plan but also know exactly what is expected of them.

3. Group Discussion: Outcomes – This one combines Gagne and Vygotsky. Students are to discuss the outcomes in a group and share any similar past experiences to stimulate recall of prior learning.

4. Theory – Here the facilitator works through the theory, allowing students to participate and providing all the resources.

5. Group Discussion: Content – Students to discuss the theory and help each other make sense of it. At this stage, it is the facilitator's purpose to encourage new avenues of thinking and weaving the conversation into a positive learning experience.

6. Applied Activity – Students apply the theory in a real-world type simulation interacting with the environment as derived from Gibson. Facilitator should provide guidance.

7. Rubric – The facilitator should constantly refer to the rubric whilst giving feedback. That is why it's important that the rubric criteria are aligned with the outcomes and very specific as derived from Biggs' Constructive Alignment.

8. Presentation of Results – Here students present their results to their peers.

9. Feedback and Critique – Facilitator provides final feedback and constructively critiques the student.

10. Exploration Challenge – An activity that applies the same skills but to a new context should be designed to enhance retention and transfer of the new skills in line with Gagne.

4.2. The template in action

The below activity plan designs a lesson on the electrical engineering threshold concept, logic gates. The template consists of four parts. The column for the learning outcomes (A) lists the behaviours (green) and criterions (blue) that must be met to master the threshold concept. The second column (B) shows the ten steps as the teaching and learning activities. These translate into 7 assessment tasks as noted in the third column (C) where the facilitator lets the instructional designer get an idea of the lesson being planned. The final column (D) is where the facilitator draws up the rubric. This is a very important step as the facilitator must ensure that the behaviours in the learning outcomes align with the criteria in the rubric. In the same way should the criterion in the learning outcomes align with the competency levels in the rubric. This way quality is ensured as the outcomes are aligned with the assessment method and students know exactly what is expected of them.

For a lesson to be designed, the facilitator merely follows the ten steps and completes the template. Then can the instructional designer support in the design as they have a better understanding of the lesson, even in the absence of discipline specific knowledge.

Learning Outcomes	Teaching and Learning Activities	Assessment Tasks
At the end of this activity students will: **distinguish between logic gates by identifying each gate from its diagram* **carry out logic gate operations by matching each logic gate to its truth table* **explain Boolean algebra by designing an electronic circuit using equations* **A.**	1. Hook challenge > Set a challenge 2. Inform the students of the outcomes 3. Group Discussion: Outcomes > Encourage them to share past experiences with similar projects/techniques 4. Theory: Facilitate theory content 5. Group Discussion: Theory content 6. Applied activity > Apply theory in class 7. Use rubric throughout to provide feedback 8. Students present results with reflection 9. Students are assessed and given feedback 10. Adapt new skills in different context > Exploration challenge **B.**	1. Hook: Fill in the blank domino ice breaker game with input/output 2. Group discussion: Outcomes are posed in question form and students discuss 3. Theory: Formal instruction with student participation 4. Group discussion: Students allowed to talk during the applied activity 5. Applied activity: Students use augmented reality app on smart devices to meet the outcomes in class 6. Presentation of results: Groups share their results and receive critique from facilitator and peers 7. Exploration challenge: Students receive a mathematical input/output challenge to take home **C.**

OUTCOMES ⇨ ALIGNED WITH RUBRIC	Level ⇨ Criteria ⇩	Fail	Pass	Master	⇦ RUBRIC ALIGNED WITH OUTCOMES
	Distinguish between logic gates	*Identified no gates from diagrams*	*Identified some gates from diagrams*	*Identified most gates from diagrams*	
	Carry out basic logic gate operations	*Matched no gates to their truth tables*	*Matched some gates to their truth tables*	*Matched most to all gates to their truth tables*	
	Explain Boolean algebra	*Did not design electronic circuit using equations*	*Designed a near sound electronic circuit using equations.*	*Designed a sound electronic circuit using equations*	

D.

Figure 1. The activity plan for the logic gates lesson in the subject Logic Design III.

5. Methodology

Students were asked to complete a survey, using the online survey tool QuestionPro, questioning them on their experience of a lesson designed using the proposed activity plan. This type of exploratory design assists researchers in shedding some light on unexplored terrain (De Vos, Strydom, Fouche, & Delport, 2011). The resulting data was then quantified in a descriptive analysis to further expand on the experience (Foster, 2016).

The target population of the study was the 52 students enrolled for Logic Design III of which 18 completed the survey. A five-point Likert scale ranging from *Not at all* to *Extremely* was used to ascertain the participant perspectives and to ensure adequate coverage. To strengthen content validity questions focused on the activities completed during the lesson.

6. Results

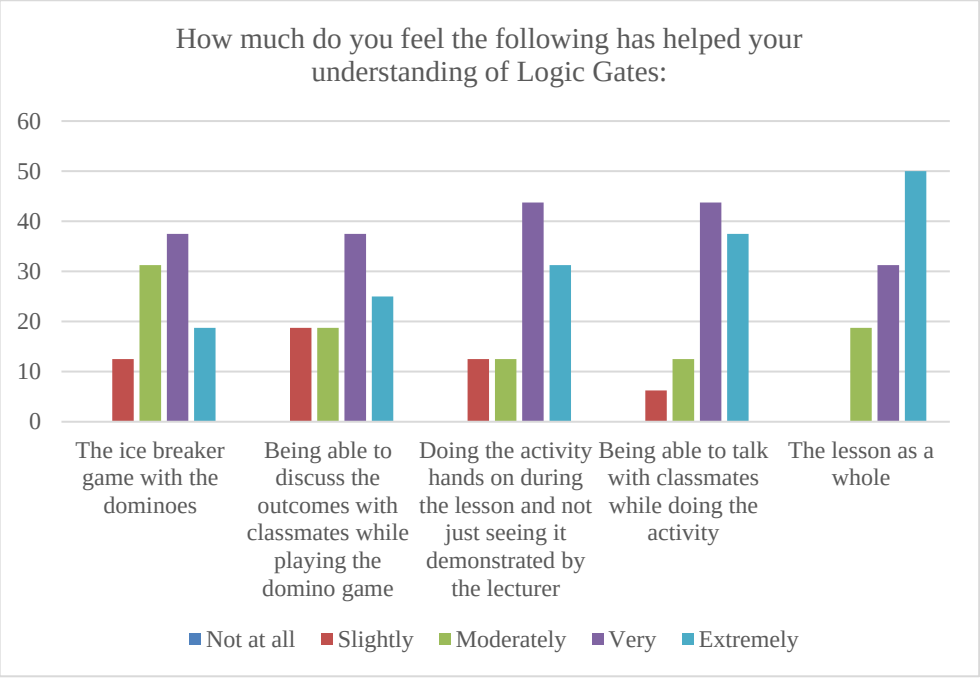

Figure 2. Participants' perspectives on the efficacy of the activity.

Overall, participants felt that the lesson designed using the activity plan has helped their understanding of this threshold concept. When asked about the specific steps 56.25% (Very – 37.5%; Extremely – 18.75%) felt positive towards the ice breaker game, 56.25% (Very – 37.5%; Extremely – 25%) benefited from the discussion on the lesson outcomes, 75% (Very – 43.75%; Extremely – 31.25%) felt that they mastered the hands-on activity and 81.25%

(Very – 43.75%; Extremely – 37.5%) felt that being able to talk to peers while doing the activity helped them better understand the concept. Finally, when asked about the lesson as a whole, 81.25% (Very – 31.25%; Extremely – 50%) felt that they understand the concept better after experiencing the lesson designed with the activity plan.

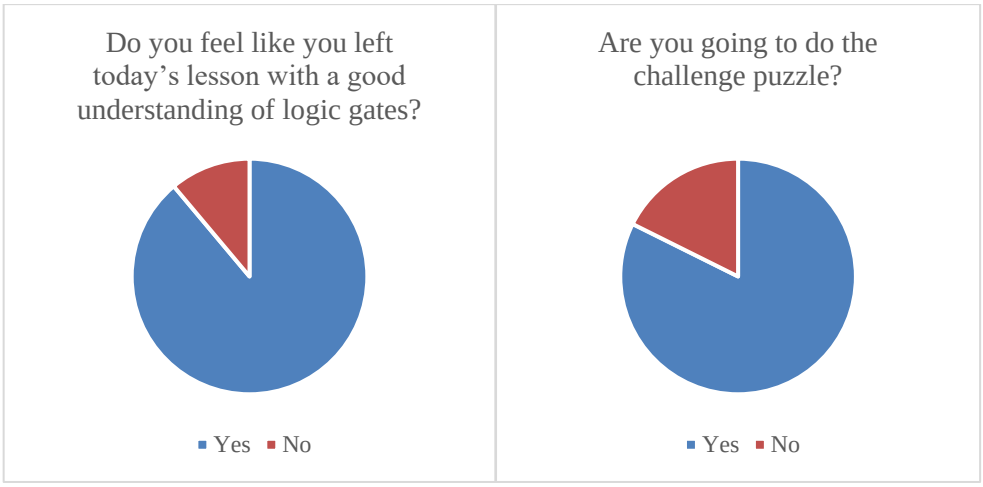

Figure 3. Participants' perspectives on their understanding of logic gates post lesson (left) and whether or not they were going to attempt the challenge puzzle (right).

When asked if they felt they left the lesson with a good understanding of logic gates 88.89% of participants answered *Yes* which indicates a very successful intervention. A further query into whether or not they were going to attempt the challenge puzzle, 82.35% indicated that they will give it a go, which shows the lesson has created an interest to explore the topic further.

7. Conclusion

This paper aimed to address the threshold concept of logic gates in electrical engineering by designing a lesson using the proposed ten-step activity plan. This template is meant to narrow the gap between facilitator and instructional designer as it lets them speak the same language. The literature review showed that a threshold concept shifts a student's understanding of a subject and that the facilitator shares in the responsibility of making that understanding happen. The proposed ten-step activity plan is derived from the learning theories of Gagne, Biggs, Vygotsky and Gibson and was used to design a lesson for the 52 students enrolled in Logic Design III. Eighteen of these students participated in the survey and provided positive results with 88.89% indicating that the lesson left them with a good understanding of logic gates.

The positive results of the survey indicate a successful intervention and that the use of a structured template will enable the instructional designer to better assist facilitators when designing lessons for threshold concepts. This template can be adapted for blended and online lessons as well as be used to design whole modules provided that an extra step of reflection is added to keep in touch with students. This template will not only improve the relationship between instructional designers and facilitators, but also leave facilitators confident that they are fulfilling their responsibility to help students with understanding of threshold concepts.

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Curriculum development in South Africa: the role of professional bodies

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Abstract

The function and main goal of higher education has evolved over time; studies show that there is a shift in focus from pure intellectual exploration to job preparation. Curriculum development literature argues that the collaboration between universities and industries is critical for skills development and provides alignment between skills required in the workplace and skills transferred through higher education. This desk study aimed to synthesis the role of professional bodies as representatives of industry in curriculum development in the South African context. Observations show that a significant number of professional bodies mandate curriculum, by accrediting qualifications offered by universities. Not all programs require professional body accreditation or approval, however approximately 60% of all university programmes in South Africa are subject to the accreditation of professional associations. Without the accreditation from professional bodies, universities would not be able to offer qualifications in certain disciplines such as health and engineering. There is evidence that professional body involvement in curriculum development ascertains a level of quality.

Keywords: *Curriculum development; Professional bodies; Higher education.*

1. Introduction

Higher education institutions in developing countries are experiencing a growing gap between their curricula and the demands from employers and other stakeholders (Kouwenhoven, 2010). Academics have historically and traditionally been at the centre of curriculum development and have had the sole responsibility to develop the curriculum consulting stakeholders for feedback only once the curricula were ready (Walkington, 2002). However, curricula should be a combination of what the industry, employers and other stakeholders are looking for in an employee and the learning interests of students (Alfredo & Bonilla, 2012), this has not been the case (Tessema & Abejehu, 2017).

Curriculum development literature argues for strong collaborations between universities and industry (Zanko, Papadopoulos, Taylor, Fallshaw, & Lawson, 2011; Bennett, 2006; Herrington & Herrington, 2006; Kiggins, Cambourne, & Ferry,2005), this is supported by the World Bank that also affirms that the collaboration between universities and industries is critical for skills development and provides alignment between skills required in the workplace and skills transferred through higher education (Larsen, Bandara, Esham, & Unantenne, 2016).

A contemporary approach to curriculum development allows for collaboration with targeted stakeholders as part of the development process (Keogh, Fourie, Watson & Gay, 2010). This allows for a broader holistic view of curriculum development, which allows for a curriculum that meets the needs of the students, employers, government and other stakeholders. Keogh et al. (2010) identify professional bodies as targeted stakeholders in the curriculum development process. Professional bodies are formed by the members of a profession with the aim to regulate practices, make sure that individuals who practice in the profession are qualified and competent, and play a disciplinary function to protect the Code of Conduct. Some professional bodies assure the competence of practising professionals by monitoring the content of education programme in universities (Harvey, Mason & Ward,1995) by participating in the curriculum development; through the accreditation of courses/programs offered by higher education institutions (Chandrasekaran, Stojcevski, Littlefair & Joordens, 2013)..

The principle of accreditation of higher education degree programmes by associated professional bodies is a widely accepted practice globally (Rawel, 2002, Mabizela, Ballim, & Mubangizi, 2014). Accreditation is ‘a process of quality control and assurance in higher education, whereby, as a result of inspection or assessment, or both, an institution or its programmes are recognised as meeting minimum acceptable standards’ (Adelman, 1992). The rationale for this practice of programme accreditation is to create uniformity across the sector (Harvey, 2004). The aim of this study was to synthesis the role of professional bodies as stakeholders in curriculum development in the South African context.

2. Observations

There are 26 public universities in South Africa with the youngest two established in Mpumalanga and the Northern Cape provinces during 2014/2015. The study summarises seven faculties, from the top five universities in South Africa namely, the University of the Witwatersrand (Wits), the University of Cape Town (UCT), the University of Pretoria (UP), Stellenbosch University (SU) and the University of Johannesburg (UJ). A list of professional bodies sourced from South African Qualification Authority (SAQA), additional information on the role of each professional body was sourced from university and professional bodies' websites. The list had 107 registered professional bodies, 15.8% of the professional bodies are statutory bodies belonging to the Faculties of Health Sciences and the Faculty of Engineering and Built Environment..

2.1. Faculty of Health Science

"Health professions are subject to legal and voluntary requirements or guidelines related to ensuring the competence of practising professionals, practice standards, and professional and patient protections" (Stobo, Salmon, & Cohn, 2002). In South Africa, there are three main health statutory professional bodies; Health Professions Council of South Africa (HPCSA), South African Nursing Council (SANC) and the South African Pharmacy Council (SAPC). The Health Professions Act No. 56 of 1974, allows the HPCSA to have control over the education, training and registration for practice of healthcare professions registered under the Act. The HPCSA has 12 professional boards, as seen in Figure 1 that are responsible for providing guidance and informed curriculum development processes, and ensuring adherence by training institutions to the Board's core competencies and training framework.

Figure 1. The 12 Professional Boards of the HPCSA. Source: HPCSA annual report 2018/19.

The educational framework for curriculum in universities and higher education institutions that offer qualifications in nursing is based on recommendations from the SANC which is regulated by the Nursing Act No.33 of 2005. The Act was passed to provide for the statutory control of the nursing and midwifery professions by nurses. The same applies to the

curriculum taught in pharmacy which is regulated Pharmacy Act 53 of 1974. Although the SAPC is not prescriptive regarding the form and structure of the learning material that will be used to implement the curriculum, it is nevertheless still important to indicate how the content will be covered in the curricular content and is comprehensively described in the curriculum document drafted by the Council.

2.2. Faculty of Engineering, Built Environment and Information Technology

Information Technology degree programmes in South Africa do not have a professional body that accredits degrees or reviews curriculum (Ponelis, Matthee, Buckley, Kroeze, Venter, & Pretorius, 2012). However, The Institute of Information Technology Professionals South Africa (IITPSA) and South African Institute of Computer Scientists and Information Technologists (SAICSIT) regulate the professional conduct of their members and provide further educational development to their members. Professionals do not have to be a member of either institute to practise or work in the industry.Table 1 provides a summary of the professions, professional bodies and Acts.

Table 1. Faculty of Engineering, Built Environment Professional bodies.

Profession	**Professional body**	**Act**
Engineering	Engineering Council of South Africa (ECSA)	Engineering Profession Act 46 of 2000
Quantity Surveying	South African Council the Quantity Surveying Profession (SACAQSP)	Quantity Surveying Profession Act 49 of 2000
Architectural	South African Council for the Architectural Profession (SACAP)	Architectural Profession Act 44 of 2000
Landscape	South African Council the Landscape Architectural Profession (SALAP)	Landscape Architectural Profession Act 45 of 2000
Project and Construction Management	South African Council for the Project and Construction Management Profession (SACPCMP)	Project and Construction Management Profession Act 48 of 2000

The Engineering and Built Environment Professions have six Councils coordinated by Council for the Built Environment (CBE), a statutory body established under the Council for the Built Environment Act No.43 of 2000. Each Council is governed by an act; the Act empowers the Council to conduct accreditation visits to universities to evaluate educational programmes. In order to assess the quality and relevance of each of the qualifications offered by universities. The Councils determine themes that describe the body of knowledge that

must be incorporated in programmes as modules or sub-modules. However, Councils do not prescribe how the themes may be designed in the programme. Each Council independently conducts accreditation visits to universities to evaluate educational programmes. The purpose of accreditation in the CBE disciplines is to ensure that the undergraduate courses offered bySouth African universities are of a sufficient standard for graduates to work as CBE professional in SA (Maneschijn, & Bester, 2016).

2.3. Faculty of Economic and Management Sciences

The professions in the faculty and the professional bodies' participation are summarised in table 2. The involvement of professional bodies in this faculty range from advisory to, prescribing curriculum and accrediting degrees programmes.

2.4. Faculty of Education, Law and Humanities

The professional body for teacher education, the South African Council for Educators (SACE), unlike councils for other professions such as Engineering, Accounting or Health, does not regulate and quality assure the development of higher education qualifications employment (Parker & Adler,2005). The Law Society of South Africa (LSSA) has always had minimal involvement in the quality assurance of legal programmes offered by South African universities (Mabizela, Ballim & Mubangizi, 2014). However, in recent years they have worked very closely with the South African Law Deans Association and the General Council of the Bar to improve the quality and uniformity of law degrees in South Africa (LSSA, 2017).

Faculty of Humanities can be divided into the following disciplines: music, visual and performing arts, languages, linguistics and literature, philosophy, sociology, social work, religion and theology, and history. Social work is the only discipline with statutory body in the faculty, the South African Council for Social Service Professions (SACSSP). The SACSSP is the professional statutory body that regulates the educational requirements, professional registration and professional conduct of members of the profession. Social Service Professions Act No.110 of 1978. Students studying towards a social work degree are required to register with the SACSSP before the commencement of the second year of their degree and some universities expect students to take a public oath to uphold the SACSSP code of ethics. Some disciplines have professional association for example the South African Sociological Association established in 1993 and The Association for Ministry Training Practitioners (AMTP) established in 2014.

Table 2. Faculty of Economic and Management Sciences Professional bodies

Profession	Professional body	Role of Professional body
Accounting	South African Institute of Chartered Accountants (SAICA)	Prescribes curriculum and accredits degrees
	Association of Charted Certified Accountants (ACCA)	Prescribes curriculum and accredits degrees
	Commercial and Financial Accounts South Africa (CFA)	Prescribes curriculum
	South African Institute of Professional Accountants (SAIPA)	Prescribes curriculum and accredits degrees
Financial management	Charted Institute of Management Accountants (CIMA)	Prescribes curriculum and accredits degrees
Investment management	Charted Financial Analyst (CFA)	Prescribes curriculum and accredits degrees
Auditing	Institute of Internal Auditors (IIA)	Prescribes curriculum and accredits degrees
Tax	South African Institute of Tax Practitioners (SAIT)	Advisory
Economics	Economics Association of Southern Africa (ESSA)	Advisory
Business Management	Southern African Institute for Management Scientist (SAIMS)	Accredits degree
Human Resource management	South African Board of Personnel Practice (SABPP)	Prescribes curriculum and accredits degrees
Marketing and Communication Management	Marketing Federation of South Africa (MFSA)	Accredits degree
	Public Relations Institute of South Africa (PRISA)	Prescribes curriculum and accredits degrees
Public Administration	South African Association of Public Administration (SAAPA)	Advisory

2.5. Faculty of Natural and Agricultural Sciences

Departments/ schools of Actuarial Science operate within the regulations of the Actuarial Society of SA (ASSA) and its Board; which prescribes 95% of the content/outcomes of the

curriculum. Actuarial Science syllabus is revised every five years in line with international and South African actuarial practice. ASSA uses the curriculum of the Joint Board of the Institute/Faculty of Actuaries, UK. The South African Council for Natural Scientific Professions (SACNCP) is responsible for the registration and regulation of practising professional in the fields of agricultural science, animal science, aquatic science, biological science, chemical science, earth science, ecological science, environmental science, food science, geological science, applied mathematics, operations research, microbiological sciences, water resources, and zoological science. The SACNCP and its registered persons play a collaborative and advisory role in higher education. The SACNCP does not accredit or prescribe curriculum in degree programmes. In addition to SACNCP the Faculty has 48 voluntary bodies. Below are three examples and how they participate:

- The Statistical Association of South Africa (SASA) communicates regularly on education initiatives in the country plays an advisory role in the curriculum development process.
- The School of Physics has made considered contributions to the Review of Undergraduate Physics Education, which was coordinated by the Council for Higher Education and the South African Institute of Physics (SAIP).
- Minerals Education Trust Fund (METF) evaluates all Geology Curricula on offer in South Africa and supports whatever initiatives it can at all Universities

3. Concluding remarks

The engagement and collaboration between universities and professional bodies are both desirable and inevitable. Professional bodies play a quality assurance role in higher education by setting, maintaining and monitoring educational and professional qualifications. Through competency frameworks, professional bodies are able to detail what must be included in curricula and syllabi. The accreditation of university programmes is a common practice globally; the accreditation process is viewed as an external quality assurance tool. This study observed that some fields have a strong dominance of professional bodies mandated by law, for example Health Science and Engineering and Built environment. However, not all programmes require professional body accreditation or approval, approximately 60% of all university programmes in South Africa are subject to the accreditation of professional associations.

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Projects with added value to increase competitiveness and student satisfaction

Case study: The renewal of the BA in Advertising and Public Relations. University of Girona

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Abstract

This communication is aimed at describing the measures implemented in the new BA of Advertising and Public Relations in the Falculty of Tourism-University of Girona at the moment of redefining its curricular design to make it more appealing and according to the needs of the era of the Internet.

According to Universities' guidelines there was a need to reformulate the academic curriculum. This need for change was used as an opportunity for boosting the internationalization of the studies, increasing the approach between students and professional profiles through the implementation of compulsory internships and eventually, among others, providing the BA program with added value activities which encompass master classes, circles of conferences given by top professionals, as well as specialized workshops about technologies of the Information..

Keywords *re-curriculum design; involving professional companies; developing optional activites; networks development; enhancing internationalisation.*

1. Introduction

Universities need to cultivate knowledge and foster entrepreneurship, collaborate with the professional sector, promote diversity and inclusion and help students assume an active role in the digital economy (World Economic Forum, 2018). Needless to say, universities should provide students with education of quality and motivate creative thinking, as well as present the necessary methodologies to help students become professionals. The BA of Advertising and Public Relations has been taught at Faculty of Tourism-University of Girona following the Bologna Plan since 2008-2009. Since then it its length is 4 years (full-time) and has 240 ECTS. The areas covered in the degree are Public Relations, Advertising, Marketing, Strategic Communication, Issues Management, Events and Audiovisual Communications. In 2016 its curriculum was restructured and the first promotion of students who have undertaken this new curriculum will graduate in June 2020. The main goal for the renewal of the curriculum has been to increase the competitiveness of this degree in comparison to well-known universities adapting it to the current needs of the professional sector.

2. Methods to change the situation

The methodology to apply these changes was based on meetings with experts and students, separately, as well as an exhaustive review of similar programs of other European universities. Considering this, the changes in the curriculum were introduced after meetings between the coordinator of the BA and managers, marketing experts, entrepreneurs and chiefs of communications, graphic designers, advertising consultants and former students. Companies are interested in attracting the best talent, this is why universities and companies should reach agreements to improve their competitiveness (Lutcher, R. Keneth, 2018). The contact between university and professionals has been a first step to consolidate our network of partners. Moreover, we organized focus group with former students to identify weaknesses perceived by students during their inclusion to the job market.

As a result, the areas identified as essentials were written communication, use of English in advertising working environments, project management, oral expression and digital and virtual skills. These aspects converge around the suggestions made by Gow, K & McDonald, P, (2000). The changes implemented in the BA are oriented to the increase of the internationalization of the Faculty of Tourism, the application of digital marketing and communication tools from the first year and the obligation for students to enrol in curricular internships. University students (Gil-Galván, R.; 2011) would like to have acquired organizational competences, time management, leadership, proficiency in oral communication and ability to work under pressure. These skills have been included in the development of the new curriculum as maximize their opportunities to work in international contexts. The incorporation of contents related to digital communications from the very first

year, the fact that the students can develop projects in "Audiovisual Production Techniques" with technical equipment for recording and editing audiovisual and audio contents from the first year, as well as the possibility to participate in non-compulsory internships since the first year of the BA required the assumption of a new role for some lecturers, which although is not officially recognized by the University, is essential to optimise the management of contents in this degree. These lecturers structure the contents of each subject to ensure that the topics of the different subjects do not overlap, which could be risky due to the similarity between the areas of knowledge covered in this degree. This monitoring made possible the creation of itineraries created through assignments done in similar subjects during the four years of the BA. For instance, in the first year the students have to create an audiovisual postcard aimed at promoting their city, while in the fourth year they have to record a music video to promote a professional local singer. Students participate in chronological itineraries that increase their difficulty accordingly their evolution. If there was not such a compartmented structure nor a check about these contents, which increase year after year, it could happen that there would be some repeated assignments, a situation that happened before the renewal of the curriculum. The new degree also incorporates initial and final surveys of each subject in order to promote the redefinition of the subjects according to the perceptions of the students. The resulting data provides valuable and insightful information that may help lecturers improve their way of teaching.

Mastering oral expression is a transversal competence. During the first year of the BA, the subject "Written and Oral Expression" focuses specifically on the development of oral and written skills in Catalan, Spanish and English. These sessions help students acquire an instrumental and practical basis which enables them to express themselves correctly in all the subjects. In most projects speakers are selected randomly before starting the presentations. It helps them practice their expression skills and increase their tolerance to stress. Subjects such as entrepreneurship and mindfulness have been included that a relevant part of students decide to found their own company once they have graduated.

2.1. Internationalization

Internationalization implies the integration of different cultures into teaching. This involves challenges related to the service provided to students. Hence, providing more subjects in English is a way of broadening the perspectives of internationalization. Moreover, this may help students interact between them in a foreign language. Qiang (2003) suggests that academic programs should be oriented to facilitate the adaptation of incoming as well as outgoing students and remarks that educative centres should have exchange programmes, motivate the study of foreign languages, cross-cultural trainings, visiting lecturers and scholars and creating links between academic programs and research. Due to the curriculum renovation, the offer of subjects in English has increased. Given that their future workplaces probably will be multilingual, multicultural and international, this offers opportunities for

students to keep improving their level of English. Additionally, it is a way of ensuring that incoming students find suitable subjects. Erasmus students represent a new opportunity for local students to practise a foreign language, as well as acquire new work attitudes and styles (Bracht, et al. 2006). In addition to this, local students are encouraged to become local guides for incoming students.

2.2. Digital competences

The new BA includes a subject called "Audiovisual and Narrative Scripts". Its methodology follows an APP (project-based learning) approach and its students are expected to assume a professional role. The students of this subject work in groups and have to face a real challenge: they have to find a local business which does not have online presence and persuade the owner to authorize an online marketing campaign. This campaign consists of a web with a blog and the management of professional profiles in social media networks such as Facebook, Twitter or Instagram. Both parts have to sign a contract in which they mention the obligations and rights of each part. This subject lasts one semester and once this period has finished most students keep developing projects for this local business. In addition, this PBL exercise joins this subject with two different ones: Documentation and Digital Marketing. By joining synergies students do not have repetitive exercises.

2.3. Compulsory internships

Internships are a crucial part of the BA because they represent an opportunity for putting into practice the knowledge acquired and it is probably the first contact of students with their future workplace. The new curriculum involved turning the subject "Curricular Internships", which previously represented 20 ECTS, into a new subject of 12 ECTS. This change implied that every student has to work in a company for at least 250 h during the fourth year of the BA. Nevertheless, the students willing to practice their skills in a company can do that voluntarily from the first year.

3. Projects with Added Value

These changes are oriented to encourage students to acquire a more active role in their learning process. Additionally, we have developed four additional projects:

3.1. "Entre Subjectes & Atributs"

This is a season of conferences celebrated on a weekly basis addressed mainly to students of the University of Girona but open to all the public. Around 30 speakers visit our Faculty each year to talk about marketing, tourism, strategy, advertising, public relations, management and communications. More than 90 conferences have been celebrated since the course 2015-2016. Speakers are selected depending on the relevance of the company they work for, the

content of their talk and the innovation. Attendance is compulsory for students because each talk is directly linked to at least one subject. All participants can suggest speakers for future editions. After every conference attendees are asked to answer a survey. According to data obtained from the report 2018-2019, the average punctuation for the overall event, the speaker and the contents is about 8,3/10. Broadening the spread of the activities held at the University maximise the interaction between University and society (World Economic Forum, 2018). Some conferences of the upcoming edition will be partly developed in collaboration with the city council of Girona.

3.2. "Plan for the improvement of written expression in the Catalan language"

A plan for implementing the improvement of the Catalan language was launched since the year 2016-2017 to help students mastering communication and meeting the requirements of the professional sector. By the moment we know that the performance of the students who started this plan is increasing favourably, as we will show later. Through this action students receive insightful feedback about their written expression and receive tailored resources according to their results. This plan is expected to increase the quality of redaction in all students' assignments, specially their final project (TFG).

3.3. "La Productora" (our audiovisual amateur start-up)

This is an in-company (audiovisual enterprise ruled by talented students of the degree). The students who participate in this project can use all the audiovisual equipment and TV, photo and radio studios of the university to broadcast and edit audiovisual material. The contents created by them are used as promotional material of the Faculty of Tourism. This action allows our students to be familiarized with audiovisual equipment and acquire experience. At the same time, their material is used to promote the university during the doors open days for families and future students.

3.4. The Creative itinerary

The "Creative Itinerary" is an optional creative and personal project addressed to those students with the highest marks. It includes two sessions conducted by creativity and advertising professionals. This started in 2018 and is aimed at motivating students' creativity and thoughtfulness. Each participant is offered four statements and has to present a solution which solves the initial problem in a creative and non-conventional way.

4. Preliminary results

These measures are created to improve the work insertion of graduates and check the evolution of the students. From the academic year 2016-2017 all the students are studying the BA with the new curriculum and are supposed to graduate in 2020.

4.1. "Plan for the improvement of the Catalan language"

The data obtained from the marks of the plan for the improvement of the Catalan language demonstrates a positive evolution in the written expression of students.

Table 1. Marks obtained by students. "Plan for the Improvement of the catalan Language".

Academic year of test		2016-17	2017-18	2018-19
1st year students	Amount of assignments corrected	84	86	85
	Students who scored grades D and E (fail)	76,19%	67,44%	63,53%
2nd year students	Amount of assignments corrected		75	72
	Students who scored grades D and E (fail)		41,33%	13,88%
3rd year students	Amount of assignments corrected			90
	Students who scored grades D and E (fail)			28,89%

Source: own elaboration from SLM (Modern Language Services) University of Girona (2019).

4.2. Job insertion index

In 2018 a study about work insertion of former students of the BA in Advertising and Public Relations was developed. The study was formed by former students who graduated in 2012 and a group of students who graduated in 2016. Those students who graduated in 2012 were the first batch of the BA degree in four-year. The participants in the study who graduated in 2016 were the ones who had switched from old curriculum to new curriculum. The main result of this study indicated that there is a relationship between internships and work insertion. Most students who had chosen top companies for their internships found it easier to find a job once they graduated. This fact is supported by the idea that "placements, internships and work-based learning opportunities are an effective way of providing university students with relevant employment skills, knowledge and awareness of employer culture." (SCRE Centre, 2011:30). It is very important to emphasize the relationship between the increasing number of subjects specialized on online content and audiovisual production techniques and the improvements in employability figures. Since we are reinforcing these types of skills that companies need, many of our students are involved in their first job, in most cases as Community managers.

4.3. Amount of incoming and outgoing students

According to the data provided by the External Relations of the Faculty of Tourism, the students who participate in a mobility program has increased. This evolution can be an indicator of internationalization.

Table 2. Evolution of outgoing students BA in Advertising and Public Relations.

2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
11	9	18	23	27	31

Sources: own elaboration from Universitat de Girona.

4.4. Minimum grade evolution and demands as first option

The availability of places to study this degree is limited to 80 students for each promotion, however the demand to study this bachelor programme is higher than this figure shows.

Table 3. Evolution of quantitative data of the BA in Advertising and Public Relations.

Academic year	Places available	Demand as first option	New intake of students	Percentage of students in first option	Cut-off mark (june)
2015-16	80	81	87	91,25	7,858
2016-17	80	139	87	91,25	
2017-18	80	128	91	88,68	8,64
2018-19	80	126	90	86,67	8,812

Sources: own elaboration from Universitat de Girona.

5. Conclusions

Universities should provide students with fulfilling challenges, supervise their learning process, motivate the innovative learning and offer valuable contents. Every action should focus on the development of skills and competences oriented to the student satisfaction and employability. They should empower students to become critical thinkers, empathetic leaders and decisive and flexible professionals. Before the graduation of the first promotion of the students who followed the new version of the BA (2016-2020) and not having more data, we can preliminary affirm that the new design of the curriculum of the BA has been useful for improving students in almost all the study areas detailed here, as written expression, audiovisual and online Skills. In comparison to the first results, the marks have improved steadily.

Regarding the number of outgoing students, this figure has increased during the two periods. Moreover, some students decide to arrange their internships with international companies. It is an indicator that curricular contents are oriented to internationalization. According to the impression of the students who enrol in subjects with a professional approach and are

assessed through project-learning methods, their grade of satisfaction is very positive. In the surveys they mention qualitative significant items such as "due to this project-learning method I have learnt how to deal with a real customer", "some customers do not know exactly what they want to promote" or "Now I know clearly what I want to be as a professional". This indicator can be related with the increasing employability we noticed. Despite living in an environment still troubled by the economic recession, it is easy to find examples of students who find their first job thanks to their internship in companies, and as we said before, also linked to online communication jobs, that are the sign of the new era of communication. To sum up, the aspects which generate added value to the new BA make a difference between similar degree programmes offered by other universities, even older that the University of Girona, are the Adobe courses, the conferences "Entre Subjectes & Atributs", the Plan for Improvement of expression in the Catalan language, the broadcasting company ruled by students as well as the approach between theoretical and professional practices. These improvements ensure the focus on the skills which can help employers to choose students from the BA of Advertising and Public Relations of the Faculty of Turism-University of Girona. As Gil-Galván, R. (2011:529) suggests "the required level of organizational competences and leadership information significantly increases job satisfaction." Hence, reaching optimal levels of motivation and satisfaction towards learning can lead to higher satisfaction in the workplace.

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Information overload and lecturer mistakes during engineering course organization

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Abstract

It has been observed that huge amount of information received from teachers can create a feeling of overload for students. Selection of modern teaching methods do not always help to solve this issue. To identify the link between information overload at various study course organization models (regular, advanced and super-advanced), various lecturer types have been described. These include apathetic, formal, teacher-centred egoist, student-centred chaotic lecturer and activist. The results demonstrated that course organization in engineering studies is closely linked to the personality of the lecturer. Successful course organization is based on good time management, selection of appropriate amount of information. In advanced and super-advanced courses regular communication between lecturers and experts in practice is favoured. At the same time selection of adequate amount of study material based on the general knowledge level of the students is required. To achieve the goal, each lecturer should evaluate the level of information required and the overall interest level of students in the course topic on a regular basis before the beginning of the course.

Keywords: *Information; overload; course organization; time management.*

1. Introduction

Nowadays to develop better communication and perception of the academic topics, various teaching techniques, such as Flipped Classroom (pre-preparations of topic before the lesson), Design Thinking (based on workshops, communications and master classes), Self-learning (use of modern IT systems, such as Mind Map to expand the ability in students to memorize large reams of text), Gamification (learning thought the games), Social Media (additional communication aimed on motivation and interest growing), different Online Learning Tools (interactive and dynamic classroom) have been recommended: Santos (2018). At the same time "fast living" lifestyle with constant streams of new information significantly affects the physiological state of individuals: Parkins (2004). Often information quantity and constant changes make people feel like their lives is in chaos and can evoke negative emotions about the obtained information. Huge amount of information in personal life (books, TV, emails and etc.) and studying process (lessons, articles, laboratory works, projects and etc.) can create a feeling of overload for also students: Rentfrow *et al.* (2011) and subsequently reduce the overall academic performance of the student: Suhaimi and Hussin (2017).

Institute of Heat, Gas and Water technologies is a part of Faculty of Civil Engineering at Riga Technical University (156-year-old state founded non-profit and accredited higher educational establishment of the Republic of Latvia). It consists two departments (Department of Water Engineering and Technology (DWET) and Department of Heat, Gas and Technology) that provide all level higher education (Bachelor professional, Master academic and Doctoral studies) and carry out research in the field of heating, ventilation, air-conditioning, water and wastewater treatment and distribution systems, water distribution network and sewage collection systems. The study programme of the institute was modified and optimised according to the industrial tendencies throughout 26 academic years. Teaching methods are aimed to grow practical understanding, skills and knowledge in the field of heat, gas and water engineering systems and its better management. Over the past 3 years, the team of DWET has fundamentally changed the structure of several courses and created a system that is comfortable for lecturers and more interesting for students. This includes multiple lecturer approach in a single course to ensure adequate replacement, better competences and more active engagement of students. At the same time in multiple courses low or no modernisation has been performed and classical academic format is retained.

Within this paper we aim to demonstrate that mistakes in the study course organization are strongly linked with the personality of the academic personnel and can cause information overload feeling in students if wrongly managed.

2. Methodology

Admission to studies at the RTU takes place in accordance with Latvian legislation, that provided that any Latvian and EU citizen can enter the studies. The regular work in DWET is performed by 15 lecturers and number of students varies from 20 to 32 in each study year. To identify the emotional opinion of students about the courses in RTU DWET, questionnaires are being sent out to all students after each study semester. Based on voluntary principle the students evaluate the quality of courses and work of lecturers from 1 (low quality) to 5 (high quality) in a standardized online system designed by RTU. Lecturers can read the summary and the number of completed questionnaires. General observations are that student activity is low and often the number of completed questionnaires and comments may be "0" or "1". Within this paper the results from questionaries' from 32 respondents of 2018/2019 study year were used. The feedback in terms of received comments from students reached at least 50 % from the overall questionnaires received.

3. Observations and disscusions

3.1. Course organization models

Every new student enrolled in a university already has some basic knowledge. During the studies they are guided through various education models in a particular program depending on the instruction style of particular academic staff: Hewes (2017). Education models can be regular (surface or apathetic learning approach), advanced (or strategic) or super advanced (or deep): Banerjee *et al*. (2019). The described course models can be found in each educational institution, as well as in DWET of RTU.

In a regular course the lecturer teaches students through memorization and recitation techniques, and not by developing their critical thinking with problem solving and decision-making skills: Snyder and Snyder (2008). This model is based on the formal learning and a teacher-student relationship: lessons, calculations, tests and final examination. Usually the courses are well structured and synchronised in terms of learning objectives, learning time or learning support: Rogers (2014).

During an advanced course, the selected teaching model is more interacting. The students learn through group participation, workshops and gaming techniques. These parts of the course are outside the formal learning system and similar to non-formal learning. It is also well structured. Unlike in regular course, advanced course and respective teaching method promotes the development of critical thinking skills, problem-solving abilities, communication skills: Duch *et al*. (2001), Klegeris and Hurren (2011), Oprea (2014). In this model the students are the active participants of the learning process.

Super advanced or deep courses include informal study through the experience of day-to-day situations, non-formal learning and also accelerated learning that include a variety of media, techniques, guest lecturers, supervisors from specialization sector or mentors: Rogers (2014). This teaching method is comparable to student-centred approach, where both teacher and students play active role: Keiler (2018). This model provides more informal environment and students' work through various projects, presentations of ideas or discussions. In comparison with the traditional learning approaches accelerated learning is more flexible and open for students. They all are involved in the learning process; the learning process is more enjoyable and productive.

Thus, the course organisation model till some extent is dependent on the level of study and subject, self-motivation of the students and type of the lecturer.

3.2. Type of the lecturer

Various types of teachers or lecturers have been described in the literature as well as they can be identified in each educational institution. Usually the working style of the lecturer can't be controlled. It is formed over time and depends on the individual characteristics of the person and life experience. Some basic types of lecturers are summarized in Table 1.

All described course models and types of lecturers are based on other studies, but up to date the linkage between information overload and lecturer type in engineering courses has not been described.

3.3. Information overload and lecturer types in engineering courses

Work area of the apathetic lecturer is very clear. Usually the lecturer works with standardised programme over several years, uses the same books as basis for course information, precise and simple exercises to learn the rules. As a result, students meet requirements of the course, gain relatively good theoretical knowledge and pass the exam if they successfully learned all the theory. Nevertheless, this type of lecturer fully supports the requirements of basic/regular courses and provides adequate amount of knowledge. At the same time the main feedback from students: "boring lectures" (rating varied from 1 to 3 in 50 % of the questionnaires).

The work of the formal lecturer is based on the same strategy (standardised programme). The difference with the previous one is that formal learning lecturer includes some laboratory works to course and theoretical engineering projects, for example, calculation of water treatment plant with the necessary methodological instructions. There is a try to make the course more advanced, but due to insufficient clarification of goals and low communication with the students this is not always possible. The rating varied from 4 to 5 in 75 %.

Table 1. Main types of lecturers.

	Title	Type	Description
1	Activist	Student centered lecturer	(+) Expert in their field, have demonstrated excellence in more than one academic specialty, has excellent communication skills with future professional or student. He reads reviews of his work and plans lessons. This lecturer follows industry trends and is qualified to lecture and/or conduct research in a particular subject. (-) Very busy person, overloaded time graphs.
2	Chaotic lecturer	Student centered lecturer	(+) Very similar to previous type. (-) Every year this lecturer adds new activities to the course as result course becomes overloaded with information. Each activity is interesting, but due to overloading, students do not complete any of them.
3	Egoist	Teacher-centered lecturer	(+) Qualified to lecture and has great time management system. He has his own communication system with students, regularly collects and reads feedbacks from them. This lecturer has demonstrated excellent knowledge in theory. (-) Has demonstrated low knowledge in practice. He has low contact with colleagues, usually works alone.
4	Formal lecturer	Teacher-centered lecturer	(+) Follows industry trends and is qualified to lecture. He has low contact with student. (-) He reads reviews of his work and makes changes in courses without specific emotions.
5	Apathetic lecturer	Teacher-centered lecturer	(+) Has demonstrated good knowledge in theory. (-) A person tired of the job and annoying to the students. The lecturer doesn't want to change anything and works only with fundamental theory.

Source: Quinn and Carl (2015), Hill-Jackson et al. (2019), Dahlbeck (2017), Shaari et al. (2014), Mitchell (2013).

In advanced courses more activities are present to grow practical understanding, skills and knowledge in the field of water and wastewater management and engineering systems. When the course is coordinated by teacher-centred lecturer egoist, the course is more theoretical.

The students that pass the exam successfully have great theoretical background in the specific field, but to become experts in the field, they require more practice. Students give positive

feedback of the lecturer`s work and show interest in the field (rating varied from 4 to 5 in 75 %), however, negative feedback from industry has been received, like “The student is stuck in theory” or “Student's knowledge is disconnected from reality” (personal communication with representatives from water and wastewater industry, n=5). To solve this limitation, practical excursions, consultations and communications with representatives and experts from industry should be organised more frequently in these courses.

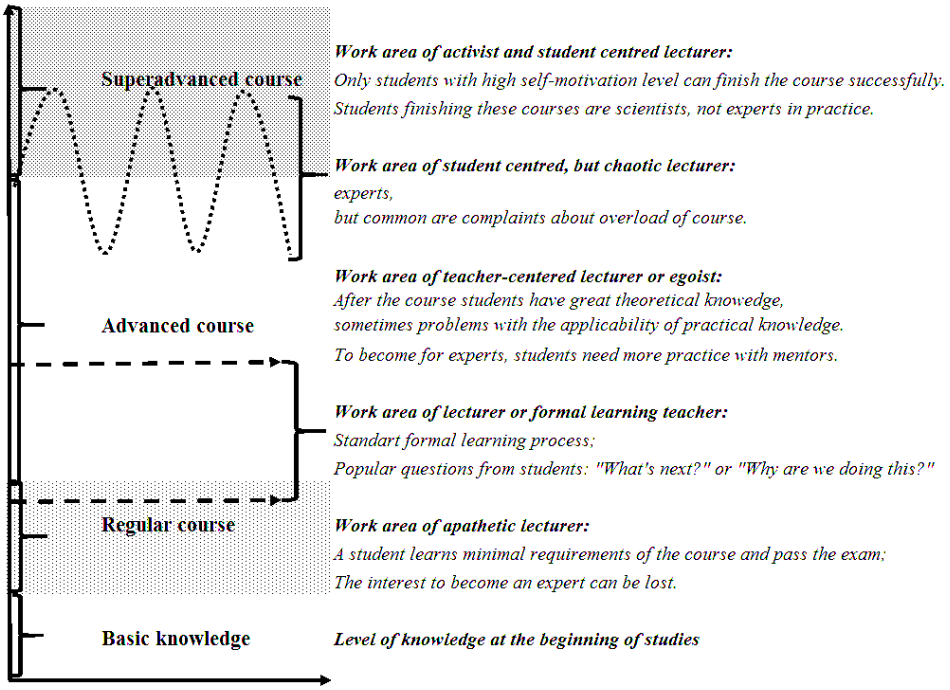

Figure 1. Connection between course level and types of lecturers.

If the advanced course is organised by a chaotic lecturer different visiting professors and workshops are organised on a regular basis. Due to the enormous excitement of his/her work, the lecturer tries to lead both theory, course and laboratory works, invite visiting lecturers not only from other universities, but also from industrial companies, to give students the opportunity to get acquainted with the practical side of the field. The worst-case scenario occurs when several complex courses are run in parallel. A lack of communication between the lecturers is common. Both overload the students with information. As result the feedback is negative: “Too much information”, “It isn’t clear, why we are doing these work” or “Several calculation projects in one semester is too hard” (rating varied from 3 to 5 in 100 %). Moreover, problems with time management have been observed.

An activist and student-centred lecturer spends more work in the course organisation. The time management and structuration of the course is very important for this type of lecturer. Sometimes the courses are realised in cooperation with lecturers from other universities. The students acquire deep theoretical knowledge and several specific topics are covered during the course. Doctoral and Master`s level students usually write positive reviews and show interest in the science provided by the lecturer. However, the type of course is suitable for those who plan to become scientists and will not practice in engineering systems. In case of undergraduate students, the negative comments are received about this type of lecturer: "Too much information" or "Too hard information". At the same time the overall rating is high (4 to 5 in 100 %) due to the quality of the courses and overall lecturer interest.

Based on the identified lecturer types, their work area of the respective courses can be generated (Figure 1). Apparently, the knowlegefull apathetic lecturers should focus on regular courses providing and strengthening basic knowledge to all levels of students with various interest in the field. At the same time the lecturer - activist should limit their skills to super-advanced courses that usually gather students interested in the specific topic and ready to work more than regulated. Other lecturers can offer some more flexibility in terms of courses, however, they have to keep constant follow up in their teaching style and outcomes.

4. Conclusions

Successful course organization is based on good time management, regular communication between lecturers and experts in practice and constant notice of the student ability level (in academic level and general interest).

Theorical courses can be applicable only to grow basic knowledge about engineering systems, not experts in practice. At the same time use of advanced and super-advanced courses for undergraduate students should be carefully selected and monitored to ensure balance between the activity of the lecturer and general student interest in the topic.

The effect of the information overload can be minimized by finding the synergy between the lecturer type and course level. Each lecturer before the beginning of the course should critically evaluate the level of information students require and the overall interest of the students in the specific topic.

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Experiential and Integrated Learning Environments – Teaching Urban Design Studio at Curtin University

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Abstract

Experiential and Integrated Learning Environments in Architecture is an educational project based on action learning pedagogy (Revans, 1980) that challenges the traditional design studio teaching approach to Architectural/Urban Design and builds on Dewey (1939) and Kolb (1984) theories of experiential learning. An innovative model of teaching Urban Design to Master of Architecture students has been trailed for the first time in 2018, when the studio was set in the City of Bayswater, and has been refined over the course of 2019 in two separate study periods – Study Period 1 (Rome/Milan Study Tour) and Semester 2. This model provided students with an opportunity to collaboratively learn from and re-design the existing urban environments by immersing themselves in the very context they are studying. The proximity of the classroom to the urban setting presented an opportunity for students to draw comparisons and analysis between national and international examples and that of the surrounding urban milieu. Additionally, advanced technology supportive of distributed learning environment and intense collaboration with industry such as Hassell, Element and The Office of the Government Architect (OGA), coupled with opportunities to visit various practices, provided deeper insights and an all rounded approach to learning and engaging with architecture.

Keywords: *experiential learning; collaborative learning environments; architecture; urban design.*

1. Learning in traditional environment vs experiential learning in Architecture

Research proves that ability to work and design in teams is a fundamental skill for creative professions (Hirsh and McKenna, 2008). Architecture in particular requires collaboration across various disciplines and an ability to synthesize the built form from a large number of inputs. The design-by doing approach, which architecture largely utilizes in a specific learning environment traditionally defined as 'the studio', resonates with a pedagogy based on experiential learning.

We consider learning environment as a combination of factors contributing to student learning. In line with The Glossary of Education Reform (2013), "Learning environment refers to the diverse physical locations, contexts, and cultures in which students learn… The term also encompasses the culture of a school or class—its presiding ethos and characteristics, including how individuals interact with and treat one another".

Experience is central to both learning and the environment in which learning takes place. Dewey (1939) and Kolb's (1984) concept of experience, described as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, 38) complements the learner-centred approach desired in contemporary education. Kolb's four-stage learning cycle consisting of concrete experience, reflective observation, abstract conceptualization and active experimentation focuses on periodically exposing learners to all four phases, linking each phase with one another rather than prioritising any of them (Healey and Jenkins 2000). This enables students to consider each stage of their learning as part of a continuum, which corresponds to their growth in theoretical knowledge, practical skills, creative applications and a life-long collaborative approach. Kolb's vision of experience presents analogies to the Design process as it aligns with constructivism (Scheer, 2012), which enables teaching design through the experiential learning theory taking advantage of a composite and diverse learning environment.

In Urban Design Research Studio units offered at Curtin University we challenged the traditional learning environment of Architectural Design units, which according to Lawson (2019) constitutes of studio space, design library, design tutorial run by academic staff and the design critiques conducted by industry guests and academics. In particular, we challenged Lawson's idea that traditional 24/7 studio culture is de facto irreplaceable due to the variety of teaching activities and informal interactions amongst staff and students which stimulate creative thought in such an environment. The growing reduction of resources in the higher education[1] increasingly challenged this studio structure that was used by most Architecture

[1] Berg and Seeber (2016) offer a comprehensive analysis of current restrictions brought by reduction of time, space and human resources in delivering higher education. Reflections on the impact and consequences these reductions have on architectural education are outlined in Mancini and Glusac (2018) 'From time to Time: A constructivist approach to sociality in learning'.

Schools for decades to simulate a typical XX century office practice. We responded to this problem by replacing the time-consuming master-apprentice model through the proposition of a project based on team work and experiential and integrated learning environment.

The two units were offered in two different contexts and delivery modes - a six weeks intensive travel Design Studio unit of Rome and north-central Italy in Study Period 1 2019 and a regular semester based studio run from the former Perth Technical College, 137 St Georges Terrace, Perth Central Business District (CBD) in Semester 2 2019. The Semester 2 iteration maintained the core principles of design learning processes consisting of learning by doing rather than through formal instructions. In this sense, the main innovation in comparison with traditional studio is the replacement of individual studio desk critique with emerging collaborative activities extracted from contemporary practice. This pedagogic strategy allowed students to question the assigned design problem through iterative propositions of possible solutions (Lawson 2006; 2019) while being stimulated by opportunities to immerse themselves in the context they are studying - a hybrid setting comprising of blended real on-site experience and digital learning environment.

Students, organized in teams of five or six, engaged in inquiry by design research to support an urban Design project through current theories of urbanism and explored integrated sustainable approaches to dense dwelling and urban mixed-use, especially at the 'ground-floor' of the city. In line with the Government of Western Australia's commitment to improve the quality of built environment, we co-designed the units with practitioners from Hassell, Element and OGA adopting "the objectives, measures, principles and processes which apply to the design and assessment of built environment proposals through the planning system" as set by the Design WA State Policy in 2019 (Department of Planning, Lands and Heritage, 2019, 3). Work Integrated Learning approach in these units follows the practice-based multidisciplinary Design Review. The robust industry partners' support and engagement culminated in a successful final presentation of student work at Hassell.

2. Experiential and Integrated Learning Environments in Architecture

Bearing in mind that Masters students are expected to take responsibility and autonomy for their learning, the teaching team progressively designed Experiential and Integrated Learning Environments in Architecture project on four fundamental principles:

1. engagement with the perceptual experience of the physical built space of the city and its abstract conceptualisation, also the subject of learning, as alternative to in-class lectures and the study of the built environment through literature;
2. work in classroom expressed through the substitution of traditional one-on-one desk critiques in studio with a collaborative methodology of work supported by robust work ethic procedures producing and exchange knowledge to complement tutorials;

3. Expanded learning environment by extending the learning design and experience through flipped classroom, engagement and collaboration with industry and international academics, including fish-bowl techniques;
4. incremental integration of traditional and advanced digital technology methods enabling guided access to online information, examination of unit digital resources and real time design constructive critique.

We based the entire learning project on real industry practices and processes to increase its coordination, implementation and evaluation, which offered us a sound model to align the scope of the unit with studio delivery practices, assessment briefs and marking rubrics. More specifically, in both Study Period 1 (SP1) and Semester 2 2019, students worked in small teams on urban design proposals and individually on building design. The teams worked on developing intense didactic learning activities aimed at developing a historical, morphological and experiential analysis which inform a complete and coherent urban and architectural proposal integrating design at various scales. To that end, they employed a variety of qualitative research methods such as site visits and data collection, sketching, drawing, photography, and writing to reflect on experiences of the studied urban context, to produce and communicate advanced 2D and 3D design concepts. The integration of the digital (e.g. Blackboard) and physical (e.g. Studio space) environments as parts of the same learning space, in which formal, informal contact time and non-contact time are part of a continuous learning experience was deemed essential as it expands the learning environment beyond the classroom.

Further to this, in Semester 2 we introduced a model of assessment as learning, whereby two weeks prior the assessment submission students presented to a multidisciplinary industry panel who assessed the presentation of each team's project against Design WA criteria and discussed the formative feedback with the panel members, as confirmed by Tanya Ring, OGA, Guest lecturer and critic: "The Office of the Government Architect (OGA) was supportive of the decision to include the Design WA planning policy suite within the curriculum for this studio... It provided students with experience in presenting in front of a panel tasked with assessing projects against the same Design Principles that current Design Review Panels … use for ascertaining design quality in the planning system."

The practice of integrating Design WA framework further enabled the establishment of thresholds of students' work against national and international academic and practice-based benchmarks by defining learning outcomes, assessment briefs and marking descriptors in line with the National Standards of Competencies for Architects, making the link between education and practice standards explicit and benchmarked by the industry itself.

3. Project Implementation

Architectural Design is about the production of built form in context, which is not just physical, urban or rural; it involves the comprehension of social, historical and cultural background of its inhabitants as well as future users, which the two studios aimed to achieve. Within this pedagogic vision, students enrolled in Rome and Perth Urban Design Studios benefited from the integration of different learning environments in a number of ways. The indispensable physical experience of the place was supplemented by digital technology enabling students easy access to historical maps and information. Together they allowed for a comprehensive understanding of the site's development to be traced.

In SP1, the Rome Studio offered "A great opportunity to understand how an urban architectural intervention can acknowledge the various physical and intangible conditions of the city at different scales…[and] how the history and the urban fabric transformations of the place can influence or underpin design." … "The constant feedback and site visits throughout Italy … informed how we thought, experienced and expanded our knowledge…[which in] turn informed our design and approach to the assignments and design for site." (eVALUate ARCH5024 2019 SP1)

Figure 1-2. The city as an open book: Milan and Perth.. Figure 3. Critique with Hassell Architecture at their office.

Building on the experience of the travel studio, in Semester 2 2019, Urban Design Research Studio was taught from the Technical College in Perth CBD utilizing once again the direct experience of the built environment as an open-air book. To this end, six site visits in the city of Perth substituted the in-class lectures and integrated the assigned readings. The studio placed an emphasis on visual analysis expecting of students to provide evidence of their reading via drawings and diagrams of the visited places substituting the traditional literature review.

The very presence in the city centre augmented the learning experience of this urban design studio, which was further supplemented through advanced technology available on the premises. The venue at St Georges Terrace within which we worked, consists of 6 screens that were used to project information from 4 different sources at the same time. The teaching team also connected an iPad with Apple pencil to the room screen system as one of the input sources. This made it possible to capture images from different screen projections showing the project site, precedents and students' diagrams which tutors could comment through

digital drawings in real time and send these to students/team via email or social media platforms for their further reflection. Students' sketches were scanned and projected on screen to comment on ideas and strategies. The available technology offered high potential for augmenting tutorials as these could be recorded and distributed synchronously and asynchronously. This process replaced the master-apprentice model based on one-on-one feedback and enabled everyone to share the traditional 'drawing conversation', typical of the one-on-one desk critique, with the whole class. Such an advanced simulation of a project critique, typical of professional practice, extends both participation and feedback's impact to the whole class/cohort, evident in the following statement: "The Curtin campus in Brookfield Place made the unit all the more interesting and motivational. The technological facilities and amenities provided to us ensured that we were always well equipped and able to interact, learn and become more of a part of the teaching / learning process." (ARCH5024-25 students' LinkedIn testimonials).

4. Impact of engagement – linking education, practice and digital technology

Diversifying the whole-day studio sessions increased students' participation and enabled students with different learning styles (Kolb 1984) to equally participate and engage in learning while building their own learning platforms to process design ideas in a manner original to them. The results of redesigning the learning experience through a new learning environment have been very positive as demonstrated by students' comments: "The most helpful aspects have been the overall learning environment. Studying in the city has been fantastic and has allowed for lots of learning opportunities, networking and site visits. The meetings with other people in the profession meant that we had mini deadlines, and this helped keep us on track and allowed us to create as much work as we did. [Tutors] put in a lot of effort to make the semester great... [It] has been by far my favourite semester for studio and methods!" (ARCH5024 eVALUate Semester 2 2019) and industry's confirmation of the high quality of students' learning: "The challenge of teamwork was embraced by the students, maintaining respectful relationships and balancing divergent 'personalities' to achieve a valuable life lesson and a positive learning outcome… The project brief was huge in scale and complexity and the students were fearless in tackling specific areas that allowed individual development of their ideas, whilst still being grounded in the group's common masterplan vision, no easy feat." (Architect Jane Wetherall, industry guest).

Table 1. Maps activities and indicators against the four fundamental principles used to design Experiential and Integrated Learning Environments in Architecture project.

Tabke 1	Curtin University Master of Architecture Urban Design Research Studio	Unit Report Evaluation - Indicators: of Agreement (%)			
Learning Principles	Learning experiences/activites	eVALUate quantitative items SP 1 2019 - 30 students - 50% response Sem 1 2019 - 12 students - 50% response rate	SP1-2019 % agreement	S1 2019 % agreement	% University Agreement
1. Engagement with the perceptual experience of the physical built space vs current planning policies	2019 S1 Framework: Milan Plannning Scheme.	1. The learning outcomes in this unit are clearly identified.	100	100	**90**
	2019 S1 Framework: Design WA SPP 7.0 On site: perceptual analysis and mapping in situ of urban contexts/ project site.	2. The learning experiences in this unit help me to achieve the learning outcomes.	100	100	**86**
	On site: lectures comparing different urban settings. Focus on historic change and present urban transformation.	7. The quality of teaching in this unit helps me to achieve the learning outcomes.	100	89	**85**
2. Collaborative methodology of work and review	Week 1 – 12: collaborative studio design sessions to develop site analysis and design proposals.	8. I am motivated to achieve the learning outcomes in this unit.	100	100	**86**
	Week 12-14: individual design studio critiques finalise the design proposals.	5. Feedback on my work in this unit helps me to achieve the learning outcomes.	100	89	**82**
	Work ethics: individual demonstrsation of contribution	11. Overall, I am satisfied with this unit.	100	100	**84**
3. Expanded learning experience through collaboration with industry and international academics.	Students weekly presentations of urban case studies, site analysis and design process.	9. I make best use of the learning experiences in this unit.	100	89	**88**
	Perth Formative presentations of work-in-progress to industry/academic guests through fish-bowl technique	10. I think about how I can learn more effectively in this unit.	83	100	**88**
	Final presentation of projects to industry/academic guests.	4. The assessment tasks in this unit evaluate my achievement of the learning outcomes.	100	100	**86**
4. Integration of traditional and digital technology methods.	Collaborative design workshops using interactive graphic/visual technology. Sharing of cloud based information system.	3. The learning resources in this unit help me to achieve the learning outcomes.	100	89	**86**

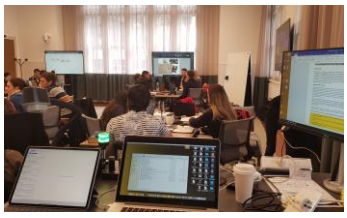

Figure 4. digital studio setting

Figure 5. Industry Design Review Panel

Figure 6. Fish-bowl Technique

Similarly, the Rome Study Tour took advantage of extensive site visits to a number of different cities in north-central Italy and lectures delivered on site to demonstrate, via built examples, concepts and theories of the assigned readings, as evident in the following statement: "Physically experiencing architecture should be an essential part of this course, as I have learnt so much more than a lecture on a particular city in Italy. My motivation was unwavering, through the critical knowledge of both [tutors], I was genuinely excited each day to uncover new layers of meaning within the city of Rome. Additionally going through the studio as a group was very important as the critical analysis was perpetuated through discussion." (eVALUate ARCH5024 2019 Study Period 1)

5. Conclusion

Educating future designers to make responsible choices is a point of difference to endow a sustainable built environment for future generations. Research proves that using different formal manipulation techniques develops designers' (and students) curiosity, empathy and lateral thinking when looking for Design solutions (Brown, 2008; Munari, 1971 and 1977). The Experiential and Integrated Learning Environments in Architecture project afforded us the opportunity to explore innovative ways of teaching Urban Design to Architecture students utilizing both physical presence and digital technology to augment student experience.

In the end, reflecting on students' qualitative responses, the project, though a success, proved that traditional studio critique can largely be replaced by up 70% of the classes through innovative collaborative learning experiences. Nevertheless, individual critiques are still an essential component in the later part of the architectural design process. With this in mind we intend to refine the project further and offer it again, for it has impacted greatly on student learning and experience and effectively contributed to the increase in overall students satisfaction which moved from 75% in 2018 (Bayswater studio) to 100% received in both Study Period 1 and Semester 2 2019.

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Design of three-dimensional cartographical didactic materials for Physical Geography teaching

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Abstract

Three-dimensional cartographic resources are an important tool in the teaching of Physical Geography and other Earth Sciences. They are also able to help the students to reach a better understanding of the natural landscape. The objective of this work is to design appropriate 3D didactic resources to facilitate the teaching of the landforms in the Higher Education context. These didactic materials have been prepared by using Geographic Information Technologies (GIT). These graphical materials have been created with specific GIT tools, but they can be used by teachers and students with standardized sotfware (Google Earth, Adobe Acrobat Reader or image viewers). Specifically, files with topographical and geological information have been prepared to work with Google Earth. The digital elevation models (DEM) can be viewed in three-dimensional files in 3D PDF format. This work also proposes the creation of photo-realistic images with thematic information draped with the DEM in isometric perspective. Finally, 3D models have been made from the application of photogrammetric techniques so that can be seen in stereoscopic mode as an alternative to the traditional techniques. In conclusion, all these 3D didactic materials proposed in this work showed a great potential as complementary resources in the teaching and learning of Physical Geography and other Earth Sciences.

Keywords: *3D Educational Resources; Physical Geography; 3D Cartographic Visualization; Photo 3D; 3D pdf; Google Earh.*

1. Introduction

Traditionally, teachers in Physical Geography and Earth Sciences education in general have used topographic maps that represent the relief by means of the so-called contour lines and spot heights. However, this didactic tool can make it difficult to understand the third dimension in the landscape representation. Instead, Geographical Information Technologies (GIT) facilitate learning through 3D visualization of the landscape, and it is an aid tool for those students that have a less developed 3D spatial perception (McCaffrey et al., 2003). For this reason, the three-dimensional cartographical or mapping resources can aid the teaching of the landforms (Anthamatten & Ziegler, 2006). Commonly, the first step to show the landforms in three dimensions was the use of block diagrams often used in geomorphology handbooks (Proctor, 1963; Martínez de Pisón & Castañón, 2006). At present, GIT have allowed the rapid generation of digital elevation models (DEM), through the Geographical Information Systems (GIS) and Computer Aided Design (CAD) software. These innovations have meant a new way of teaching geomorphology (Fisher, 1989; Allen, 2008). Also, the development of the GIT has provided automatic and more sophisticated methods for the graphic representation of the terrain, which allows to get a more realistic 3D geo-visualization. Moreover, it is also possible to drape various thematic layers to the DEM and apply different rendering techniques to obtain photorealistic scenes (Priestnall, 2009; Dübel & Schumann, 2017). Since the emergence of Google Earth (GE) at the beginning of the 21st century, this tool has been one of the most used in the teaching of geography and geology (Patterson, 2007; Sanchez, 2009, Demirci *et al.*, 2013; Hsu *et al.*, 2017). In fact, students can visualize in GE different spatial information in a three-dimensional way, and even elaborate topographical profiles easily (Hsu *et al.*, 2017). On the other hand, the recent development of the Structure from Motion (SfM) photogrammetry is allowing to obtain 3D models of the landscape surface (Smith *et al.*, 2015). The cartographical products generated in these programs can be exported to the commonly used Portable Document File (PDF) format with 3D content (*pdf 3D files). This widely used file allows the graphic representation of 3D data and its visualization with the commonly used Adobe Acrobat Reader. The interface of this program has several 3D tools that allow to the user (i.e., the teacher or the student) to interactively move, rotate, scale, measure and illuminate the 3D model in different modes (Mañana-Borrazás, 2014). Also, photogrammetry software offer generating stereo images, very useful for students to get a realistic three-dimensional (3D) visualization. The objective of this paper is to show the didactic potential of the 3D resources, which facilitate the teaching of geography, and above all, geomorphology. Although these materials necessarily have to be generated using GIT methods, the results can be exported to easy-to-use programs.

2. Materials and methods

In this work, we have used different GIT tools to prepare and design different examples of 3D teaching resources. These 3D cartographic materials have been prepared by teachers and students of the Master in Geographic Information Technologies of the Complutense University of Madrid (Spain). From these GIT tools, the materials have been homogenized and exported to formats that can be opened in commonly used programs (GE, Adobe Acrobat Reader 3D, 2D and 3D image viewers), so that students can work easily with them. The elaborated 3D materials can be classified into 4 types of files:

2.1. Google Earth files

Topographic and geological maps at 1:50,000 scale are the materials prepared with GIT to create different 3D mapping products. The information contained in both types of maps is very dense, making it difficult to read and interpret. The Bentley MicroStation CAD platform has been used to simplify and prepare this information, and organize it in levels or layers (e.g. contour lines, spot heights, stream network, lithological units, tectonic symbols amongst others). Therefore, when exporting the CAD file to GE's native extension (*kml or *kmz), this program recognizes the entire levels structure as it was designed on the CAD software.

2.2. 3D PDF files

The representation and analysis of the terrain through DEMs is an essential teaching resource in geography (Brown & Olson, 2001). In this proposal, GIS and CAD programs have been used to generate DEMs, which have been subsequently exported as files in 3D *pdf format. The advantage of this extension is that it maintains all 3D information. Thus, this material offers unquestionable didactic possibilities since students can visualize the graphic representation of the landforms in their whole extent from different points of view.

2.3. Images in different isometric views

Generally, different thematic layers (e.g. geology, geomorphology, land uses, and even aerial photographs) can be overlapped on the 3D terrain model, and generate expressive isometric views. Usually, when using GIS programs with visualization purposes, the most common solution is to apply a transparency to the thematic variable that overlaps the DEM. However, in this work we propose to use alternatively the lighting and rendering techniques to generate photo-realistic 3D images (Dübel & Schumann, 2017).

2.4. 3D models

The SfM photogrammetric technique, so called 3D photo-reconstruction, is a new tool with versatile teaching applications in multiple disciplines (Smith *et al.*, 2015; Tomás *et al.*,

2016; Williams *et al.*, 2016; Sautière *et al.*, 2019). At present, it is possible to obtain 3D models and other cartographical products (point clouds, orthophotos and digital surface models) from the automated processing of a sequence of overlapping photographs, taken with drones or with simple commercial compact cameras.

3. Results

3.1. Visualization of topographic and geological information in Google Earth

GE offers a valuable didactic resource. Figure 1 shows the geological and topographical information of the surroundings of the Patones village (Central Spain) in GE, organized in levels (see table of contents on the left side). In this way, the student can interact in 3D, using the tools offered by the GE cartographic viewer: rotate and shift the view, change the exaggeration of the relief, activate or deactivate the levels, add transparency to the lithological units and create topographic profiles. These tools not only allow the simple visualization of information, but also its teaching use in a didactic way. As the information is organized in levels, students will have the possibility of activating or deactivating their display, facilitating the understanding of the interrelations between the different features of topographical and geological information.

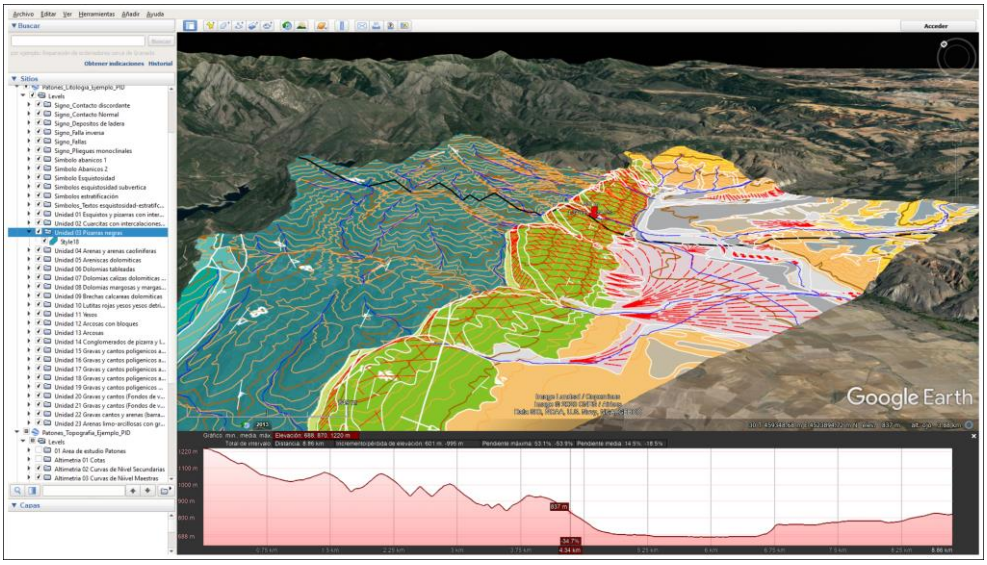

Figure 1. Example of didactic material prepared with CAD tools, and exported to be visualized and used in the Google Earth platform. Students could interact with the topographic profile (the black line in the 3D view). The red arrow shows the location in the 3D view of the geological map and its place in the profile.

The students often have difficulty interpreting the 3D meaning of the contour lines as well as their relationship with the landforms (valleys, plains, divide, etc). Similarly, the visualization of the geology together with the contour lines and river network brings an easier learning of concepts such as dip and strike direction of the bed of sedimentary rocks, and observe the relationships between outcrop lithology and arrangement of the contour lines (e.g. V-rules of outcrops crossing valleys in geological mapping).

3.2. Visualization of DEMs in 3D PDF files

Files in *pdf format with 3D content can be managed interactively with the 3D tools offered by Adobe Acrobat Reader. The 3D cartographic resource that has been prepared shows the DEM around of the Patones area (Fig. 2).

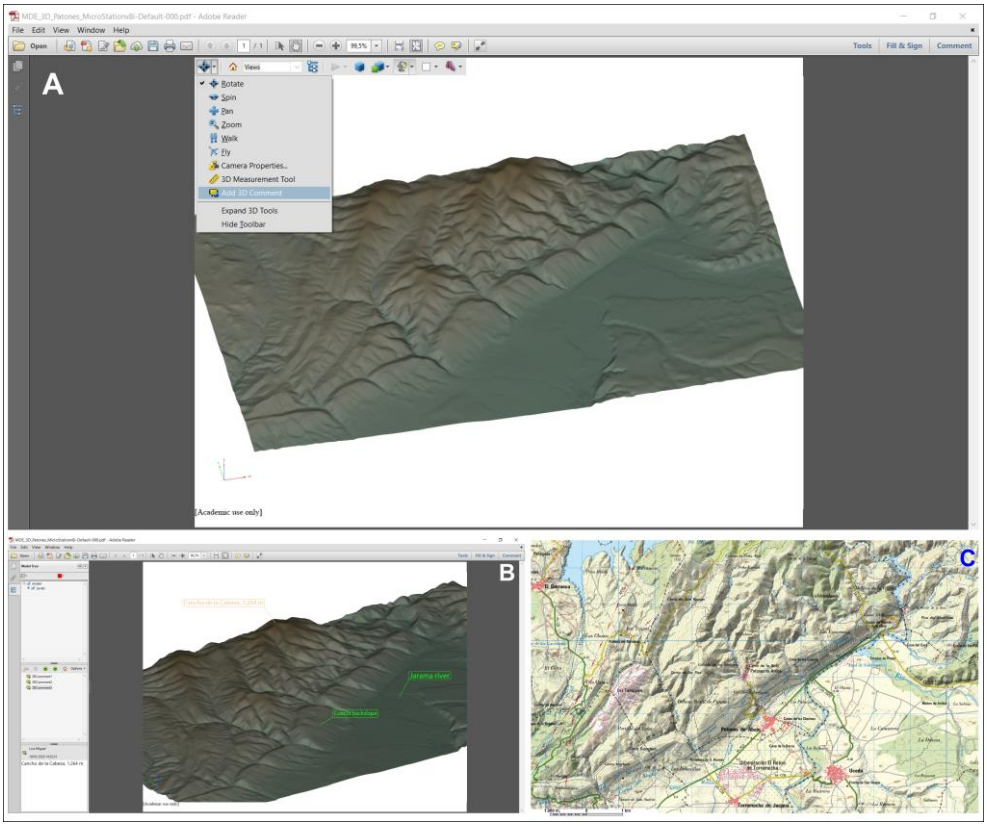

Figure 2. DEM prepared as a didactic material with TIG tools, and exported to visualize in the Adobe Acrobat Reader program (A). Example of comments added to the DEM (B) and topographic map of the study site (C).

The students could apply different lighting styles and rendering modes (transparent, solid, illustration, shaded, wireframe) to display the 3D model. Therefore, this tools allow to visualize the model from different points of view, favoring the understanding of some basic

geographic concepts (e.g. aspect, slope, etc.). In addition, students can work simultaneously with the topographic map and the DEM in order to locate and identify geographic features on the DEM, and also perform different types of measures or even add comments, indicating the location of geographical sites or features (peaks, rivers, places name, towns, etc.) or the main landforms that they recognize in the model (Fig. 2B and C).

3.3. Visualization of thematic layers draped to the DEM in isometric views

Photorealistic 3D images are also a valuable teaching resource. Although it is a "static" 3D scene (Allen, 2008), the teacher can create these images that facilitate the teaching of the landforms. For example, the isometric 3D scene of Figure 3 allow the teacher to explain how the relief is formed in relation to various variables: the topography (represented by the DEM), the stream network, the lithology and the tectonic structure.

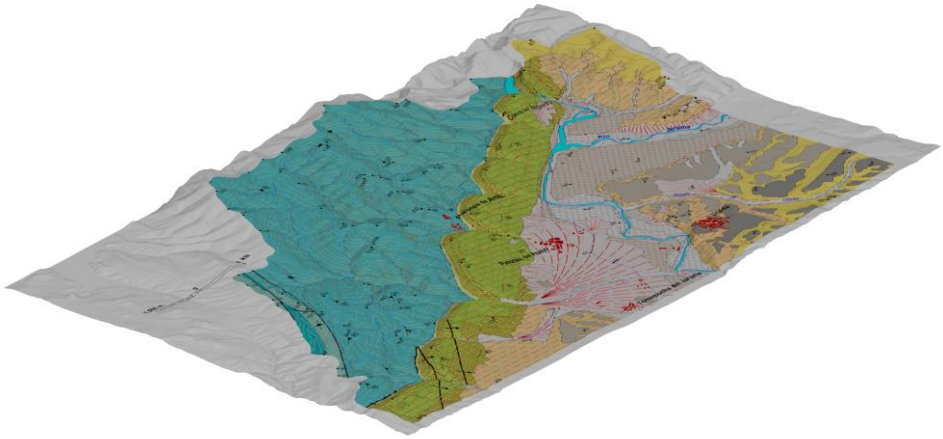

Figure 3. Photo-realistic 3D rendered image showing the lithology and tectonic structure draped on DEM.

3.4. Detailed visualization and interpretation of the landforms with dynamic 3D models

As example, we have generated a 3D model of a small quarry with the use of the 3D photo-reconstruction technique, using Bentley ContextCapture sofware. From a didactic point of view, this type of resource offers many possibilities in the teaching of physical geography and geology. In the example of the Fig. 4A, students could, among other activities, recognize the type of rocks, measure the thickness of the strata, recognize the competence and hardness of the rocks, and the relation between types and erosive processes, and even while visualizing the model in stereo mode with anaglyph 3D glasses (Fig. 4B).

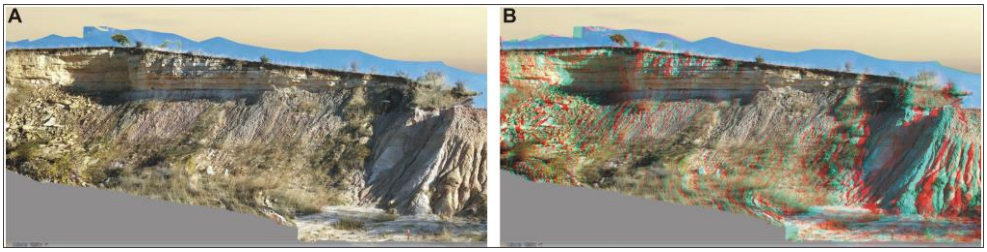

Figure 4. Example of a 3D model of a quarry. Normal isometric view (A) and stereo isometric view (B).

4. Discussion and conclusions

Topographical and geological maps, aerial and satellite images, block diagrams, digital elevation models and topographic profiles have been traditionally used for the teaching in geography and geology, as they help to reach a better understanding of the Earth's surface and the geomorphological processes (Allen, 2008). Its use is also essential when planning fieldwork activities (McCaffrey *et al.*, 2003; Marra *et al.*, 2017). Currently, these materials have been improved with the development of GIT, offering new opportunities in geography and geology education (Sanchez, 2009). From this perspective, the development and use of 3D cartographic resources will promote the understanding of the landscape for students.

The use of GE has shown its effectiveness as a didactic tool for the teaching of geography (Allen, 2008, Demirci *et al.*, 2013). The students who learn with GE improve their abilities to read the topographic map, as well as to assimilate concepts of geomorphology (Hsu et al., 2017). In fact, the application of 3D geovisualization techniques has become a priority objective of researchers for scientific, educational and outreach purposes (Dübel & Schumann, 2017). On the other hand, generating photorealistic 3D images could be an extraordinary recourse to explain a particular landform, the configuration and evolution of the relief or landscape or to acquire mapping skills (Hsu *et al.*, 2017). The 3D representation and visualization of the terrain in novelty applications such as Adobe Acrobat Reader, or the creation of 3D models with SfM technique, with the possibility of generating stereoscopic images, opens up multiple possibilities in the teaching of geography or geology (Smith *et al.*, 2015).

However, work with 3D cartographic materials would not be enough to achieve student learning, if the teacher does not propose its use with didactic objectives and activities. All in all, 3D cartographical materials are useful as complementary resources since they ease the teaching activities and improve student learning and understanding of the theoretical contents. The present work has demonstrated the pedagogical potential of elaborated 3D mapping materials. These resources have been implemented in the current academic course in the practical activities of the subject "Physical Geography" (Archaeology Degree), although they still have not been assessed in the class sessions. Thus, we will have available

results in the near future to confirm a better understanding of the theoric contents by the students.

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Veterinary students´ perceptions of participation in a service-learning activity

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Abstract

Citizens worldwide are increasingly concerned about the animal welfare of farm animals but lack knowledge about animal production systems, as fewer and fewer people have a direct connection to rural environment. Veterinary students these days present low motivation for teaching subjects related to agricultural species because they are more focused on companion animals. The aim of this work was to evaluate the perception of veterinary students about the degree of utility for learing achieve, satisfaction and acceptability of participation on an service-learning activity integrated in a teaching innovation project. We choose the service-learning activity because learner-centered methodologies could be appealing to students to stimulate external motivation and, simultaneously, provide benefits for society. The participants reported increases in the awareness of lack of knowledge about food animal production aspects and the importance of university involvement in activities that provide social benefits. Together with a 94 % of high or very high self-reported learning increase about the specific topics of the curricula of the subject and an 80% of high or very high self-reported global satisfaction with the participation in the SL activity, despite some technical difficulties, led us to conclude that service-learning methodologies could be successfully integrated in the veterinary curricula.

Keywords: *Motivation; satisfaction; knowledge; social issues; service; innovation.*

1. Introduction

Over the last fifty years the livestock sector has been undergoing changes without precedents to deal with the increasing demand of food derived from animals in the world's most rapidly growing economies (FAO, 2019). To meet the 72 kg global meat consumption per head/per year expected by 2050 (Miele, 2016) intensification of livestock production systems seems inevitably (Buller *et al.*, 2018). In the current socioeconomic global situation, there is a strong evidence of public concern over the moral implications of intensive animal production systems on farm animal welfare (FAW) (Eurobarometer, 2016; Fernandes *et al.*, 2019). In the actual concept of sustainability poor welfare of animals could make a system or procedure unsustainable because members of the public consider them unacceptable (Broom, 2019). Nowadays a large part of our society lives in urban environment and during the last decades both the physical and the mental distance between producers and consumers have grown (Brom, 2000) and there are evidences of little or no knowledge about farming activities in the mayority of citizens (Clark *et al*., 2016; Malek *et al.*, 2018). On the other hand, the proportion of urban people that have pets has increased in affluent countries and the pets are considered as members of the family, increasing the emotional and social ties with animals during the twentieth and twenty-first centuries (Wilkie, 2005 Boogaard *et al.* 2010), rising the moral or ethical status or all the animals for extension. Likewise, farmers have serious difficulties in providing effective information to society, being, on occasion, victims of sensationalist media that produce great harm. Like Grandin (2014), we consider the existence of a gap between society and farmers a serious problem and we think that it is our duty, as veterinarians and responsible members of the University, to try to find the link between them.

During the last decade the number of students enrolled in veterinary medicine degree who came from urban environment is increasing. They have the aforementioned background of lack of links with farm animals and farming practical experience and are much more focused on companion and exotic animals. All this translates into a low motivation for the teaching subjects related to agricultural species and this phenomenon is observed worldwide (Alonso *et al.*, 2019). As motivation is one of the most important factors that should be considered in order to improve the processes of teaching and learning (Williams & Williams, 2011; Kusurkar *et al*., 2013) we try to increase the external motivation of our students troughout the voluntary participation in a service-learning (SL) activity as learner-focoused methodologies are considered more engaging than tradicional teacher-focused activities (Garnjost & Lawter, 2019).

SL is a educational experience in which students participate in an organized service activity that meets identified societal needs (Bringle & Hatcher, 1995, p. 112) and is a student-centered methodology derived from experiential education (Furco, 1996). The societal needs identified for the present activity was information for citizens and consumers about

different aspect of housing, handling and welfare in the production systems of cattle and sheep. Despite the institutionalization and widespread use of SL methodologies in many Universities (Bringle & Hatcher, 2000) there are not commonly used in veterinary degrees.

The aim of this work was to evaluate the perception of veterinary students about the degree of utility for learing achieve, satisfaction and acceptability of participation on an SL activity integrated in the teaching innovation project financed by the University of León in the year 2018 call (PAGID-ULE 2018-19).

2. Material and Methods

2.1. Students

During the second semester of 2018-2019 academic year, third year students of Animal Production and Higiene (APH) subject were challenged to participate in a SL activity to improve knowledge of society about different aspect of housing, handling and welfare in the production systems of cattle and sheep.

The students, individually or in groups of two, visited different cattle or sheep farms to record a video. On the farm or after the visit they explained some of above mentioned aspect related to milk or meat production in a way that could be understood by non veterinary or farm environment people. Duration of videos should not exceed 10 minutes with the intention to be uploaded on a YouTube channel created to this purpose.

The participant students were asked to respond a voluntary and anonymous survey of 15 questions following the Likert scale, with a score of 1 to 5 (1 being very low and 5 very high), to gain knowledge about how the student perceived social disengagemet from farming activities problem and about their self-perceived learning achievement and satisfaction level related to the SL activity.

3. Results and Discussion

From a total of 124 student only 17 participate on the SL proposed activity. This is in accordance with the low level of initial students´ motivation to farm species detected worldwide (Alonso *et al*., 2019) and the self-reported interest in animal production prior to participate in APH subject (Figure 1). Comparing percentajes of self-reported interest before and after this subject (answers 1 and 2 of Figure 1), it is clear than knowledge and personal experience is a good way to increase motivation and the level of awaresness about some social issues, in this case the existence of a physical and mental disconnection between urban and rural environment and existence of a knowledge/understanding gap between them (answer 4 of Figure 1). We can not distiguish between the influence of the

participation in APH subject or in the SL activity on the results in previously mentioned answers because we did not made the survey with students that do not participate in the SL activity. We planned to repeat the survey to participants and non participant in the 2019-2020 academic year when the activity will be repeated. To have diferenciate data will allow us to prove if our results are in accordance with some papers that reported civil and social skills benefits of participants in SL activities (Conway *et al*., 2009; Celio *et al*., 2011).

Considering the gender, 69 % were females and 31 % were males, and this result is not in accordance with other studies (Astin & Sax, 1998; Brail, 2016) that reported higher percentage of females involved in SL activities, because, even when in our experience the female percentaje was double than the males one, it is lower than the average ratio females (82 %) *versus* males (18%) observed in the academic year.

The ratio urban 65 % *versus* rural 35 % in the origin of the participants could explain the result of very low or low knowledge about animal production prior to particitate in subject APH observed in Figure 2. Self-reported levels of very low or low knowledge about animal production aspect prior to APH subject participation of 60% are surprisingly high for veterinary students but are in accordance with reviewed literature (Clark *et al*., 2016; Malek *et al*., 2018) for citizens of Europe and Australia.

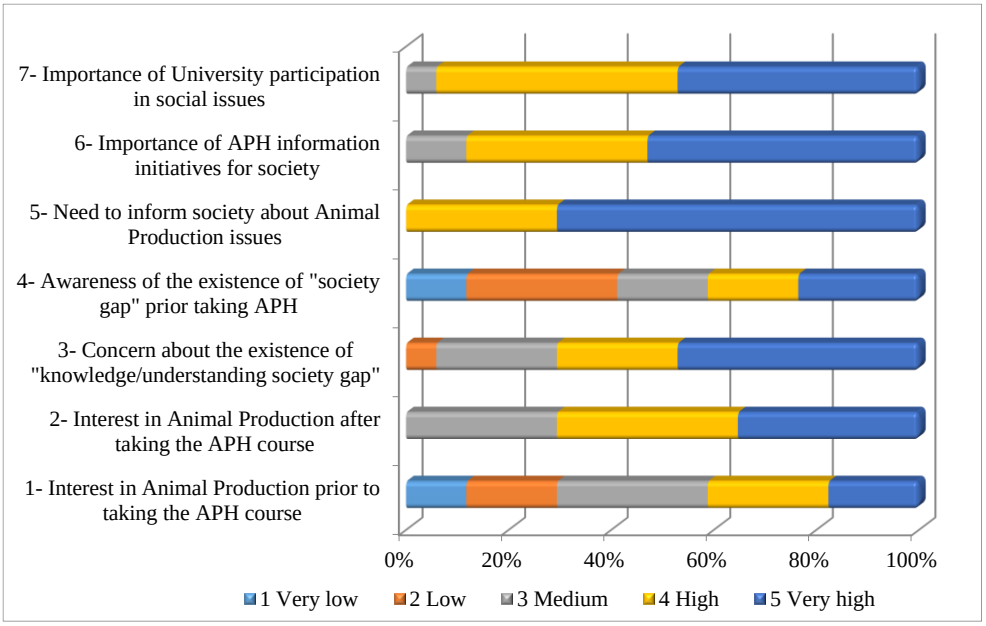

Figure 1. Results in % of the students´questionnaire answers regarding social and animal production issues.

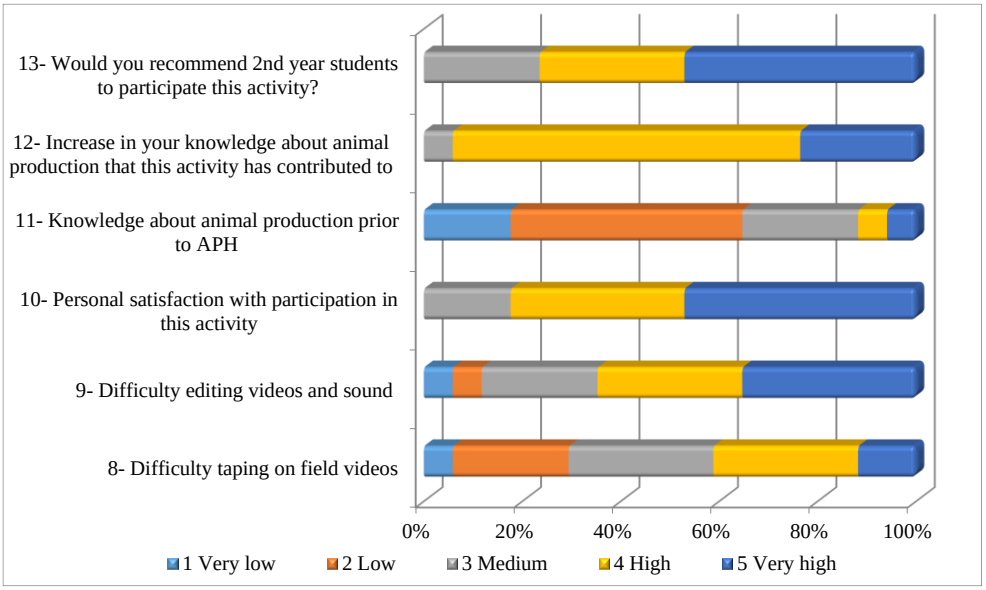

Figure 2. Results in % of the students´questionnaire answers regarding personal learning, satisfaction, and difficulties with the service-learning activity issues.

The dificulties reported by the students about the editing of videos and sound (answer 9 of Figure 2) was an unexpected outcome of the use of videos for YouTube that proved to be an efficient learning tool well received by students (Chintalapati & Venkata, 2016; Alonso *et al*., 2017).

Self-reported learning benefit about the specif topics of the curricula of the subject by means of the participation in the SL activity, answer 12 of Figure 2, was high 71% or very high 23%. Together with the fact that 80 % high or very highly recommend to participate in the activity to other students encourages us to continue with this initiative in the present academic year. In the explanation of the 94% knowledge´s increase reported two factors could participate simultaneously. On one side, first-hand experience visiting farms could be a relevant constructive learning experience that also contribute to made people more conscious about farming issues (Boogard *et al.*, 2010). On the other side, better levels of learning achievement with SL activities were reported (Bringle & Hatcher, 2000; Celio *et al.*, 2011; Brail, 2016; Garnjost & Lawter, 2019). Garnjost and Lawter (2019) published a mean, in the Likert scale 1 to 5, of self-reported value of knowledge acquisition of 4.04, close to our 4.15 that represents an increase of almost 2 points over the 2.35 mean value of answer 11 of Figure 2 of prior knowledge.

Finally, a 45% of students very high and 35 % high satisfied with the participation in the SL activity confirm previous studies that consider the SL learner-based activity greatly

satisficing for performers (Ciesielkiewicz & Nocito, 2018; Garnjost & Lawter, 2019). Our 4.29 mean value in the Likert scale was higher than the 4.00 reported by Garnjost and Lawter (2019) and this is a very valuable results because the students are satisfied despite the technical difficulties in editing the videografic material and the time and resources involved in the participation in the SL activity.

4. Conclussion

Veterinary degree students who participate in a SL activity perceived it as satisfactory and beneficial for increasing learning achievements and awareness of social issues and would recommend other students to participate in this activity. All this led us to conclude that service-learning methodologies could be successfully integrated in the veterinary curricula.

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CLab Torino: a transdisciplinary environment to provide a challenge-based teaching model

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Abstract

Promoting an open dialogue, a constant interdisciplinary collaboration with companies, between universities, about partnership or open innovation perspective, today is a challenge that still faces some resistance. Learning to deal with complexity, with the coexistence of different points of view, in collaboration to combined and re-combined know-how in ever new, original and challenging formulations, brings with its specific needs. In this sense, design takes on a fundamental role to create projects with a view to sustainable innovation, projects that are increasingly responsive to contemporary complexity. So, how does design education need to change? How do working designers and design researchers can update their skills to meet the challenges of the present and future?

This contribution, through the experimentation of the Contamination Lab Torino, investigates a new design-driven educational model intended as an extremely dynamic process from the creation of a multidisciplinary team to the transition from a product design logic to a Product Service System one, as the most effective way to face the issue of the system management, as a way to guarantee the appropriate flexibility to the contemporary needs of our society.

Keywords: *Entrepreneuship education; educational model; transdisciplinary education; design; sustainability.*

1. Introduction

Never as in the cultural contemporary scenario, the design field intrinsically understood, is facing continuous, fast and radical metamorphosis. Metamorphosis that are shifting the attention from a traditional focus on the product in favour of a design more oriented to service, process and communication. A design that necessarily, will have to get closer to the companies core business, with the final goal to enable design-lead entrepreneurship.

If though, until a few years ago, the design discipline remained almost independent and separate from company functions, now organizations have begun to invest and increasingly consider the opportunity to involve design skills as an innovative tool to grow and expand their strategies to face the most complex challenges. On a practical level, included in the Europe 2020 context in 2015, the European Commission with 'Design for Enterprises' realized a free formative programme to approach small and medium-sized enterprises to the world of innovation, showing how this can be the key to improving efficiency, competitiveness and sustainability. As J. Maeda highlighted in his report 'Design in Tech 2018', many companies started to introduce designers in their team. IBM, to name one, increased its designers' share from a ratio of 1 designer every 72 engineers to a ratio of one to eight. McKinsey published their 'The Business Value of Design' report 2018, authored by trusted management consultants, that created real design buzz in boardrooms (Beausoleil, 2018). In 2017, 21 creative agencies had been acquired by larger players: Acne has been acquired by Deloitte, Intrepid by Accenture, DeviantArt by Wix, to name a few (Maeda, 2018). The discipline of design, in this sense, plays a fundamental role, shifting its interest from simple product design to the entire process, from data analysis to implementation and final development. This inevitably leads to an increase in the complexity of the design; new avenues are always being opened, unexplored business models, ever new forms of innovation that could favour a greater ability to unleash entrepreneurial potential. Just think of the academic and research spin-offs, which could strategically find the right ecosystem both in terms of use and funding. So what do we expect from the entrepreneurship education of the future? From this scenario, the contribution aims to explore the design role within a training system focused on the developing entrepreneurial skills. A development of skills based on a multidisciplinary approach, the use of innovative teaching materials and original tools. A development of entrepreneurial skills guided through the lens of sustainability.

2. Towards a new design-driven educational model: the Contamination Lab Torino

According to Glen et al. (2014), design-thinking provide *'a very useful front end to the new approaches to entrepreneurship, in giving students much more useful guidance on how to carry out a productive and user-centred ideation process'* (Glen et al. 2014, p. 662). Starting

from the analysis of the national and international state of the art (Fiore et al., 2019a; 2019b), the discussion in this article is based on data derived from a real case study carried out in Italy: Contamination Lab Torino (CLabTo). This programme is characterized by bringing challenge-based activities, that are usually performed outside the university (such as hackathons), within the academic system, transforming them into structured training courses. Although other programmes have been carried out in the academic field, however they often refer to a single field of study, such as business and management education (DeTienne and Chandler 2004; Musteen et al. 2018), sciences and technology (Souitaris et al. 2007; Barba-Sánchez and Atienza-Sahuquillo 2018) or computer engineering (Arias et al. 2018). The programmes performed in design schools (Glen et al., 2014), so far do not involve multi-background students. Indeed, if it is quite common providing a multidisciplinary teaching, it is not as common involving students from different disciplines, due to constraints and the little exchange expected. The experience of Thursby et al., (2009) turned out to being multidisciplinary, but it does not involve students from humanities nor design. Contamination Lab (CLab) is a nationally-funded programme that, at the state of the art, counts 22 CLabs spread out throughout Italy. Each of these CLabs is recognised at a ministerial level. This entrepreneurship programme involves two universities – the Politecnico di Torino and the University of Turin – the former focuses on technical disciplines, the latter on science and humanities, thus providing the opportunity to involve students from every field of study. The CLabTo programme has the twofold aim of developing the students' entrepreneurial skills in running their businesses, as well as in working in interdisciplinary teams to address real-life challenges and complex situations by developing skills such as problem solving, team working, system thinking, and more. CLabTo is based on challenges of limited duration (from one week to a few months) directed towards innovation. The programme is divided into training and teamwork. The first part involves a discussion between students and professors from different research fields, and it is aimed at filling the theoretical-methodological and entrepreneurial gaps of the students with diverse curricula and from different backgrounds. Professors from different departments and research fields also increase the multidisciplinary aspect of delivering pedagogy (Fiore et al., 2019b). The second part mainly involves team-based work facilitated by tutors, which are professors, experts from industry and entrepreneurs. Challenges have the peculiarity of being complex, and the expected outcome should consist of a viable idea to address a problem or a new scenario. Mentors and tutors help students by giving feedback on their teamwork in planned time slots or during intermediate presentations and pitches. CLabTo engages students in tasks, activities and projects that should enable them to acquire key entrepreneurial skills and competences in a real-life situation (Nielsen & Stovang, 2015). For further information on the methodology of the ClabTo programme, please refer to the related section in the paper '*Entrepreneurship Education in a Multidisciplinary Environment: Evidence from an*

Entrepreneurship Programme Held in Turin' (Fiore et al., 2019a p.7-8). Below we will deal in detail with the characteristics of the CLabTo useful for the debate of this contribution.

2.1. Transdisciplinarity

Transdisciplinarity is not only the relation and the interaction of separate branches of knowledge but the integration of them as a whole (Peruccio et al. 2019). From this assumption, the CLabTo works to create an environment rich in cultural contamination, in the sense of mixing skills and competencies. From economic sciences to social sciences, from engineering to linguistics, ensuring transparent, informed and cooperative access to decision management. The high number of interlocutors multiplies, therefore, the interactions in terms of quantity but at the same time the openness towards the outside to heterogeneous realities characterized by diversity in terms of identity and skills, soliciting the decision-making action in qualitative terms, unifying the overall organizational system consistently. With these premises, the need to form transdisciplinary teams arises from the need to face increasingly complex real-life situations and highly multi-thematic challenges. For this reasons, we usually spend the first days of lessons to build these transdisciplinary teams, giving the students the task to form their team with at least three different skills included, that we can summarise in the following categories: Design/architecture, Engineering, Humanities, Management, Natural Science.

2.2. Teaching model

Entering more deeply in the structure of the case study proposed, about the teaching models, we can summarize as follow the main 'educational activity':

- first day: welcome and presentation of the brief by the managers the company involved;
- first week: we provide the students with short teachings (1-2 hours) on sustainability, entrepreneurship, design thinking, digital innovation, etc., that is, the general and mandatory modules of our programme, and also all the challenge-specific contents useful for the complete comprehension of the specific thematic.
- second week: to all students, we ask to work in teams to develop the idea with the support of tutors and mentors;
- last day: 10-minute pitch per team to present and explain the idea to an audience that includes CLab programme members, university faculty members, industry mentors and members of the university incubators (Fiore et al. 2019b).

2.3. Learning by-doing and expected outcomes

According to Rae & Carswell (2000), a learning-by-doing programme enhances the development of student's entrepreneurial skills. The balance between the theoretical part and the practical one is very important for this programme because it allows students to work on a real case study developing their own idea. Watts (2000) explained that individuals learn from experiences and failures. Students learned more about the specific topics from the tutors, mentors and professors from both industry and academia (Fiore et al., 2019a). It is important to highlight how all the projects emerged from the CLabTo do not consist of marketable products. In particular, they embrace a Product Service System (PSS) logic that often includes products, IT and services. These types of projects require longer engineering, which would often need the creation of an in-depth business model and a number of test on the final PSS in order to be able to screen and test the functioning of the system. For this reason, in most cases the projects are considered completed at a concept phase, accompanied by some studies that include a rough economic and technical feasibility. Only those students who decide to create their startup continue developing their entrepreneurial idea in other structures, such as incubators.

2.4. Focus on sustainability

About mobility, in the fight against food waste, in order to convey meaning in a more transparent way, at the energy level, CLab Torino investigates sustainability in its broadest and most complex meaning. The fil rouge of the entire programme is the attention to the user's needs and the possible future effects of the project with a specific point of view to sustainable innovation. A sustainability that finds a balance between the social, environmental and economic dimension. A sustainability whose prerogative and whose ultimate goal are precisely innovating for and with the territory, generating value for companies and therefore for the territory itself. A sustainability that qualifies the systemic use of resources daily as well as a collaborative and participatory approach. Finally, due to the growing attention on this topic, it will be our commitment to future challenges to encourage students to adhere with more and more emphasis of one of the circular economy strategies or one of the objectives of sustainable development goals.

3. Results

Based on the evidences emerged from the CLab To experimentation analysis, the role of design education, with ever greater emphasis, it will necessarily have to be defined and redefined as an extremely dynamic process, able to guarantee the appropriate flexibility to the emerging needs of a context that is, by nature, dominated by flexibility: the entrepreneurship. About CLab To results, three are the main macro-categories on which the investigation carried out so far moves: the observation about designer's facets, the

experiences about teaching and learning and new tools useful to support and drive the new educational model proposed.

3.1. The designer's facets

In order to properly cope the flexibility mentioned above, designers cannot anymore act alone: they become the interface in a multidisciplinary team in which the network of knowledge enables to embody in the process the contemporary complexity. We investigated different roles that today a designer could introduce within the corporate. The analysis can be summarized in 10 different skills (Yee & al., 2017).

Designer (D.) as a technology enabler, able to emphasize and improve the usability of a device by maximizing involvement and minimizing errors and frustrations. D. as a creativity enabler, to all intents and purposes a figure capable of bringing out the individual creative potential of each, in order to facilitate the work of the entire team [Kelley & Kelley, 2013]. D. as a community builder, for the ability to see with the eyes of another, put him/herself in the position of another — a way to enhance the human dimension of the entire process. D. as a power broker, to be able to shift attention from purely economic metrics to solutions focused on the context by creating an inclusive environment by encouraging plurality. D. as a transformation reader because innovation cannot exist without an attitude to change. D. as a data culture enabler, because data today is a precious medium from which to derive insight for more conscious design. D. as a knowledge broker, to help the entire team to define processes, establish the tools and methods to create a structure capable of providing a guide and a common language for all the actors involved. D. as a cultural catalyst or intended as the enabler of lateral thinking to definitively break the silos-centric vision. D. as a sustainability consultant, to promote a real breakdown of the traditional cliché linked to sustainability, guiding companies to a 360-degree investigation of this concept. Finally, D. as a system thinking promoter, to promote a culture of responsibility, a culture geared to change to generate progress. Promoting systemic thinking means creating new opportunities starting from the power and strength of the relationships that exist between all the actors and elements of a system (Bistagnigno, 2011).

3.2. Teaching and learning experiences

Due to the peculiarity of the educational experimentation, we decided to provide on one side a practical approach through learning-by-doing activity, on the other side to apply the concept of 'thinking outside the box' for any field of study involved. Achieving a pedagogical delivery that simultaneously engaged all the student was challenging. For this reason, we decided to set up a new lessons programme, using contamination between the offers of the two universities involved. First of all because, due to the extemporaneousness of the experience, we needed to cover particular and always different topics in specific days and at

specific times. Secondly, we needed to balance the differences in students' background and consequently find the right balance between generic and fundamental themes and the specific focus based on the challenge brief. In other words, the key for the class structure is delivery to inform those with limited backgrounds, while avoiding annoying those with in-depth knowledge (Thursby et al., 2009). As a result, from the first edition, the winning team got the second place during an internal competition of the Italian CLabs and those students obtained funding for a research grant from the company who sponsored the challenge. From the teams of the third edition, the winning team passed the first selection of the Start Cup regional prize, obtaining a prize of €5000 euros for a pre-incubation at the incubator of the Politecnico di Torino (I3p).

In order to assess the extent to which CLabTo classes and team experiences contribute to fostering the professional development of design students, they were asked, in both pre- and post-surveys, to provide a self-assessment of their capabilities and perceived expertise in each of six skills listed in Fig.1, which are derived from the GUESSS project[1] (Fiore et al., 2019a).

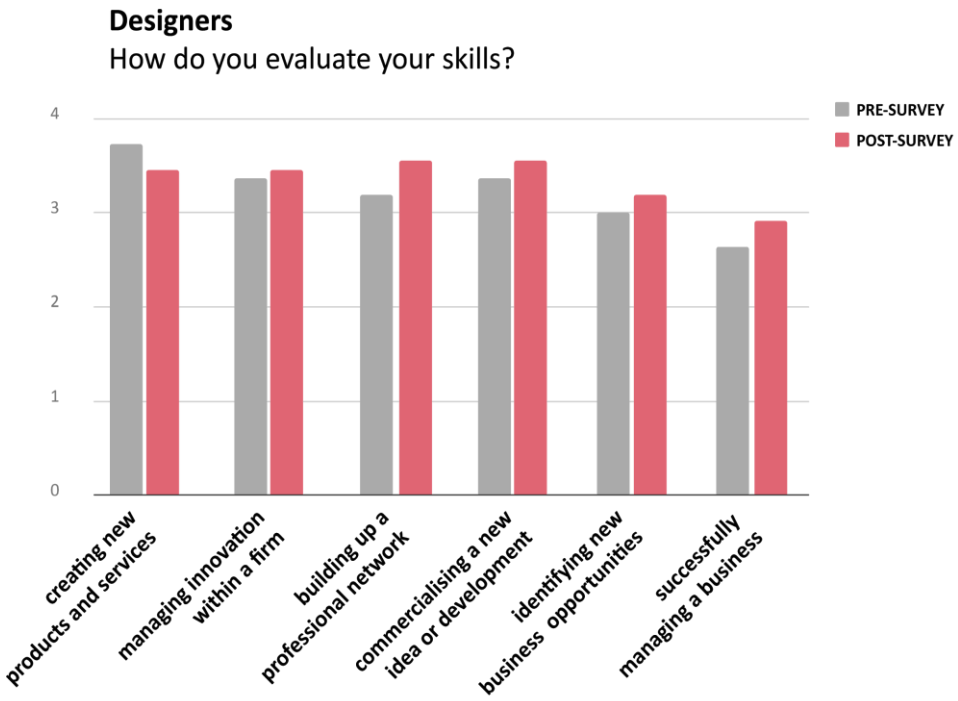

Fig 1. The perception of the design students' entrepreneurial skills in the pre- and post-course questionnaires.

[1] GUESSS is a large, global research project on student entrepreneurship. More information is available on: http://www.guesssurvey.org/.

Comparing pre- and post-survey results, we could notice that the first two items related to innovation and development of new ideas/products/services have experienced smaller increase or even a decrease. We supposed designers had found it difficult to put their skills into practice in a complex challenge, thus they finished the programme a little less confident. On the other hand, students from other disciplines experienced an increase in the perception of these skills (Fiore et al., 2019a). The third skill "build up a professional network" experiences an increase, while the last three skills refer to the business aspects of commercialising new ideas, identify business opportunities and managing a business strategy. The perception of these skills has increased, testifying the importance of providing designers with an interdisciplinary entrepreneurial programme.

3.3. Innovative materials and new tools

Students were taught new tools to brainstorm and disseminate their ideas such as visual scribing and sketch-notes in order to provide all types of students some non-trivial communication tools, together with other practical tools on the business side. Visual scribing is a graphic narration of the interventions of a seminar or a conference so that the concepts are schematized and made accessible to the audience. We decided to borrow this expertise and apply it in a working table with the same purpose; in addition, the goal of rationalizing ideas that otherwise could get lost in the flow of the debate. This skill will help them to make a joint work session productive (from brainstorm to the business plan or other). In our opinion, this skill allows them to manage the interdisciplinary team and collect everyone's ideas and contributions. It gives a certain structure to the team working and brainstorming hours, allowing the team to achieve their goals. This type of activities can be considered soft skills. Moreover, CLabTo adopts teaching methods and space layouts for teaching and teamwork, which stimulate cooperation among the students who work in teams (Fiore et al., 2019b). We work is a single multipurpose room that can be shaped based on the activity to be performed. Other activities have been performed outside the classroom thanks to a network of industrial partners scattered throughout the area.

3.4. Experiences outside the classroom

Many and of a different nature are the activities that take place outside the classroom, for example: FabLab Torino hosted our students in order to develop their prototype with adequate support and tools. The development of the prototypes included both the hardware and the software. Besides, the students experienced working closely with an incubator, by working with I3p during the StartCup competition mentioned above. CLabTo is part of a national network called Italian CLab Network, and it organizes or helps to organize, or takes part in, shared events. In May some selected students participated in a joint event together with the other Italian CLabs organized by the Italian CLab Network, the 'Italian CLab Running'. This competition was based on two aspects, a team race of a mile and the

presentation of projects through a pitch. The teams were rewarded on the combination of race time and pitch quality. Eight universities with their own Contamination Labs attended the event also involving CLab staff in the one-mile race, and the team of CLabTo won the silver medal.

4. Remarks

This contribution highlights how much important is the collaboration between people with different know-how. However, the process to create the right balance between hard and soft skills, technical and humanistic point of view, theoretical and practical activities, can be complex, and it requires some experience. The importance to introduce practical approaches such as design thinking in multidisciplinary teams is, the key on one side to unlock the potential and the creativity inside each student, on the other side to determine a new model that we can define a design-driven entrepreneurship education. Nevertheless, as another strand of literature points out the need to introduce Entrepreneurship Education (EE) into the curricula of design schools to increase the ability of design candidates to turn product ideas (concepts) into actions and to develop managerial, economic and strategic thinking skills. EE is expected to allow designers to develop entrepreneurial skills and mindsets, in order to create new jobs in the future and to become major drivers of economic growth through creativity and innovation (Fiore et al., 2019b).

5. Conclusions

Enable a sustainable innovation through design is, but even more so in the future, a strategic opportunity that will involve every aspect of daily business life, becoming a skill increasingly close to the company's core business. The competences, or rather the facets that characterize the complexity of the designer figure, today include for example the ability to work and collaborate in heterogeneous teams, high empathy without sinning in technical expertise, commercial acumen or strategic thinking. For this reasons and through the real case study of the Contamination Lab Torino we can assume that design education needs to change, becoming an always more dynamic process, able to guarantee the appropriate flexibility and compliance to the emerging need of our society, a society intrinsically dominated by changing.

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On strategies to improve student engagement

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Abstract

After Bologna declaration, the change of roles between student and instructor in Spanish Higher Education has meant the search of new strategies to improve student engagement. In fact, they are trying to transform the previous extremely instructor-centred model to a learner-centred model. In this line, many courses of Higher Education have used new learning methods, such as problem-based learning, project-based learning or flipped classroom, during the last decade. Faculty also is able to count on new tools, for example, virtual classrooms. In this paper, we analyse the use of a virtual classroom in an elective course of the Degree in Mathematics at the University of the Basque Country to detect the assignments to improve student engagement and the impact on achievement of competences. We conclude that the inclusion of collaborative assignments in virtual classrooms increases their use and, hence, student engagement. Moreover, the acquisition of competences is also getting stronger, as the percentage of students that pass the course increases.

Keywords: *Learner-centred learning; virtual classroom; student engagement.*

1. Introduction

Undergraduate degree programs adapted to European Higher Education Area bring along a high level of student engagement in learning-teaching process. This also implies to institutions, which have a duty to provide resources that promote it. Zepke & Leach (2010) suggest that the engagement can act as a proxy for quality in education. Therefore, faculty has explored strategies to facilitate student engagement. In such a way, new learning methods, such as flipped classroom (Baepler *et al*. (2014)) have appeared. Moreover, other learning resources, for instance virtual classroom, have been widely used. In fact, many lecturers use virtual classroom as a supplement to face-to-face learning. Indeed, a new learning method emerged at the end of the 90's: the blended learning (Bonk & Graham (2006), Rooney (2003)). It combines the benefits of face-to-face learning with the advantages of on-line learning, enabling to choose appropriate resources for each educational need (Moran (2012)). This blended learning, or b-learning, has spread quickly, due to not only the institutional support, but also learners and instructors has received it very well. For example, if we consider Degree in Mathematics at the University of the Basque Country, an 81.69% of the courses uses virtual classroom as a supplement to face-to-face learning. Moreover, Means *et al.* (2013) analysed the effectiveness of online and blended learning. They showed a significant increase in performance with blended learning compared to face-to-face learning. However, they did not study factors that could influence in the positive results, such as additional learning time, instructional resources and encouragement of interaction among learners.

In this paper, we related the experience implemented in a virtual classroom as supplement to face-to-face learning for an elective course of the 4th year of Degree in Mathematics at the University of the Basque Country from the academic year 2015/16 to the academic year 2019/20. This virtual classroom has changed its design during these academic years, by adding/removing resources in order to facilitate student engagement and the acquisition of competencies. These changes have made it possible to identify activities that promote student engagement and improve their outcomes.

2. Methodology

2.1. Experience framework

As we have said, the course that we have developed the experience is *Codes and Cryptography*, an elective course of the 4th year of Degree in Mathematics at the University of the Basque Country. The number of credits ECTS for this course is 6, which are divided in 3.6 ECTS of master lectures, 0.9 ECTS of classroom practices, 1.5 ECTS of computer practices and 0.6 ECTS of seminars. This course is given during the first quarter (from September to December) of each academic year.

In the University of the Basque Country, their virtual classrooms as a supplement to face-to-face learning use a learning management system based in Moodle (Cole & Foster (2007)). As we have said, the virtual classroom for *Codes and Cryptography* has regularly added/removed resources to facilitate student engagement, because of continuous improvement. Thus, at the beginning of every academic year, the instructors develop tasks that learners complete and submit by virtual classroom, before the final exam. Until the academic year 2017/18, these tasks were related to computer works. During the two last academic year, in 2018/19 and 2019/20, collaborative work, which is done in seminar sessions, has been added to the virtual classroom.

2.2. Participants

Two hundred and twenty eight persons participate in this study. They are the enrolled students in *Codes and Cryptography* from the academic year 2015/16 to the academic year 2019/20 (see Table 1). The average of enrolled students per academic year is 45.6 students and the standard deviation is 11.37 students. The fact of being enrolled only 26 students in 2017/18 causes that the average and the standard deviation do not represent properly the set of experimental data. If we remove the observation of enrolled students in 2017/18, we obtain an average of 50.5 enrolled students per academic year and a standard deviation of 3.51.

Table 1. Number of enrolled students in the course Codes and Cryptography per academic year.

Academic year	# Students
2015/16	54
2016/17	53
2017/18	26
2018/19	48
2019/20	47
TOTAL	**228**

Source: University of the Basque Country.

2.3. Data analysis

The virtual classroom as a supplement to face-to-face learning for *Codes and Cryptography* collects resources of a broad spectrum. Thus, it contains:

- General information useful for the student (Infor.), such as, teaching guide, tutorial schedule, task calendar, forum, links, exam templates, ordinary/extraordinary exam call, …

- Lecture notes (Lect.).
- Exercises and problems to solve (Exer.).
- Lecture note and exercises to solve during seminar sessions (Sem.).
- Papers related with the course (Other)
- Computer exercises to solve (Com.Exer.).
- Links to submit solved computer exercises (Submi.).
- Collaborative tasks (Col.), such as: wiki, database,...

Then, by using the activity report giving by the system, we have analysed the evolution of student activity, in order to detect the resources with higher activity than others. We have also calculated the achievement rate for ordinary call in each academic year and we have analysed whether the activity in the virtual classroom can influence the acquisition of specific competences or not.

3. Results and Discussion

The virtual classrooms at the University of the Basque Country give detailed activity reports, computed by the participants' logs. Instructors can receive these reports by student or by resource. If the instructor chooses "by resource", then the number of students and views to a particular resource appear in the activity report of that resource. We have obtained activity reports by resource for all resources of the virtual classroom yearly, from 2015/16 to 2019/20. Hereafter, we have classified all the resources that appear in the virtual classroom according to the above-named categories (see 2.3 Data analysis) and we have computed the total of views for each categories divided by the number of enrolled students in that academic year

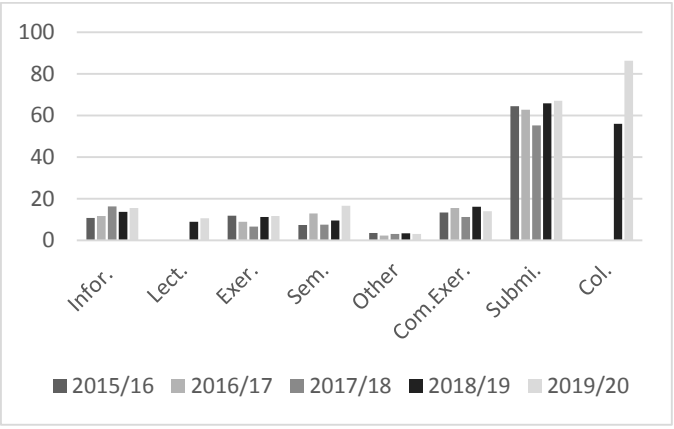

Figure 1. Activity per student and academic year. Source: Virtual classroom activity report from 2015/16 to 2019/20. University of the Basque Country.

to obtain the average profile of student activity per academic year. Figure 1 shows the evolution of this average profile. Types of resources state in horizontal axis and the vertical axis gives the number of logs.

The resources in the virtual classroom change every academic year to encourage student engagement. During the first three academic year of this study, the resource with the highest activity was the submission of solved computer exercises. This submission use the assignment activity module of Moodle. Students submit individually files with programs implemented in *Mathematica*, which solve the proposed computer exercises. When reviewing assignments, teachers leave feedback comments and assignments are graded using a numerical scale. Final grades are recorded in the gradebook.

For the academic year 2018/19, we included two collaborative tasks, which were developed in seminar sessions. It was not compulsory to participate, but faculty recommended doing it. The first collaborative task used the database activity module of Moodle and the participants had to create, maintain and search a collection of entries (i.e. records) related with *Codes and Cryptography*. The teacher defined the structure of the entries as a number of fields. Field types included checkbox, radio buttons, dropdown menu, text area, URL and/or uploaded file. The second one used the wiki activity module of Moodle. The students added and edited a collection of web pages with the solutions of the exercises proposed in seminar sessions. It was defined as collaborative, with everyone being able to edit it. A history of previous versions of each page in the wiki was kept, listing the edits made by each participant. These two resources increased the student activity. Indeed, 100% of enrolled students participated in these two tasks.

However, we detected that the wiki implemented in our virtual classroom was not suitable to write mathematics and the students required excessive time to obtain a good result. Moreover, the use of the database was not as useful as we had planned, because students did not look for additional information in the references of the database. Thus, for the academic year 2019/20, we have changed these two collaborative tasks and we have used the workshop activity module of Moodle. The students, divided in groups of 4-6 students, submit the solution of exercises proposed in seminar sessions in a file. Students, using a multi-criteria assessment form defined by the teacher, assess submissions. The process of peer assessment and understanding the assessment form can be practised in advance with example submissions provided by the teacher, together with a reference assessment. Again, although it was not compulsory to participate, 100% of students have participated. To increase the acquisition of competences, the teacher has given feedback of the proposed solutions. Two thirds of the students have consulted this feedback. Moreover, this new collaborative task registers the highest activity in the virtual classroom during 2019/20 and it is a maximum of the data for average profile. Nevertheless, this activity has not influenced in the activity in

the other categories. We also notice that the category with the lowest activity is "Other" during all academic years.

Furthermore, we have calculated the achievement rate per academic year for ordinary call (see Table 2). We notice that the inclusion of collaborative tasks in the virtual classroom can increase the acquisition of competences. Thus, the achievement rate has increased the last two years (see Table 2). Indeed, the rate in 2019/20 is the highest achievement rate.

Table 2. Achievement rate per academic year.

Academic year	Achievement rate
2015/16	60%
2016/17	42.59%
2017/18	65.38%
2018/19	68.08%
2019/20	85.11%

Source: University of the Basque Country.

4. Guidelines for instructors to design an effective virtual classroom

Based on authors' experience, few suggestions are proposed to make virtual classroom more effective:

- Include selected collaborative tasks in the virtual classroom to increase student engagement.
- Include resources with feedback or assessment to encourage student involvement.
- Include lecture notes, exercises and test or exam templates to facilitate student learning.
- Encourage the reading of additional lectures or papers by including an activity with student participation linked to them, such as a test or a short summary.
- A calendar with submission dates helps to plan student work.

5. Conclusions

The main conclusions drawn from the analysis of the students' reports in the virtual classroom of the elective course *Codes and Cryptography* and their outcomes are the following ones:

- The resources that involve that students submit personal work (such as: submission of solved exercises, participation in wiki, and assessment of exercises,…) are the ones with higher activity in the virtual classroom.
- The information that is included in the virtual classroom, but it is not assessed (such as: papers, additional lectures,…) does not generate interest among students.
- To include collaborative tasks in virtual classroom implies higher student engagement. However, student activity focuses on these tasks and it does not seem to be reflected in the activity registered in the other resources of the virtual classroom.
- The inclusion of collaborative tasks in the virtual classroom can increase the acquisition of competences and improve the achievement rate.
- A future action will be to include collaborative tasks in virtual classrooms for other courses and to compare them. Besides, the authors will design new activities related to the reading of papers and additional lectures to improve the students' interest for these resources.

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Helping tomorrow's social professionals to learn about social robotics

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Abstract

This paper identifies that social robotics and autonomous technologies will inevitably impact on the field of care for human beings. Those currently employed in caring roles, and those about to enter these roles, are generally ill-prepared to respond to this challenge: whether it is to develop the skills to work alongside such technologies or to critically engage with their development. The paper outlines a current Erasmus+ funded international project (PRoSPEro) that brings together social roboticists, educators, learners, practitioners and policymakers in order to develop, pilot, assess and deploy innovative pedagogical materials to address the gap in provision. It also describes a locally-generated learning opportunity within futures studies that facilitates learners to engage directly with these new technologies. The paper provides ideas for strategies and techniques to successfully engage learners from social science and therapeutic-based fields to engage with urgent contemporary technological issues.

Keywords: *social robotics; pedagogy; EU project; technology; innovation.*

1. Introduction

We are all touched by the health and care systems. As we age, we need more care, while the supply of many categories of health and care workers is failing to meet demand, due to demographic changes and other forces. Digital technology is now increasingly part of the provision of human services, but is often not well understood, in terms of technology, ethics, economics or systems. While technologists strive for constant improvement, professional practice knowledge and user perspectives are often underused in technology development, leading to failed innovations and missed opportunities.

Of particular interest has been the explosion in Human Robot Interaction [HRI]. Topics emerging from numerous global research centres include: artificial empathy; robots in education; robotics and human care; impact of gender and personality in HRI; anthropomorphic social robots and numerous other issues and applications (Vincent *et al* 2015). Notwithstanding a number of false starts and failed enterprises, such as the *Kuri*, *Jibo* and *Anki* robots, there continues to be substantial global financial investment in social robotics by major technology and electronics firms such as Toyota, Midea and Bosch.

Though not yet widely distributed in the field of care in Europe, the development of social robotics continues apace, with numerous examples now in prototype or production stage. Application is a current reality in, for example, the fields of dementia (eg *Paro*); autism (*Nao*), early years education (*Cozmo*), companionship for children in long-term hospital stays (*AV1*), and care of older people more generally (*Mylo*) (Fig. 1).

AV1 Cozmo Mylo Nao Paro

Figure 1. Some social robots currently in production and use, in care and education settings

2. The social significance of social robotics

Social professionals must engage in social analysis of these novel technologies. There is now extensive discussion of the social shaping of robotic technologies (Markoff, 2015; Broussard, 2018) and of their impact at global, community, workplace and individual level (Vincent *et al*, 2015; Willcocks & Lacity, 2016; Kiggins, 2018). Researchers offer widely diverse assessments of the impact of autonomous and robotic technologies, but most see a

significant technological shift, with future societal impacts that exceed those of other recent and contemporary technologies. This 'technological determinist' view (Neven & Leeson, 2015, p. 85) prevails in writing about robots and society. A smaller literature exists on how these technologies have been socially and culturally shaped (Sone, 2017) and there is less still on 'mutual shaping' processes at play (Neven & Leeson, 2015; Winkle *et al*, 2019).

Driven at least partially by such analyses, there is a strong view that societies should explore adapted or new types of institutional innovation, such as codes of ethics, laws, regulations and regulatory regimes, to manage, regulate and ultimately control these developments. Technologies already developed and applied (such as certain types of algorithmic decision-making; the widespread use of some social robots) have already led to important concerns over regulation and have raised key ethical challenges (Eubanks, 2018).

3. The challenges for social professionals

These novel technologies will 'augment' the work of social professionals, such as social pedagogues, social care practitioners, aged care workers, social workers and early years practitioners and occupational therapists, but little thought has been given to the impact on their everyday tasks, career development and professional identity; less to how these challenges can inform professional formation, including curriculum content; pedagogy; and regulation and professional standards of proficiency (Share & Pender, 2018).

Like any technology, robotics will not be neutral in its social impacts. The field is highly gendered: most robotics researchers (with important exceptions) are male and located in the global North; those involved in the delivery of care remain predominantly female, often drawn from the global South. Those in receipt of care - such as those with dementia, young children or those on the autism spectrum - are often the most vulnerable in our society. It will also be important to be sensitive to intended and unintended broader social impacts.

4. The challenges for social professional education and training

Despite these incipient trends and developments, educational programmes designed to train and educate the social professionals of the future rarely prepare graduates for the technology-infused future that they will encounter. No such programme in Europe specifically exposes students or current social professionals to the reality of social robotics development. The educators, for their part, do not necessarily have the materials, access to robot technology or the pedagogical tool-kits to comprehensively address this issue.

Social professionals' skills are often shaped through educational programmes based on social sciences (sociology, psychology, education); creative arts (drama, visual art); health and therapeutic knowledges; communicative skills and people management. Typically,

their formation does not expose social professionals to autonomous technologies, such as algorithms, AI and social robotics. They may thus be ill-equipped to encounter them in the workplace or to contribute to related policy-making, implementation or regulation.

We have conducted (2017-2018) three focus groups with social professional educators and students that reveal strong interest, but little knowledge, in the field of social robotics and care; reinforced by participants (n=80) at an international symposium in Sligo, Ireland (Nov 2017). This finding has been further supported by a subsequent (2019) focus group with physiotherapists within a hospital setting in the North West of Ireland (unpublished data).

5. PRoSPEro

In response to this gap, we initiated the PRoSPEro project (Pedagogy of Robotics for the Social Professions in Europe)(Project 2018-1-IE02-KA203-000611). PRoSPEro links the education and training of social professionals to the latest research developments in social robotics. It involves partnerships across Europe (5 countries) between social scientists and roboticists; HEIs and local municipalities; service users and care-providers; and amongst teachers, students, practitioners and policy-makers. It seeks to create a transdiciplinary learning community that draws on experienced educators, cutting-edge robotics researchers, practitioners and learners to co-create the necessary pedagogical responses.

The project seeks to identify, operationalise and practice key skills and competencies for working with social robots. It trials a range of educational interventions and resources to explore how best to facilitate the social professionals of the future to learn about future technological challenges. It explores user-centred design and co-creation of social robotic solutions. Outputs of the project will include: development of scoping reports in key areas; a position paper on ethical issues; intensive workshops that involve access to existing social robots; a participatory design workshop to include social robotics researchers, social scientists, students, practitioners and policy-makers; development of effective pedagogies to facilitate learning about social robots. It will combine these approaches into two (1x20; 1x10 ECTS) module descriptors for use in social professional education anywhere.

6. What have we achieved already?

We have sought to organise this complex field through the completion of five scoping reviews: on defining social robots; ethics; regulation; pedagogy; and key trends and statistics. We have developed two small-scale workshops (Aarhus, Denmark and Valencia, Spain) that have drawn on the direct social robotics experience of one of the partners: the 'Emily' robot baby as deployed in Danish family services. Aarhus participants identified that perhaps humans can learn something about the concept of 'care' from using robots,

that to imagine 'robot-provided care' forces us think of the essence of care and the uniqueness of being a human. We must think about and deconstruct how human-to-human care may be better than robot-to-human care. These are important and deep-seated ethical issues that are inherent in the topic and that will help to shape future pedagogies.

When the workshop was repeated in Valencia (a large group that included trainee teachers, computer science students and local government personnel), other important concerns arose: for example the surveillance involved in the use of the 'robot baby' to assess the parental capacity of vulnerable young people. The physical presence of the 'robot baby', as it was passed around the classroom, was an important element in the learning process

The next scheduled activity is a Design Workshop hosted at the University of Twente Design Lab. This is aimed to be a highly interactive and exciting experience, that brings together cutting-edge researchers with other participants such as care workers, health professionals, policymakers and students from a variety of European countries.

All of these outputs will be actively disseminated through the digital platforms, multiplier events, relevant media and policy briefs and meetings with education and practice regulators. The materials will be enduring as they will be maintained on a permanent project website (prospero.via.dk/en) and through EPALE (https://epale.ec.europa.eu/en). The overall result will be to develop a trans-European social robotics/care knowledge base amongst social professionals, educators/students, regulators and citizens more broadly. Participants' skills and competences will develop, and they will also develop as citizens who are more engaged (in a critical way) with important and disruptive technologies.

7. Engaging with the project locally

In order to leverage the impact of the EU-funded PRoSPEro project, locally-based pedagogical initiatives in relation to autonomous technologies in care are being designed and piloted. One of the authors has been delivering a futures and foresight elective module 'Futures of care, society and welfare' to social care practice and early years education students since 2004; to our knowledge, the only module of its kind offered in Irish higher education. Futures studies broadly seeks to posit 'possible, probable and preferable futures' (Bell, 2005). Originating in the aftermath of World War 2 (Winthorp, 1968; Cornish, 1977), futures studies has intellectually evolved significantly, as has the application of many innovative futures methodologies directed at a plethora of post-industrial societal issues and challenges (Slaughter, 1996; Dator, 2019). It draws upon sociology, economics, politics, psychology, anthropology, and science fiction narratives (Son, 2014).

Students undertaking the module experience a lecture programme spanning 13 weeks/26 hours of contact time. Lectures unpack the building blocks and historical contexts of

futures studies including an immersion in foresight and forecasting methodologies that evolves to incorporate critical explorations of issues as diverse as the futures of food; education; health and genetics; artificial intelligence (AI) and social robotics; politics and economy. It considers wider assessments of the abilities of advanced societies to sustain welfare provision to vulnerable groups in the contexts of ageing demographics and the ongoing challenges of a global climate crisis and rapid technological change.

Related to the trends in technologies of care outlined above, and drawing on the availability of social robot examplars (*Nao*, *Paro* and *Cozmo*), the assessment strategy for the module was redesigned in early 2020. Learners will be facilitated to demonstrate their awareness of the function, purpose and possibilities of social robots in their anticipated future world of care work. They must also effectively communicate and share their knowledge to carefully selected health and social care audiences.

To this end, learners have been presented with an assessment brief grounded in de Castell's (2010) 'pedagogies of production' teaching and learning philosophy. This offers a multidisciplinary and multimodal array of learning opportunities: 'where learning actors are supported to engage real-world research challenges and design competences, using real-world tools'. It reflects a constructionist rather than an instructionist paradigm of learning (Yanez *et al* 2019, p.31). *Learning by doing* enables learners to create authentic artefacts that are presented to 'authentic audiences' selectively invited to participate in and share knowledge production (Thumlert *et al*, 2015). It empowers learners to use real-world technology tools 'instead of curricularized surrogates' (Yanez *et al*, 2019, p. 32).

The assessment strategy requires learners to form action learning groups (ALGs) of no more than four members. Each ALG has been advised to identify a social robot or AI entity that members have little or no knowledge of. They must undertake substantial research in order to develop and present an interactive workshop on the futures of care to an audience with little or no prior knowledge of the artefact or its situational functionality. This may involve new ways of using, adapting and/or significantly modifying an existing social robot or AI entity. Learners will be provided with two master classes on approaches to design and user experience and on how to develop affective AI applications.

The learner-led workshops will facilitate the production and dissemination of new knowledge about how social care/early years education undergraduates acquire knowledge and understanding about social robots/AI. They will develop the ability to effectively communicate this knowledge to their peers taking cognisance of the following:

- what is the purpose of the identified social robot/AI algorithm and what care need(s) has it been designed to address?
- what evidence base have the developers drawn up?

- how has the social robot been received by (a) end-users; (b) service providers?
- how would you assess and evaluate the design and user-friendliness of the social robot/AI algorithm from an end-user and an overall perspective?
- how is the technology being marketed - are there any design/UX issues?
- are there issues that would inhibit the acceptance of the social robot/AI algorithm among service providers? What might these issues be?
- what type of knowledge/understanding do care providers require to effectively co-work with a social robot/AI algorithm?
- what pedagogical framework could be designed to effectively deliver a one-hour *learning from demonstration* (LfD) training session to a group of health and social care participants on the application of a selected social robot/AI algorithm?
- what resources/supports will be required to deliver this training session?
- how might workshop audiences be encourage to actively engage in the co-production of knowledge wider participation in the workshop?

8. Conclusion

We have identified that social robotics and autonomous technologies will inevitably impact on the field of care for human beings. Those currently in paid (and unpaid) caring roles, and those about to enter these roles, are generally ill-prepared to respond: whether to develop the skills to work alongside such technologies or to be able to critically engage with their development (which may mean mobilising to reject them). We have briefly outlined an Erasmus+ funded international project (PRoSPEro) that is bringing together roboticists, educators, learners, practitioners and policymakers in order to develop, pilot, assess and deploy innovative pedagogical materials to address the gap in provision. In association with PRoSPEro, we have sketched out a locally-generated learning opportunity that facilitates learners to engage directly with these new technologies. We do not know what the future will bring, but we are taking active steps to provide the social professionals of the future with the critical tools to respond, assess and ultimately help to shape it.

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ICT and Accounting Education. An innovative teaching method: the Practice Enterprise

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Abstract

The training of future accountants also needs to take into account the changes which have taken place in the accounting profession following profound transformations at economic level. Most of all, however, it should promote a teaching approach which manages to go beyond traditional frontal lectures in order to facilitate active learning. For all these reasons, the various accounting education syllabuses should be integrated with the use of ICT, thus helping achieve skills which are considered fundamental for employment purposes. These include problem solving, decision making, and team working, which is what the literature about accounting education continuously suggests. This paper is dedicated to discussing how all this can become possible through what is known as the Practice Enterprise methodology. The latter allows students to get to know the company by shaping it, as well as to apply accounting disciplines in a proactive and involved manner, making use of the most advanced ICT tools. The intent of this paper is also to show, also through research outcomes, how this method can reshape the teaching of accounting and allow for students' training in an environment where they can apply effectively their theoretical knowledge and thus develop new knowledge, skills and competences.

Keywords: *Accounting Education; Active Learning; ICT; Pracitice Enterprise.*

1. Introduction

There has been much debate in literature about the need to go beyond the traditional way of teaching disciplines related to Accounting Education in Universities, using more innovative methods based on Active Learning. In this regard Osman S.Z.M *et al.* (2014), among many others, have underscored the importance of involving students in the achievement of results; on the other hand, Prince (2004) has given his own contribution by highlighting the concepts of *collaborative and cooperative learning*. Active learning and teaching by competences go hand in hand towards outlining a quantum leap in the training of accountants, being aware that the latter cannot merely be based on conventional theoretical backgrounds, but should also be aimed at achieving skills which are considered fundamental for finding a job. These are: *team working, problem solving, decision making, critical thinking, communicative skills, autonomy and responsibility*. These are actually the indications given by the Dublin Descriptors in December 2004 which have implemented the Bologna Process. At the same time a more active role on the part of the student is acknowledged, and the competences mentioned above can be achieved more effectively by using the new ICT tools. The latter are the drivers of the main changes which are occurring on a world scale. According to Elsadaani (2015), economic development relies on ICT, therefore it is necessary to prepare students for its use in an advanced way throughout the academic pathways followed. The job of accountants itself has changed and diversified, to the extent of being unable to do without new technologies. This study includes a presentation of an active learning method – the *Practice Enterprise* – where use is widely made of ICT to show hos their use can help renew the teaching of accounting and prepare undergraduates in the best way for changes in the accounting profession.

2. Theorethical Background

One of the elements in common between the different approaches followed by authors who have studied this topic is the acknowledgement of how difficult it is for training systems to keep in step with the changes which have taken place in the accounting profession, caused in turn by economic transformations at social level. Albrecht *et al*. (2000), in a survey conducted in the USA, highlighted the difficulties for traditional lecturing to encourage critical thinking in would-be accountants and to use concrete approaches to apply the theoretical concepts that are being presented. Howieson, (2003) pointed out that "despite the changes underway and those expected in business practice, accounting still seemed to be mostly taught as part of a format which consisted in a long series of lectures, exercises and workshops based on independent topics and associated with technical matters, totally unrelated to other similar disciplines, with little effort being made to establish connections between abstract concepts and what happens in the real world." According to Rhodes (2013), accountants' training has not been adjusted to changes in the profession itself, which is why it needs to be integrated

with ICT in order to fill this gap. It is the opinion of Baharun *et al.* (2006) that accounting education needs to be reformulated in order to include competences related to ICT. According to Jebeile *et al.* (2010), the use of ICT for training accountants can help develop a learning environment which fosters the achievement of important competences such as communication, interpersonal skills, as well as critical and analytical thinking. In the view of Veneziani (2016), it is essential to introduce, as part of the training of accountants, specific courses on ICT, and "to combine the traditional frontal lecture with active methods aimed at developing skills and soft skills". It is the opinion of Wessesls (2007) that the gap between the competences of graduates in accounting and the requirements of the profession is due to the limited use of software packages during their course of studies. One of the purposes of this paper is to prove that it is necessary to go beyond a separate use of these software systems, to make sure that their integration results in a learning environment where the new technologies which are being used allow for sharing information, processing data and making them available to students so that they can apply as effectively as possible their theoretical knowledge, thus developing new knowledge, skills and competences.

3. The Practice Enterprise (PE) in Accounting Education

Among the active learning methods in Accounting Education, aimed at promoting the skills which have been outlined in section 1, those based on simulation seem to be the most effective. The latter range from Business Games to what is known as Practice Enterprise. PE reproduces the actual way of operating of a company in respect of corporate organisation, environment, relations and objectives, presenting the main functions in the company, most notably *administration, human resources, sales*, with each of the students being assigned a specific job, which is expected to be as close as possible to what happens in the real world. The PE method has become widespread in upper secondary schools and in various Universities at international level. There are currently 7,500 PEs which have joined the Europen-Pen International global network. Managing a virtual enterprise as if it were real, allows for an understanding of how it operates, its organisation, the relation between the various management areas, with a view to using the accounting IT system in a unified manner, fully grasping the logic and purposes of company operations. As part of this innovative simulation space, according to Gualdi *et al.* (2015), the student is expected to interpret the various events within the company from different perspectives, as well as to take over different roles depending on the performances required, in order to gradually become more aware of their learning process, building knowledge through collaboration processes facilitated by the internet. Moving from the classroom to a workshop, for Veneziani (2012), means going beyond the "talk and chalk" approach to the topics dealt with, thus favouring a new way to learn about accounting.

4. The PE organisation and ICT

In a workshop dedicated to PE, students are called upon to perform the same management tasks as in a real company, from incorporation to company management, including virtual manufacturing and trade in goods and services, possibly until the business is wound up. As part of this experience, according to Bianchi *et al.* (2014), the student is expected to abide by all legal formalities, mandatory tax and accounting deadlines, to become familiar with paperwork, management software and communication procedures, which are commonly used in a company. All this is done with the indispensable support of ICT. The IT system is actually a pivotal point where management transactions are recorded to produce documents which include statements of accounts, balance sheets and the necessary data for control and planning in the company. The software used is generally the same as in real companies. If company operations are limited to bookkeeping, a dedicated software might be sufficient; on the other hand, as is usually the case, if the idea is to train students in all aspects of accounting, including management control, human resource administration, treasury management and auditing, then specialized software systems are required, each of which will need to be integrated within the company's IT system. Training students through the use of virtual enterprise technologies, results in a quantum leap in terms of learning about them. The use of ICT tools helps make students accountable for entering data in the company's IT system, searching for possible errors, consistencies and correlations, moving towards a learning approach focused on problem solving. Acording to Krishna (2007), students are expected to "use technology as a tool aimed at searching, organising, assessing and communicating information". It is clear that actually managing a company's IT system to produce financial statements is different from knowing about how the latter are drafted; as a matter of fact the process leading to the production of financial statement involves the ability to deal with accounting issues, conduct surveys, make assessments, consider the company as a unified system, and – last but not least – deploy adequate mental flexibility. In each of these phases the exercise of critical knowledge is stimulated, as well as an approach based on seeing the company as a system where all the sectors in which it is organised contribute to defining the results to be achieved. The accountants' training process begins by entering in the IT system the business plan, and a budget for the business period. This is followed by management operations, the latter include purchases, sales, collections, payments, corporate financing, the cost of staff, fiscal transactions, etc… during this phase the student needs to be able to select all relevant paperwork for accountancy, to record them correctly under general and analytical accounting and to regulate them financially, according to the deadlines, as well as meeting mandatory legal requirements. In each lesson the student is called upon to verify the accounting situation and to check in real time that the books are being properly kept, to point out any error, ascertain the consistency of all transactions which have taken place, as well as allow other offices and departments to get the necessary information for their own activities. The reporting

and auditing activity takes place through a continuous comparison between accounting data and those required for budgeting purposes. The accounting process ends with the drafting of the financial statements, after having calculated the taxes due from the company. As regards using the PE in the Accounting sector, in respect of other departments, reference is made here to research (Benvenuti 2019) carried out on the basis of a questionnaire filled in by 137 students at Bologna University di Bologna, Scuola di Economia, Management e Statistica in Forlì and by the Department of Economics in Parma, who have attended the respective PE courses in the Academic Years 2016/2017, 2017/2018 and 2018/2019. Each student was asked five questions regarding what had been learnt in each office, in respect of knowledge acquired and issues encountered. Each of them could be assigned a score between 1 and 5, based on the relevance of the results which the respondent felt had been achieved.

A comparison between the deviation of survey results in the various deparments and the average values produced the values summarised in fig. 1.

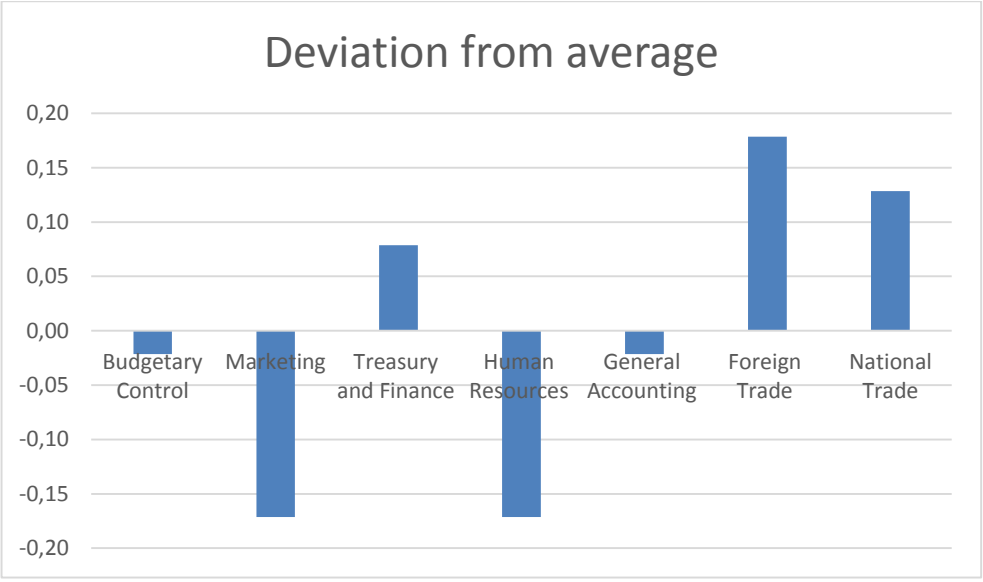

Figure 1. Deviation from average of students' self-assessment of learning outcomes.

It appears that the smallest deviation from average refers to the Accounting, Management Control and Treasury and Finance offices. Marketing and Human Resources show the most negative deviation, while the deviation for Italian and Foreign Trade is positive. Students attending marketing units were mainly involved in designing the company's websitesi, the sales strategy, as well as the products and services to be offered. A theory, confirmed by interviews with participants, is that in departments with the highest deviation values, the objectives assigned to students were not as clear as those in offices supported by a dedicated

software, specifically Managemetn Control, Treasury and Finance or Accounting. On the other hand, the Italian and Foreign Trades units, with the most substantial positive deviation, share a direct perception of the results of the results of their work through the contact with customers and a positive trend of the market tresponse registered every time products and services are launched (Bianchi 2020).

This theory is confirmed by the answers which students have given in respect of the improvement of their knowledge.

As regards Accounting functions, which are developed in the PE for *General Accounting* and *Management Control* students have pointed out the following:

1) General Accounting

At the end of the course, the 25 students who worked in this department have awarded the highest score (4,4) to *improving the knowledge of the subject* and to *more solid preparation* (4,3). More specifically, this has been achieved thanks to the use of software (4,4) which has allowed for *better understanding of the financial statements* (3,2). The increased knowledge and skills have resulted in the *ability to assess corporate trends through an evaluation of the accounting situation* (3,5); on the other hand, with regard to theoretical knowledge, the learning outcome has involved making it easier *to select the most relevant transactions and paperwork from a bookkeeping perspective* (3,8).

2) Management Control
   a) The self-assessment by the 15 students who worked in this office, has led to concluding that there has been a marked *improvement in their knowledge of management control* (4,6) and *a more solid preparation* (3,8). More specifically, this experience was considered useful to establish a *clearer relationship between general financial accounting and management control* (3,3). The greatest difficulties were encountered in *managing dedicated software* for management control (3,5), and in connecting financial statements with the budget (3,4). As regards the improvement of their knowledge, this translated into *better understanding of the accounting process: general accounting measurement, control, analysis of deviations, redrafting the financial budget* (3,7). These results confirm that using in the PE some form of dedicated software for Accounting purposes leads to positive results, altough this is still true only to a limited extent in other corporate departments.

5. Conclusions

In this paper an attempt has been made to prove the need that traditional frontal lectures for Accounting Education should be complemented by more proactive methods, based on the

centrality of the student and better able to achieve the skills which are most sought after on the workplace. At the same time the importance of adding ICT as part of academic curricula for accountants has been highlighted, in order to adjust the training of the latter to the changes which have been taking place in the accounting profession. Regarding the various active learning methods, the main focus here has been on PE, which allows the student to get to know the company by participating in it and applying the theoretical contents acquired in a setting which reproduces the phases of corporate management. The use of ICT for the purposes of this training experience is essential and concerns all aspects of accounting. The latter can avail itself of a corporate IT system where accounting is the pivotal point for all operations. It allows students to gain first-hand knowledge of the tools used in the accounting profession, to share information, data and documents with other students in the course, which results in the development of *team-working, problem-solving and decision-making*, skills which are strongly recommended by scholars, accountants' associations and operators in the business world. At the same time the management of the company's information system through ICT makes it possible for students to expand their knowledge through analysis and critical assessment of the operations which are implemented, as well as to have a unified vision of the company. This is indeed a distinctive trait of the PE method, which can easily allow for the expression of the effectiveness of ICT use in order to train future accountants.

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European Joint Doctorates: myth or reality?

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Abstract

Today, there is a lack of consensus for the full implementation of common programmes recognizing the "highest" level of higher education in Europe. Even though cotuttelle agreements are widely used for international joint supervision of PhD theses, these are merely bilateral and individual case-based agreements, far away from a real joint degree under a legal framework that establishes the programme. This article aims to describe the experience of the authors in the management and coordination of a joint doctoral programme between 2015 and 2019 and the results obtained from the interrogation of official websites about the reality in Europe concerning such programmes. Our conclusion is that, still in the 21st century, there is a huge gap to be overcome before the existence of Joint International/European Doctorates can be considered an everyday reality. Although various attempts have been made in the last 20 years, there is still a long way to go for Higher Education institutions to integrate all aspects of such programmes, and to make them something more and different than an additional Diploma Supplement. In the authors´ opinion, major efforts must be made by the administrative bodies, although the drive of the academic staff is crucial for success.

Keywords: *European/International Joint Doctorates; Erasmus Mundus; Marie-Sklodowska Curie ITN; European Higher Education Area.*

1. Introduction

Starting in 1999, with the launching of the so called "Bologna Process"[1], and continuing in 2010, with the implementation of the European Higher Education Area (EHEA), different strategies have been followed by the European Commision (EC) in order to promote the development of common programmes within the three cycles of the University educational system: Bachelor's, Master´s and Doctorate. The high success of one of these strategies in the first cycle degree (Bachelor's), regarding the establishment of the joint credit system, can be inferred by the number of undergraduates studying abroad every year under the umbrella of the European Region Action Scheme for the Mobility of University Students (ERASMUS). This is, indeed, the EU's flagship programme for education, training, youth and sport and, according to the 2018 evaluation report (European Commission, 2018), the programme funded learning mobility for more than 4.3 million young people between 2007 and 2016, aiming to reach 1.8 million additional individuals 3 years later. Although not initially conceived as a mechanism to achieve joint degrees, the reality is that the implementation of the joint credit system (ECTS) has allowed students from the 48 countries subscribing to the agreement, to combine, in their curricula, subjects learned in different universities and, at the end of the course, all of them are reflected in one unique degree awarded

As for the second cycle (Master´s), it is also very frequent for students to acknowledge Erasmus opportunities, mainly those for traineeships abroad (more than 880.000 practitioners were funded in the same period 2007-2016) but also those included in the Erasmus Mundus Joint Master Degrees (EMJMD)[2], with a total of 127 programmes being offered in the academic year 2020-21[3] and more than 18,600 Master's scholarships funded from 2004 to 2015[4].

In contrast, at the Doctoral level, there is still a lack of consensus regarding the full implementation of common programmes recognizing the "highest" level of higher education. Even though the cotuttelle agreements are widely used for international joint supervision of PhD theses, these are merely bilateral and individual case-based agreements, between two specific centres for a specific thesis, and far away from a real joint degree under a legal framework that establishes the programme. Hence, the European Joint Doctorates, first

[1]European Higher Education Area and Bologna Process. Retrieved January 20, 2020, from http://www.ehea.info/.

[2]Erasmus Mundus Joint Master Degrees - European Commission. Retrieved January 20, 2020, from https://ec.europa.eu/programmes/erasmus-plus/opportunities/individuals/students/erasmus-mundus-joint-master-degrees_en

[3]EMJMD Catalogue - European Commission. Retrieved January 20, 2020, from https://eacea.ec.europa.eu/erasmus-plus/library/scholarships-catalogue_en

[4]Joint Programmes: the story of Erasmus Mundus – Blog. Retrieved January 20, 2020, from https://www.eaie.org/blog/joint-programmes-story-erasmus-mundus.html

included by the EC in the Erasmus call (until 2013)[5] and later moved to the Marie-Sklodowska Curie (MSC) actions (namely MSC-ITN-EJD since the launchiof the Horizon 2020 call), were created with the objective of "promoting international, intersectoral and multi/inter-disciplinary collaboration in doctoral-level training in Europe through the creation of joint doctoral programmes, leading to the delivery of joint, double or multiple doctoral degrees"[6].

According to the definition on the EC portal[6], a joint degree is "a single diploma issued by at least two higher education institutions offering an integrated programme and officially recognised in the countries where the degree-awarding institutions are located". In contrast, a double or multiple degree refers to "two or more national diplomas issued by two or more higher education institutions and recognised officially in the countries where the degree-awarding institutions are located". That is, while in the joint degree an integrated structure is implemented at the academic and administrative level, in the double or multiple degrees this does not happen, with the degrees being merely officially recognised by 2 or more institutions.

Bearing in mind that the total EJD programmes under the Erasmus Mundus framework funded 1400 doctoral fellowships between 2004-2015[4] and that the MSC actions have subsidized approximately 10 programmes per year since 2014, with a maximum of 15 scholarships per programme (900 students in total), we could infer that, in the last 16 years, a total of 2300 students could have been awarded a Joint PhD degree. But the question remaining is: how many of them really got a joint diploma and how many, having followed an international, intersectoral, multi/inter-disciplinary, highly prestigious and integrated study programme ended up with a double or multiple degree? Even more, assuming that the majority of them have got a double or multiple degree instead of a joint degree, which are the reasons for such a paradox in the framework of European funded projects? Are the causes related to the difficulty of academic staff to agree about the acquisition of competences by the students, or are they more administration- related issues?

The following text will try to respond to these questions from the experience of the authors in the management and coordination of one such MSC-ITN-EJD programme between 2015 and 2019.

[5]Erasmus Mundus Joint Doctorates & PhD opportunities. Retrieved January 20, 2020, from https://www.em-a.eu/en/erasmus-mundus/erasmus-mundus-joint-doctorates.html

[6]Single Electronic Data Interchange Area - European Commission. Retrieved January 20, 2020, from https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/msca-itn.

2. What can be learnt from the previous experience of the Erasmus Mundus doctoral programmes?

A systematic search performed on the 41 EMJDP included in the list available from the European Consortium for Accreditation (ECA[7]), showed that just 13 of those programmes (32%) proposed to award a Joint Degree to their graduates (Table 1). Programmes indicating the delivery of Joint/Double degrees under co-tutelle modality have not been included since, as previously explained, this structure does not correspond to the definition of a Joint degree. These data do not indicate that all of them had this objective, but it shows that a low proportion of the funded EMJDP considered, at the time of the proposal submission, that a Joint Degree was a viable option. Information about MSC-ITN-EJD has not been found nor, to our knowledge, is available at public official websites.

3. The European Joint Doctorate in Biology and Technology of Reproductive Health: a history of successes and failures.

3.1. Origin and Structure of the Programme: REPBIOTECH is funded by the EC

The European Joint Doctorate in Biology and Technology of Reproductive Health (REPBIOTECH) was initiated in 2016 under an agreement signed by 5 European Universities. It was the direct consequence of a compulsory deliverable required by the MSC-ITN-EJD grants, but it was, at the same time, the result of years of collaboration between scientists enrolled in the proposal whose origins were established in a former Master's Degree Programme developed by the coordinating institution. After years of student exchanges, visits by academics and researchers, and common publications, the proposal for a Joint Doctorate was being shaped and was first submitted under the EMJDP call. It was rejected and, the next year, this call was no longer launched. Therefore, the project was modified and adapted to the MSC-ITN-EJD call and got funded at the second attempt.

REPBIOTECH was always designed to fullfil all the "musts" to become a Joint International Doctorate according to the definition given by de Rosa (2010) that included issues regarding a) Administration and Management, b) Training and Structure, and c) Quality Control and Evaluation System. As has been said, the consortium was composed of 5 European Universities acting as factual beneficiaries, although the 10 associated partners involved played a role very similar to that of the beneficiaries. They consisted of 7 leading academic research groups and 3 private companies from 9 different countries: Spain, France, Ireland, Italy, Belgium, Germany, USA, Japan and Netherlands.

[7] http://ecahe.eu/w/index.php/Erasmus_Mundus_Doctorates

Table 1. Doctoral programmes funded under the Erasmus Mundus call aiming to deliver a Joint Doctoral Degree to their graduates at the time of the proposal application.

Programme	Comments about the degree awarded
AgTraIn	It is the ambition of the AgTraIn programme to issue joint degrees as soon as the national legislation allows it, in order to truly reflect the integrated nature and common rules, management and quality criteria of the programme. http://www.agtrain.eu.
ETeCoS3	Successful completion of the PhD programme will be awarded a fully recognized and accredited joint Doctoral Degree in Environmental Technology.http://www.internationaldoctorate.unicas.it.
EUDIME -	The successful candidates will be awarded a fully recognized multiple and/or a joint degree issued by three consortium institutions (Home University and two Hosting Universities), completed by a diploma supplement. http://eudime.unical.it.
EUROSPIN	Each PhD candidate will pursue an interdisciplinary research project leading to a joint or a double PhD degree from two universities. http://www.kth.se/en/studies/phd/joint-doctorate/eurospin.
SETS	Their research is conducted in at least two of the three universities awarding the joint degree. http://www.setsjointdoctorate.eu.
SMDTex	The national PhD degrees of the three involved countries will be delivered to each student after the success of his/her final examination. Based on the experience of this programme, a joint doctorate degree will be developed around 2016.http://smdtex.ensait.fr.
IDEALAB	To make clear reference to the joint doctoral training of the partner universities, there are common application and selection procedures, common quality assessment and programme monitoring, a joint curriculum and a common research training programme cumulating in a joint degree. http://em-idealab.com
TEEME	Joint degrees will be awarded to TEEME candidates by Kent, FU Berlin and CU Prague. http://www.teemeurope.eu/.
EMJD-DC	EMJD-DC will initially award double degrees; however, a task will study pathways to the implementation of a Joint Degree. http://emjd-dc.eu.
MACOMA	http://www2.uca.es/serv/catedra-unesco/erasmusmundus/macoma/index.htm.
NeuroTime	Each PhD candidate will perform a research project in collaboration between two or three partner institutions. The Universities of Amsterdam, Strasbourg, Jerusalem and TIFR-deemed University of Bangalore deliver a Joint Degree. The universities of Basel and Freiburg award double PhD Degrees (unless a new agreement about Joint degree is signed before the end of the PhD period). The title of the PhD degree will include the official titles of the respective universities, with the mention "Joint Degree" or "Double degree". http://www.neurotime-erasmus.org.
SMART	Successful completion of the PhD programme will be awarded a joint and double Doctoral Degree in River Science. https://www.riverscience.it/.
LAST-JD	The partners deliver a joint degree between four partners and a double title with the other. http://www.last-jd.eu .

As mentioned in the Horizon 2020 Work Programme 2014-2015 (legal framework of the REPBIOTECH application), "enrolment in a doctoral programme and the creation of a joint governance structure - with joint admission, selection, supervision, monitoring and assessment procedures" was mandatory for the EJD modality. Therefore, to fulfill these requirements and for the joint supervision of the 15 PhD students enrolled, a joint governance structure was designed to enable smooth management and coordination of all the aspects of the programme with a minimum of bureaucracy. Specifically, three main committees were established:

1) Supervisory Board, responsible for the fairness of the selection process, the final admission of the candidates, the assignment of the supervisors and research topics and the assessment of the quality of the PhD process. This board included one member of each beneficiary and partner organisation plus two second-year students.

2) Progress Committees (PC, specific for each student), responsible for the quality of the research and the guidance of the students during the entire length of the programme. These Committees included at least two external advisors from institutions not affiliated with the consortium, in addition to the supervisors and the advisors from the institutions where additionals mobilities were going to be carried out. The compostion of the PCs was decided at the very beginning of the project (kick-off meeting).

3) Thesis Committees (specific for each student), the final jury in front of which each graduate defended his/her thesis. It was arranged according to the European PhD or Doctor Europaeus/ Europaea rules originating from an informal initiative in 1991 and adopted on June 23rd 1993 by the Confederation of EU Rectors' Conference (now EUA, European Universities Association), but with some modifications, such as the requirement to have a minimum research period of at least one trimester in another European country (6 months in REPBIOTECH, and at least in 2 different countries, from any part of the world).

In addition, the governance structure was completed with the Coordination Management Team, responsible for communication with the European Commission, and the Work Package Leaders, in charge of the research coordination and decisions regarding each Work Package. Also, all partners signed a Consortium Agreement with detailed issues related to administration, intellectual property rights, the management adopted, training policies, mutual recognition of joint PhD degrees, conflict resolution, gender equality policies, recruitment strategies, and in general any term that they should respect.

3.2. Problems with the Implementation of the EJD

Not only were the scientific objectives and the necessary networking activities in each of the 15 REPBIOTECH theses to be developed clearly established and smoothly accomplished from the very beginning, but also the administrative issues with regard to contracts,

secondments, research costs and mobilities were agreed by the 5 institutions without noteworthy problems. However, there were, indeed, many stones along the way through the EJD that are classified below, according to the 6 main obstacles identified by de Rosa (2010):

3.2.1. Confusion in terminology: this was a main issue among the staff involved in the project, especially the differentiation between the concepts of double, multiple and joint degrees. While initially, during the proposal preparation, all the academics and administrators seemed to talk the same "language", this became a fallacy as the project developed. The already mentioned article by de Rosa (2010) as well as Annex 2 in the report of Aerden & Lokhoff (2013) are highly enlightening in this context and its reading is recommended to avoid such misundertstandings.

3.2.2. Resistance towards joint doctoral programmes among academics, departments and faculties: in our case, this obstacle did not appear at the academic level, perhaps due to the long history of previous collaborations between participants and the mutual trust that prevailed above any other question. In fact, such enthusiastic conviction was transmited towards further hierachies at the University structure, including departments and faculties. The general perception was that most of the European Universities are, today, in agreement about the need (and benefits) of internationalization and this type of programmes are really useful to reach these objectives.

3.2.3. Lack of funding for long-term sustainability: this has become a major issue once the EU grant ended. Only one of the 5 Universities has continued enrolling new students in the programme and another has decided to discontinue awarding the joint degree for students enrolled outside the initial grant period. Although new proposals are being submitted, the dependency on external funds is something that Universities have assumed as normal and puts the sustainability of the EJD at risk.

3.2.4. Different status of doctoral candidates (student or employee) in different institutions: this obstacle did not happen in the framework of REPBIOTECH because all of the students were hired by the hosting Universities according to their national legal requirements.

3.2.5. Legal framework: as inferred from the above issues, the legal frameworks of the 5 institutions awarding the joint degree were highly varied, as shown in Table 2. Some legal frameworks did not allow their Universities to award joint degrees, while other legal frameworks limited the award of a degree to those students that had actually studied at that institution. For this reason, one group of 3 institutions agreed to award a common joint degree while the other group awarded student-based joint degrees, similar to the traditional co-tutelle agreements.

3.2.6. Lack of experience/expertise: this was also a repetitive aspect throughout the whole project, mainly from the administration side, since every new matter arising needed to be

studied at different levels. In contrast, no scientific or academic issues arose, since all the supervisors were experienced researchers with a long track of international scientific cooperation and history of PhD students successfully graduated.

Table 2. Summary of the legal situation about Joint Doctorates at the 5 Universities awarding degrees in REPBIOTECH programme.

University	Legal processes to deliver a Joint Diploma available		Legal Entity awarding PhD Diplomas (signatory)	Joint Diplomas awarded
	At 2015	At 2019		
1	No*	Yes, regulations were adapted.	Ministry (Rector in the name of the Head of the State)	Yes**.
2	No*	No	University (Rector)	Yes ***
3	No*	No	University (President of the University)	Yes ***
4	No*	Yes	University (Rector)	Yes **.
5	Yes*	Yes	University (Rector)	Yes **.

* Only for those attending the hosting University for at least 6 months.

** To any student fulfilling the programme requeriments.

*** Only to students physically attending the hosting University for at least 6 months.

4. Final results and concluding remarks

The information provided above, both from the personal experience of the authors and from the collection of available data on public websites, shows that, still today, there is a huge gap to be overcome before the existence of Joint International/European Doctorates can be considered an everyday reality. Although various attempts have been performed in the last 20 years, there is still a long way to go for Higher Education institutions to integrate all aspects of the programmes, and to make them something different than an additional certificate. It is expected that the recent initiative for building up the so called European Universities[8], *going beyond existing higher education cooperation models***,** can finally achieve the long-term ambition of a real and integrated European Education Area, where students and staff can move between countries within a common legal framework. For this, the drive of the academics encouraging their administrations to move forward is the crucial point.

[8]European Universities Initiative - European Commission. Retrieved January 20, 2020, from https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative_en

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Future competencies for digitally aligned specialties: coping intelligently with global challenges

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Abstract

The main goal of any education is to prepare students for future professional and life challenges. What is missing, however, from current curricula is the subject that deals with developing core competencies that are cross-cutting and focused on building the skills necessary for any specialties - technological, medical or humanities. Main results from presented joined projects - Robotic Psychology & Robotherapy Study, and the Coping Intelligence Project - build a configuration for a shared knowledge databank on human-technology interface, as well as on how coping intelligence impact academic achievements, professional expertise and life success. Evidence suggests that generalized efficient and inefficient problem solving in college students majoring in science, CS & IT, and mathematics is associated with various profiles that differ by learning experiences with STEM disciplines, academic locus of control, and the level of academic achievements. Furthermore, implementing a coping intelligence approach in academic curricula elucidates the transformative role of core competencies, required for the successful management of risks and challenges associated with a variety of digitally aligned professional activities.

Keywords: *Coping intelligence; core life competencies; digitally aligned specialties; global challenges; robotic psychology; robotherapy.*

1. Introduction: bridging the innovation gap

The main goal of any education is to prepare students for future professional and life

challenges. What is missing, however, from current curricula is the subject that deals with developing core competencies that are cross-cutting and focused on building the skills necessary for any specialties - technological, medical or humanities.

The core of educational innovations for computer sciences (CS) & information technology (IT), and other digitally aligned professionals, is grounded not in the computer-related disciplines itself, but rather in the set of abilities that often called "soft skills" or "integrated disciplines", or "cross-cutting and overarching competencies".

In our methodology of studying core competencies we merged conceptually and experimentally two different accounts. The one that takes technology as a starting point, namely *Robotic Psychology and Robotherapy Project* (Libin,A. & Libin,E., 2004), and a human-centered approach focused on the vital role of Coping Intelligence in mastering both technological and psychosocial skills while dealing with the complexities of global challenges (Libin E.,2003).

The results suggest that an attempt to replicate a broad repertoire of interactive strategies, offered by a human coping intelligence with the programmed, AI-based, responses, is doomed by default. Even the most advanced innovative technology can not compensate for the lack of core human ability to cope with real world situations.

2. Framework for exploring core life competencies for human-technology interactions

Approach-I. Although we interact with digital gadgets daily, humans do not completely understand how the technology works. Moreover, we tend to use our imagination to transform tools into "living creatures", "partners", and even "friends". The goal of our *Robotic Psychology and Robotherapy Project*, a longitudinal study across countries and ages and abilities (2001 – present), is to explore what is real in our interactions with the engaging machines, called robots. We define robotic psychology and robotherapy as interdisciplinary fields of research and practice that focus on the compatibility between people and artificial creatures on different levels: sensory-motor, emotional, cognitive, and social. Robotic psychology studies the psychological significance of robots' behavior and its intertwining with elements of physical and social environments. Different classes of robots are aimed at fulfilling different human needs. Artificial creatures have their own distinct individuality, which manifests itself in the robot's design and behavioral configuration, in the same way that people and other living beings differ from each other by various parameters, such as weight and height, behavioral reactions and character, emotions

and cognition, abilities and coping strategies. Analyses of person–robot interactions account for the essentials of both humans' and their artificial partners' behavior.

Methods-I. A cross-cultural mixed-methods study on children, youth, and elderly interacting with social communication robot (see Figure 1), characterized by advanced artificial intelligence and synthetic sensory feedback. More than 300 participants of different age, gender, competencies, and life experiences in USA, Russia, Ukraine and Japan were involved since 2001 with our project, funded by the Libin Coping Intelligence Institute, LLC (USA).

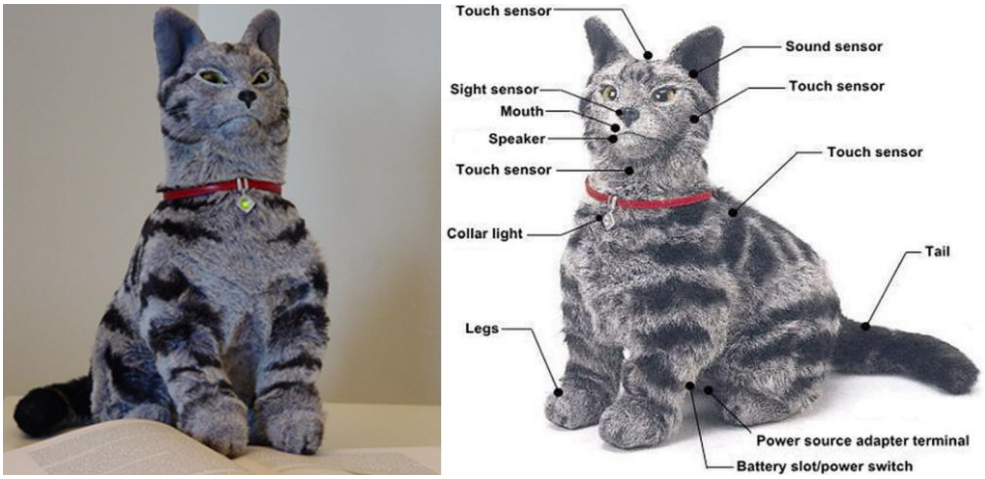

Figure 1. Robotic communication partner as a tool for RoboticPsychology and Robotherapy Project
Source: Libin & Libin, 2004.

Main findings-I. AI algorithms responsible for robot's behavioral configurations, despite their programming complexity, were extremely limited in their capacity to adapt to the needs of interacting humans challenged by the complexity of real-life situations. Human communication with the robot, as well as any interactions with the AI-based systems by that matter, are shaped not so much by the programming codes, but by our own life skills amplified by personal experiences and world-views.

In fact, the very way we deal with so called "smart" gadgets, characterized by any level of complexity, serves as a litmus test, or, to be more specific, a projective psychological assessment, thus revealing coping or destructive strategies in managing life difficulties.

2.1. Coping Intelligence competencies in the era of global Artificial Intelligence

Approach-II. As intriguing as the concept of AI sounds, human intelligence is a real blackbox with an unknown input and even more fascinating outputs when it comes to predicting the outcomes of our dealing with the complex real life situations. Our joined

with the person-robot communication project is focused on the role of coping intelligence in managing the uncertainties presented by both modern digitalization and societal global challenges. The approach originated in 1995 and continued through present, aims to bridge scientific knowledge regarding efficient coping versus inefficient defense with real-life individual strategies for handling daily problems, including adequate decision-making and the intelligent use of emotions and smart behaviors in difficult circumstances. Coping processes, whether emotional, cognitive, or behavioral, are organized as a complex system defined by the result, evident from the successful resolution of life difficulties.

Coping Intelligence is defined by a broad repertoire of life skills essential for successful management of everyday challenges in order to sustain individual and social well-being (Libin, 2003, 2019). A concept of Artificial Intelligence (AI) evolves form the notion put forward by Marvin Minsky (1959), who defined AI as "the science of making machines do things that would require intelligence if done by men." We investigate decision-making in the real-life context, focusing on the criteria that differentiate decisions based on human intellect from algorithms programmed into AI.

Methods-II. Coping intelligence measurements were developed through a three-phase algorithm. As it was reported in previous studies (Libin, 2017), consequential steps or phases were implemented in designing both the quantitative and qualitative parameters of the Libin Coping Intelligence™ Questionnaire (LCIQ® 1.0) including: a literature analysis and the pool of items development (Phase I), a content validity study of the questionnaire items and relevant global rating scales statements through the expert review panel (Phase II), and an exploration of the psychometric properties of the LCIQ® 1.0 via factor analysis and Cronbach's alpha (Cronbach, 1951) reliability test (Phase III).

More then 450 people, mostly students of different specialties and professionals with various level of expertise, residing in Russia, USA, and Ukraine, were involved in the reported phase of the Coping Intelligence Project.

Main findings-II. Research focused on the assessment of effective and ineffective ways of handling daily challenges greatly improves our understanding of the close relationships between coping versus defense processes, as they define our interactions with the digital world. The proposed conceptual model, underlying the Libin Coping Intelligence™ Questionnaire (LCIQ® 1.0), identifies the result as the primary factor that organizes any coping activity, whether emotional, cognitive, or behavioral, within the complex coping intelligence system. Depending on the result, any given coping activity can be estimated as efficient or inefficient, successful or unsuccessful. Thus, the functional systemic organization of coping efforts applied toward the resolution, or the result, is identified as the primary cross-cutting parameter of coping intelligence. The functional organization of coping efforts applied toward a resolution, as the primary cross-cutting parameter,

differentiates between efficient and inefficient strategies. Successful efficient strategies are focused on resolving the difficulties in order to reach meaningful goals; while, inefficient defensive strategies diverge from resolving life difficulties (see Figure 2).

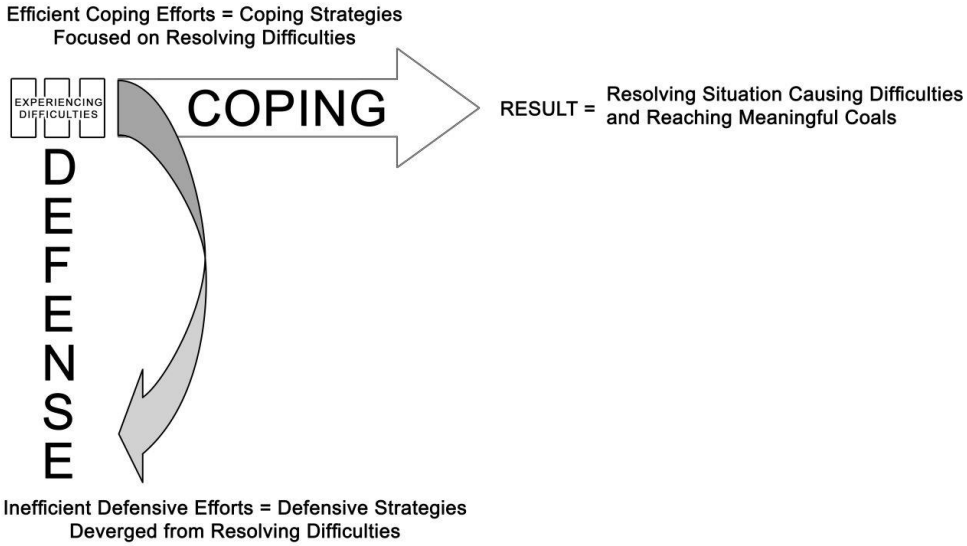

Figure 2. Efficient coping versus inefficient defensive strategies pathway. Source: Libin, E.2003.

Such a distinctive differentiation between two modes of human interaction with the physical and social environment triggers the enormous complexity of coping intelligence as a chief navigation system guiding us through life's hurdles.

2.2. Future competencies for digitally aligned specialties

Main results from joined projects build a configuration for a shared knowledge databank on how coping intelligence impact academic achievements, professional expertise and life success. There is plethora of evidence suggesting that generalized efficient and inefficient problem solving in college students majoring in science, CS & IT, and mathematics is associated with various profiles that differ by learning experiences with STEM disciplines, level of anxiety, academic locus of control, and the level of academic achievements (Daniel, 2018).

Furthermore, implementing a coping intelligence approach in academic curricula allows the inclusive design of special educational programs aimed at the development of efficient coping skills that are vitally important in all areas of life.

Overall, individuals with deficient coping intelligence are characterized by patterns of defensive inefficient strategies, such as an inability to manage social relationships (Nicolas

et al., 2013), a tendency to ignore the interests of others in favor of egotistic personal goals associated with bullying (Washington, 2015), and a propensity to be uncooperative and emotionally discouraging with oneself and others (Granieri et al., 2017).

Coping intelligence curriculum is of vital importance to digitally aligned professionals who develops technologies that shape our daily life. Indavertendly, today's students facing the same dilemma that is embraced by the society in general. Since the dawn of time the human kind mastered the set of skills necessary to survive and strive. The basic values remained the same – improving the quality of life, developing intellectual capacity, building relationships to achieve success and happiness. Artificial intelligence and digital innovations while remaining an important subject for higher education is burdened with the potential conflict between technological tools development and human skills to handle it (see Figure 3).

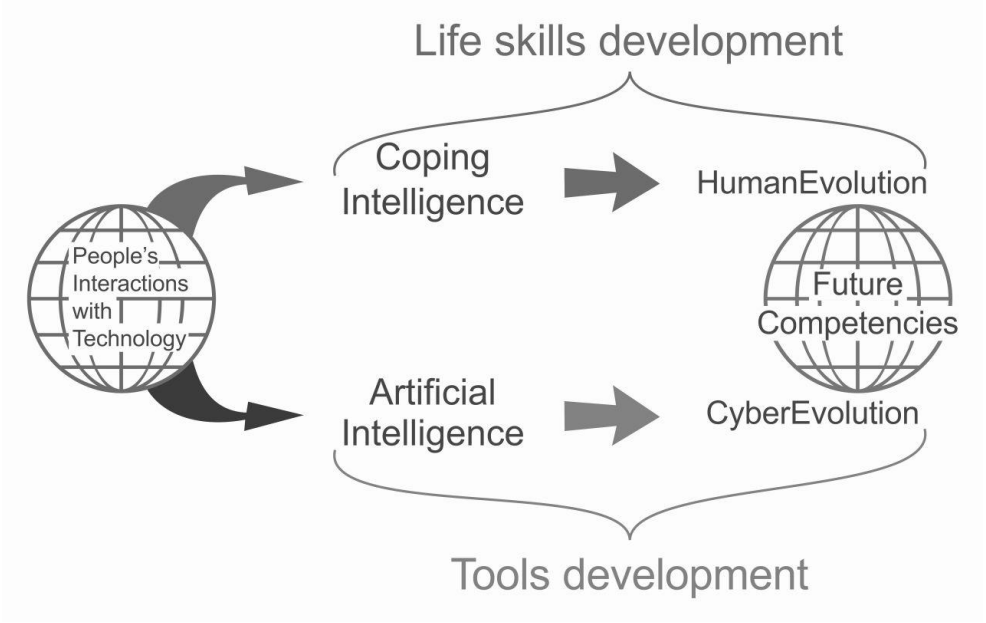

Figure 3. An innovation gap that needs to be addressed through the core competencies curricula.

Dangerous situations have been already documented when humans lost control of even guided artificial intelligence (Nicas et al., 2019). It is unknown what goals will artificial intelligence pursue running amok. But it is easy to predict, that learning competencies and professional expertise, enhanced with human coping intelligence, can balance even the most daring outcomes of technological expansion.

Being part of the design for advanced prospective studies, the coping intelligence approach elucidates the transforming role of coping competencies, required, along with the core soft

skills, for the successful management of risks and challenges associated with a variety of professional activities. It is hard to overestimate the importance of effective coping skills in the context of the increasing complexity of modern life. A broad efficient coping repertoire helps each of us to successfully overcome obstacles triggered by socioeconomic pitfalls and obscurities of emerging technologies, and triumph over life adversity.

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Do text discussions improve the academic skills of students of HE? Andorra University case

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Abstract

Reading is a core competency in learning processes of higher education as a tool for accessing discipline-specific knowledge. The aim of this case study is to analyse the impact of text group discussions on the academic skills of students at the Universitat d'Andorra (UdA). Qualitative techniques -non-participant observation, interviews and discussion groups- were applied to UdA students and faculty. Five student groups belonging to the Bachelor of Teaching and Learning (BTL), Bachelor of Computer Science (BCS) and Bachelor of Business Administration (BBA) were studied.

After processing the data with Atlas.ti, the first results were obtained. Evidences of a positive impact on the academic skills are identified. Firstly, both students and faculty indicated an improvement of the text comprehension mainly because of the peer interactions. Improvement of the critical and analitycal attitude, the own speech as well as the metacognitive learning are also highlighted as areas on which dialogic reading has positive impact.

Keywords: *Text group discussions; dialogic reading; Higher Education.*

1. Introduction

Reading competence is an ability inherent in any learning process within the university academic context. It is a basic generic competence and an instrumental one (Tuning, 2003). University students use this skill in order to access to new and general knowledge of the discipline and at the same time to acquire other competences (Hjortshoj, 2001; Cassany, 2008; Carlino, 2013). Moreover, students need to overcome obstacles such as a lack of familiarity with technical vocabulary or becoming increasingly immersed in the academic subcultures of the communities to which they belong (Estienne & Carlino, 2004; Gottschalk & Hjortshoj, 2004).

A review of the scientific literature in line with the evidence-based teaching has been conducted in order to identify teaching strategies that promote reading proficiency at university level (Blouin et al., 2009; Schwartz & Gurung, 2012). One of the teaching actions that has shown the best results in improving reading proficiency, according to the scientific literature, is text group discussions.

This strategy involves performing a first individual reading and then sharing the interpretations of the text with other readers. Text group discussion has been deeply analyzed. For example, the interactions established among the reading participants enhance their communication skills (Finke & Edwards, 1997; Flood et al., 1994; Fredricks, 2012; Parrott & Cherry, 2011). In the established dialogues, participants share their interpretations of the text and discuss them and, consequently, there is a more in-depth learning of the content worked from the text (Chocarro de Luis, 2013; Hamouda & Tarlochan, 2015; Tynjälä, 1998). In addition, the dialogic environment favors that different contributions be linked to other knowledge in the same discipline and to other areas of knowledge that are not directly related to the text read (Macoun & Miller, 2014).

Impact on academic skills also includes an improvement in analytical and critical capacity which is evident in the elaboration of participants' speeches. Tynjälä (1998) describes how from the perception of students themselves there is an increase in the development of thought. As the sessions progress, speeches become more complex, in-depth, and analytical, demonstrating that participants increase their analytical ability and relate different inputs from peers' contributions (Aguilar Ródenas, 2017; Carroll & Sambolín Morales, 2016; Chirita, 2007; Flood et al., 1994; Tynjälä, 1998). In addition, reader discourse also improves because speech is argument-based and supported by literal references of the texts studied (Bixler et al., 2013).

Metacognitive learning is also promoted by text discussion. On the one hand, the way they learn is modified and the participants are aware of this phenomenon. The same protagonists express that they move from superficial to more global learning in the discipline by connecting new content to other theoretical frameworks of the discipline (Tynjälä, 1998).

They are also aware that their interpretations and meanings are built on knowledge and past experiences (Jarvis, 2000; Tynjälä, 1998) and that their knowledge advance from an epistemological dualism to a relativism by discovering and understanding peers' interpretations (Bixler et al., 2013; Tynjälä, 1998).

In addition, learning belief is transformed from an individual to a collective process of meaning negotiation: it becomes an intersubjective construct of knowledge and meaning collaboratively creation (Aguilar Ródenas, 2017; Bixler et al., 2013; Chirita, 2007; Finke & Edwards, 1997; Flood et al., 1994; Fredricks, 2012; Lake & Evangelou, 2019; Tynjälä, 1998).

Within the framework of this study, in order to deepen students' reading habits, in April 2019 an anonymous, virtual survey of 26 faculty of Universitat d'Andorra (UdA) was applied. In general, lecturers consider students' reading habits to be very low (42.3%), low (26.9%) or medium (26.9%) and a low 3.8% consider it high; in no case very high. Otherwise, the majority of the professors, 92.4%, would like to foster a greater habit of academic reading among the students.

Being the group text discussion a strategy that has been widely studied and validated by the international scientific community, the present study seeks to implement this strategy at UdA and to analyze its impact.

2. Method

This research is a case study (Yin, 2009) with a communicative approach (Gómez, Latorre, Sánchez & Flecha, 2006). The case study seeks to understand and shed light on a particular phenomenon in a certain context (Neiman & Quarant, 2006). This case study aims to obtain an analysis of Universitat d'Andorra after implementing an specific teaching strategy.

2.1. Context

During the academic courses 2018-19 and 2019-20, five groups of UdA students have participated: two of Bachelor of Teaching and Learning (BTL) - 21 students enrolled, 21 years old on average-; one of Bachelor in Business Administration (BBA) -21 students enrolled, 24 years old on average- and two of Bachelor of Computer Science (BCS) -27 students enrolled, 27 years old on average-. The five groups have made a total of 18 readings: ten BTL, three BBA and six BCS.

Group text discussions have very diverse characteristics. Each teacher has chosen a typology of academic text: texts written by classic authors, newspaper articles, reports published by national or international institutions, and scientific articles. On the other hand, activity development has also varied in structure (small groups or large group discussions),

resources used (reading patterns, previous activity, etc.) and task evaluation (task integrated into the evaluation or participation adds a point to the written work).

Notwithstanding the differences, all students have read individually the text, prepared a contribution, and shared their interpretations of the text using the printed or screen text to refer to specific quotes or parts of the text. In addition, all the text discussions have been developed within the framework of a course or seminar and in no case the activity has been optional.

2.2. Data analysis

Five interviews were conducted with UdA lecturers and nine discussion groups with UdA students. After processing the data with Atlas.ti, the analysis matrix was used (*Table 1)*. This is defined by the subcategories extracted from the scientific literature and according to whether the information is considered a difficulty for the improvement of academic skills - an excluder dimension - or an advantage - a transformative dimension-.

Table 1. Analysis matrix of the data obtained in the UdA study context.

Category	Subcategory	Excluder Dimension	Transformative Dimension
Academic skills	Impact on reading comprehension	1.1	1.2
	Impact on analytical and critical ability and speech	2.1	2.2
	Impact on metacognitive learning	3.1	3.2

Source: own elaboration.

The research is in line with the ethical guidelines adopted by various international organizations (European Science Foundation & All European Academies, 2011). An Informed Consent was drawn up to ensure that the participants exercises their full freedom of choice.

3. Results

Below, *Table 2* includes data collected pertaining to the transformative dimension, either from the information collection techniques applied to the faculty (P) or the student (A).

Table 2. Analysis matrix of the data obtained in the UdA study context.

Subcategory	Qualitative data
1.1. Impact on reading comprehension	BTL1920_P1: Yes, yes, I think they have improved reading comprehension. I have seen it in the examination of module 5. I see that reading is worked in class, then I always ask questions about the readings in some case and you see that the result is better, it is more optimal. They also linked the text to the challenge of Module 6. BTL1819_P: Yes, today we were, for example, in the evaluation of practices in schools and (...) a lot of concepts came out of the Proximal Development Zone (PDZ) readings, adjusted help, previous knowledge ... There are many concepts in the subject of Educational Psychology that are very conceptual and the readings are also very conceptual but after the debate and the application they can better understand it. BTL1819_A6: Yes because everything that is theoretical you can prepare it at home, that is you have the power point and I can read it but if I do not understand something then I will talk. "I did not understand this, did you understand? Okay, tell me! " BBA1819_A3: Yes, of course, expand! (...) we never see it and when we start talking about it we see things that if you talk to people and there are many opinions and each one can expand a little bit. Yes, we expand the knowledge much more. BBA1819_A4: to contextualize and the cases we talked about help me in the exam because I thought “oh, this is what we talked about last day in the Reading group”, so I can apply there my knowledge. BCS1819_A1: yes, because we were doing a debate that allowed us to see how to see it from another point of view of the challenge or the issue that was being faced, that is fine, also in terms of understanding concepts ... of course, being more scientific, maybe it was more difficult to understand or to handle and there is always another or other classmates that dominates more or understands it from another side and explains it to you from their side and you understand it. BCS1920_A2: in the end when they are teaching you elaborate an idea and you think it is fine and when you argue with classmates you see that maybe your idea is not right, that maybe it is another thing, I think you learn much more. In the end, what you do is validate your idea. BCS1819_A3: At least in my case… we expand the arc of knowledge, I think it is more cultural, culture of our career that is necessary some concepts that the teacher gives us.

2.1 Impact on analytical and critical ability and speech	BCS1920_P: The comments were more mature because they had analyzed the graphs, results ... the comments were very "careful I see where you go!", "I find this very interesting or I do not see this much" ... BTL1819_P: During the first reading they did not connect the text with the practices or other aspects, very summarized and very superficial. This has seen an improvement to the point where there were debates that brought them super interesting things, especially this. (...) his speech has improved greatly. And what has improved a lot is the use of subject-specific vocabulary. (...) And the readings help a lot in this, it is the way that they acquire the vocabulary of the subject. BCS1920_A5: more specific! When people say an argument they say it more specific, for example, today with the blockchain many did not know what it was and have been able to explain it more concretely than what could be taken from the article. BTL1819_P: Yes, they especially support their arguments better! It is not "I liked the practices very much, I liked what the teacher did", no! "I have seen the teacher activate the previous knowledge of students asking questions ...", that is, they can justify and argue, readings are key, it's key! Without reading and without this reflection, only with the lectures, is difficult, very difficult. Also the exam is much higher quality because of its ability to relate theoretical concepts and then the use of subject specific vocabulary, this is a significant improvement! BTL1920_A5: what I see is that many times more than arguments are emotions and for me a debate must be in the arguments, in the facts ... in a debate you have to find a solution, not use the typical techniques to deny someone to to be right, or to appear to be right…
3.1 Impact on metacognitive learning	BTL1819_A6: To read a power point the truth is that I am bored! The important thing is to explain it, that we all understand it, that I can explain it to you, that you can say "ah, I believe this!" And so, I don't know, it's like you understand it so much better! You get it! The things I remember most about studying and learning are the things I talked about... BCS1920_A3: in the debate they would correct me at the moment and make me change the perspective of this, and I would not have the feeling that I have failed at that moment because here is my answer, here is the correction and it is not the same, it is a different concept, it is more a consensus than a correction.

4. Discussion and conclusions

Consistent with the perception of faculty, group text discussion has a positive impact on text comprehension, in line with Tynjälä (1998), Chocarro de Luis (2013), Hamouda and Tarlochan (2015), and Intriago's team (2016). Lecturers indicate that there has been an

improvement in the resolution of exams and *challenges* in which the content of the reading is addressed.

On the other hand, students emphasize the importance of the interactions with group peers (Flood et al., 1994; Finke & Edwards, 1997; Jarvis, 2000; Parrott & Cherry, 2011; Fredricks, 2012). The improvement of the comprehension of the text lies in the possibility of sharing with the classmates their first interpretation of the text, the resolution of doubts and the formulation of questions to the classmates, as well as the ability to clarify their interpretation of the text from the contributions of colleagues.

The BCS1819 students also pointed out how the discussion of texts allowed them to "further expand the arch of knowledge, the culture of our career". Therefore, there is an improvement in one's own knowledge of the discipline and other areas of knowledge (Macoun & Miller, 2014).

In terms of analytical and critical ability and speech improvement, both students and faculty affirm that there is a positive impact: speeches are more complex, in-depth and analytical (BTL1819, BCS1920), they make references in the text to arguing their speeches (BTL1819), they use the technical vocabulary more frequently (BTL1819) and elaborate more specific interventions (BCS1920). In general, the quality of the contributions is accused (Aguilar Ródenas, 2017; Chirita, 2007; Flood et al., 1994; Sambolin & Carroll, 2015; Tynjälä, 1998).

In addition, an opinion-based turn of speech is also denoted by validity arguments (Finke & Edwards, 1997; Bixler et al., 2013; Aguilar Ródenas, 2017): students reflect on the need for support arguments, setting aside emotion and opinion (BTL1920) and professorate notice an improvement in argument elaboration (BTL1819).

Related to the metacognitive learning, students (BTL1819) particularly value interactions with peers as a source of knowledge, tending from an epistemological dualism to a relativism as knowledge is constructed based on different interpretations of colleagues (Tynjälä, 1998; BCSxler et al., 2013). Consequently, students (BTL1819) change their perceptions of an individual learning process to a collective one in which a continuous intersubjective construction of knowledge occurs (Flood et al., 1994; Finke & Edwards, 1997; Tynjälä, 1998; Chirita, 2007; Bowers-Campbell, 2011; Fredricks, 2012; Bixler et al., 2013; Sambolin & Carroll, 2015; Aguilar Ródenas, 2017). Therefore, they consider essential the involvement and participation of most peers in order to learn from all (BTL1819).

In the same line, it is stated that the difference between examining or discussing texts is that while the former is learned through corrections, the second is about consensus (BCS1920).

At the same time, a change in the concept of reading is emphasized: from an individual reading to a reading understood as a social act (Finke & Edwards, 1997; Jarvis, 2000).

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Design and Evaluation of Gamification Experiences in Computer Science Studies

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Abstract

This paper presents two gamification experiences developed in the Computer Science (CS) degree at the University of Barcelona. Usually, the *CS degree suffers from low class attendance, which impacts the participation of students in in-class programming activities. Additionally, this degree includes a basic course related to human computer interaction that, despite of being valuable for the formation of students, they feel as boring and useless, far from their - heavily computer focused - interests. Then we decided to gamify a basic course of programming skills and the mentioned HCI course. We decided to use two different formats, online and physical. First, one experience was performed in "Human Factors in Computing" course of third year of studies, with 70 enrolled students. First, students attended to a 3D online theoretical class related to emotional design in "The education district" (TED) platform, which is a 3D Virtual World (VW) for educational purposes, developed by Virtway corporation. Afterwards, they participated in the 'Game of thrones' gamified activity where they evaluated the usability of TED. Second, we designed 'physical' gamified classes to increase attendance to Data Structures course, and in consequence, augment the number of programming exercises that students perform and the assistance they receive from the teacher. During the gamified sessions, the 120 enrolled students enhanced their skills in solving programming problems. The experience consisted of three kinds of challenges (with easy, medium, and hard difficulty level) solved in large, medium, and low-sized groups of students, respectively. The results of both experiences were satisfactory as evidenced by the percentage of students (>=66,7%) that rated the activities between 6 and 10 (in a 0 to 10 scale).*

Keywords: *Gamification; Computer Science; 3D Virtual Worlds.*

1. Introduction

Gamification is the use of game elements in non-game contexts (Werbach, 2012). Whatever the context, gamification design should consider two key elements: the goal and users' profile. Undoubtedly, any product design, either in architecture, fashion or gamification areas, works for the purpose and the users it was created for. What is right for a goal and profile of users may not be right for others. Additional factors that gamification design should contemplate are mechanics and dynamics that fit users' profile, assessment as well as needed resources and the format (online/offline, duration, activities) of the experience.

Gamification started in the business field but soon expanded to other contexts such as health, tourism, and education (Pereira et al., 2014) (Rodriguez et al., 2019) (Xu et al., 2013). Gamification design is a task that should be well thought so that it is important to follow a gamification design framework such as FRAGGEL (Mora et al., 2015) and LEGA (Baldeón et al., 2016a).

The literature of gamification in education shows, on the one hand, works that are entirely integrated in the curriculum of the course and thus the gamification extends to every teaching session (Iosup, 2014) (Mora et al., 2016). On the other hand, other gamification initiatives (Baldeón et al., 2016b) focused on concrete parts of the curriculum that, consequently, occupied part of the course planification, e.g. one or a few course sessions This research aligns with the latter works.

This paper presents two gamification experiences for Computer Science undergraduates. Our students perceive human interaction course as boring and useless, far from their - heavily computer focused - interests. We also have students with low class attendance, which impacts their participation in in-class computer programming activities. Thus, we decided to gamify two different courses. The first experience was performed in "Human Factors in Computing" of third year of studies. The experience lasted a session of two hours and was performed in the 3D virtual world platform TED (https://www.theeducationdistrict.com/en/). The main goals were to introduce to the students concepts closely related to gamification, you will forgive the repetition, in a gamified environment, and to let them practice an usability evaluation method learned in the course while interacting within the 3D interface. Class attendance was voluntary, 40 out of 70 students were enrolled in the online class. The second experience was carried out in "Data structures" course of the first year of studies. The number of students was 120, although the gamified experience was designed and deployed in three groups of 40 students. This experience was developed in (physical) classes oriented to solve programming problems that make use of data structures.

2. Gamified online virtual world class: Game of thrones

2.1. Learning context

The course "Human Factors in Computing" focuses on human-centered design, User eXperience (UX) guidelines and user evaluation studies. The goals of the gamified 3D online class were twofold. First, make the students active participants of an emotional design, i.e the design of attractive and delightful user experiences. And second, give them the case study of TED to practice heuristic evaluation, a technique introduced in the course, which consists in finding good and bad usability aspects in the design of an interface (Nielsen and Molich, 1990). Collaterally, we also aimed to break the course routine with a disruptive activity, stimulate teamwork and students' creativity. The designed activity made use of gamification mechanics such as on-boarding, rewards, challenges and social engagement (we put them in italics when referred during the text). Regarding gamification assessment, we use a satisfaction questionnaire and analyze the participation of students and their grades in the heuristic evaluation.

2.2. Gamification design

The experience was performed in "The Education District" (TED), a 3D virtual environment (3DVE) to facilitate online learning. Although many of our students were usual players of MMOGs (Massively Multiplayer Online Games), which have features in common with 3DVE, this time they were to make "a serious use" of VW.

The session was divided into two parts (see Figure 1): a *theoretical class* in which the teacher presented the emotional design lesson in an outdoor space (garden) of the 3D virtual world; and a *gamified activity* in which the students collaborated in groups to construct a 3D building. Note that, while the students were building they had to elaborate a heuristic evaluation (usability) report of TED's user interface. The theoretical class lasted 30 minutes and the gamified session lasted one and a half hours. The former consisted on several stages: game rules explanation, houses' formation, castles building and conquering, and castles scoring. In the following, we detail them.

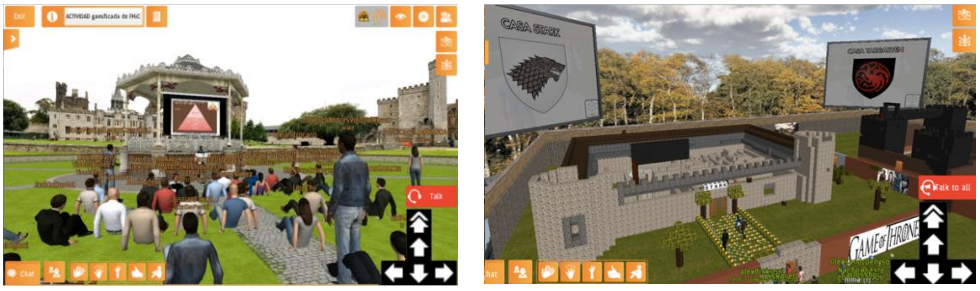

Figure 1. On the left: theoretical class in the garden, on the right: gamified activity in TED's bricks space.

Game rules. The teacher introduced the activity: "*Welcome to game of thrones! (a happy murmur denoted that students were full delighted and excited). The houses of thrones, Stark, Targaryen, and Lannister, shall build their castles. The king leads the construction and hopefully make strategic decisions. The castle should have at least 2 towers, 2 access key doors, 2 windows, and the flag of the house. Afterwards, you must conquer your enemy's house. The teacher decides when castles construction begins and ends, and the house you have to conquer"*. Finally, students were informed about the information point situated in brick's landing point, with the game rules (*on-boarding).*

Groups formation. The teacher asked the students to sit in three groups (*social engagement*), and, to speed up the process (time was gold for us), grouped them by last name. To choose each king, the teacher repeated the following process three times. She asked a question related to the course, both via voice chat and textual chat. The student who wanted to answer by voice, raised her hand, but they also could send the answer by text chat. The latter was the preferred option (maybe it was the quicker way and was better for shy students). The teacher gave hints: "The answer contains the E", "it begins with "J", etc. The first student who answered the question correctly became king of one house of game of thrones. If nobody answered it or nobody got the right response, the teacher gave more clues. If they did not get it right either, she asked a new question. The king of each house led the distribution, monitoring and coordination of tasks to be performed by the members of his house during the castles building, and received a prize for developing this task (*reward*).

Castles building and conquering. Students had 30 minutes to build the castles (*challenge*, *cooperate* within the group, *compete* against other groups). The construction was facilitated by 3D bricks tools. Towers, windows, doors and walls of the castles were done by creating, moving, rotating different kinds of 3D shapes. Once the castles were finished, each house had to (*challenge*) conquer the enemy house, accessing the castle of another house and placing their flag. The 2 gates of the castle had words of passage, which were the answer to a question related to some lessons of the course. Students were informed about it so that they could review the material before the online class. When the students touched the gate of the enemy's castle, the question appeared and then, they should type the response. If the response was correct, then the door opened. The quicker house placing their flag on the enemy's castle received the reward of +1 point in the exam (*group reward*). The king of the winning house got a reward, the possibility of labeling a multiple-choice question of the exam as "King of game of thrones" (avoiding negative mark if the answer was incorrect) (*individual reward*). As a consolation prize, the other houses (i.e. players who did not win any reward) could win up to 0.5 points in the exam whether they sent the teacher, in the next few days, the heuristic evaluation report (*group reward*).

Castles scoring. Once the mission of building and conquering the castles was finished, participants should score competitors' castles. Unfortunately, we had no time to do it.

2.3. Gamification deployment and evaluation

We asked the participants to rate their satisfaction filling a questionnaire. Figure 2 show that 64,3% and 76% of the students scored greater than 6 (in a 0 to 10 scale) the garden and the bricks activities, respectively. Hence, we see that students enjoyed both experiences. Nevertheless, a few students complained about their Internet connection that impeded them to participate in the construction activity seamlessly, we guess they could be the ones that gave 0 score (right part of Figure 2). Some students found the construction activity quite stressful (In short time, they had to construct the castle, set the passage words, and set the flag), and they complained it was the first time they manipulated objects in this 3D virtual space. Regarding the heuristic evaluation report, 47% of the students did it, and the average grade was 9,3 (out of 10).

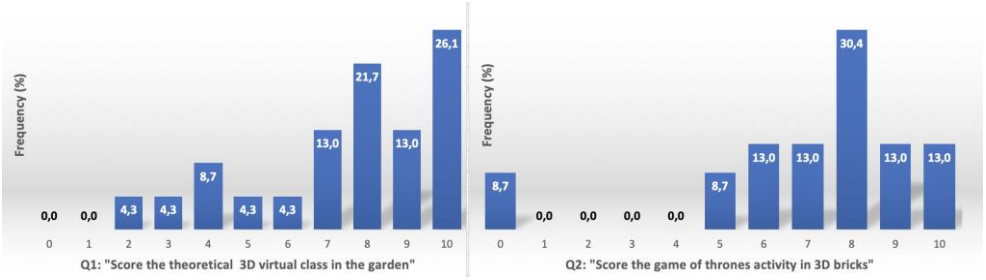

Figure 2. Satisfaction questionnaire for Human Factors in Computing, in % of the scores (from 0 to 10).

3. Gamification in Data Structures course: DS Olympic Games

3.1. Learning context

The goal of "Data Structures" course is to provide students with the basic skills on data structures as well as to train them in the application of the different data structures in computer science problems. In addition, a secondary goal is to improve student's programming skills and their mastery of C++ language, since the resolution and implementation of complex projects that include data structures depend on this ability.

3.2. Gamification design

We decided to include gamification in this course in order to increase engagement of the students. Students are in their first course in CS degree and they still need a large amount of teachers' assistance for solving problems. Basically, our goals were: i) to augment student attendance to the classes devoted to solving problems; ii) to improve student understanding of course content; iii) to enlarge their skills for solving problems.

The course content is divided in different sessions: theoretical, problem solving, and laboratory sessions. We had a total of 120 students in the course. Students were separated in

two theoretical groups (i.e., 60 students per group), three problem-solving groups with 40 students each and six laboratory sessions, each one with 20 students. Considering the main goals of our course, we decided to apply gamification to three of the problem-solving sessions out of 10 total sessions. Related to competences, the experience aimed to stimulate the work in group, creativity in problem-solving and improvement on their skills to move them towards self-sufficiency. The design made use of mechanics such as rewards, levels, social engagement, and medals that will give them a prize at the end of the course. We propose to assess goals achievement with an online questionnaire at the end of the course.

We divided the gamification of the course in three problem-solving Olympic sessions. Each one of them corresponds to a different level to acquire and it is focused on different topics of the course. First Olympic session was focused on the acquisition of a high level on C++ programming skills. Second one was centered in linear data structures, such as stacks, queues or lists. Finally, third Olympic session was devoted to the use and application to real problems of non-linear structures, such as binary trees or AVL trees.

It is important to mention that all the Olympic sessions had a duration of an hour and a half. First of all, before starting the problem-solving Olympic sessions, we detail the purpose of the gamified activity to the students and contextualized the activities that will appear in the session. Additionally, the teacher divided randomly students in large groups (10 students per group), by using a deck of cards. It was important to separate randomly the students to avoid alliances among them and to facilitate the learning progression of all of them. We spent 10 minutes to introduce the session. Afterwards, we started the Olympic session, which is divided in four activities of 20 minutes: an activity in large groups, another one in medium groups, an activity working in pairs, and an individual activity.

The Olympic session always starts with the activity in large groups. It was devoted to successfully solving a large problem-solving but easy in difficulty to favor social engagement and let students to understand the basic concepts of the subject. Next, students in large groups are reorganized in subgroups to form medium-size groups (4 or 5 students per group) and they start with the second activity, whose purpose is to introduce a problem with a medium difficulty that they must solve in 20 minutes. We maintain social engagement and we augment the difficulty with problems in which students need to apply advance concepts. In the third activity, groups are separated to form pairs of students. We focus the third activity on solving a medium-high level but short problem in pairs to consolidate the acquired skills. Finally, the last activity is focused on evaluating the final individual assessment of students. We prepared a Kahoot[1] for this evaluation. Every Olympic problem-solving session offers 100 reward points. Every activity had a reward for the participants that depends on the overall

[1] https://kahoot.com/

assessment and ranking, which are 15 for the winner in the activity in large groups, 25 for the winner in medium activity, 30 for the winner in activities in pairs, and 35 points to the winner of the Kahoot. It is important to highlight that all students receive a reward when they solve a problem (in groups, pairs or individually) although it is decreased according to the ranking.

With the three Olympic problem-solving sessions students were able to obtain a maximum of 300 points. Note that there are 100 points per session and after each one we publish a ranking of students to increase participation in the next one. Additionally, at the end of the course, we divide the ranking in quartiles. Those students that are in the first, second and third quartile receive a medal. First medal has a prize that consists of an increment in the final grade, second medal's prize is an increment in the exam, and third medal's prize is extra time to do the exam. Those students that fall in the last quartile do not receive a medal. The idea is to promote cooperation and social engagement with group work and a bit of competition among the students with the levels, medals and the prize that they may obtain.

3.3. Gamification deployment and evaluation

We asked the participants to give their opinions filling a questionnaire. First, we requested students to evaluate the Olympic sessions. Figure 3 (left) shows that 66.7% of the students scored greater than 6 points the sessions out of a total of 10 points. Note that 44.4% scored their satisfaction with 7 or more points. It is worth mentioning that a few students complained about the time for answering each one of the questions of the Kahoot. We will define much more time to answer this part next course.

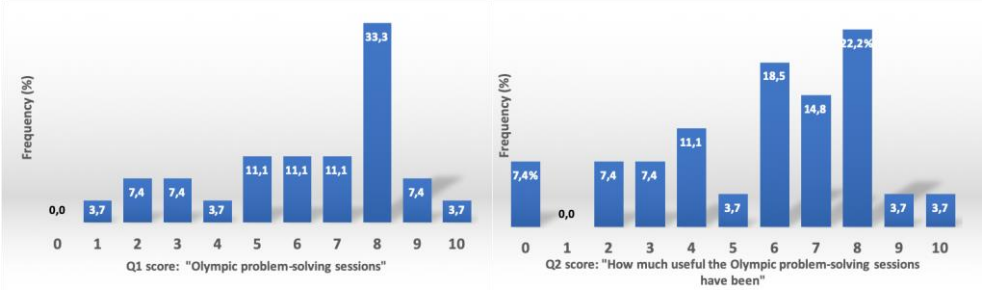

Figure 3. Satisfaction questionnaire for Data Structures, in % of the scores (from 0 to 10).

Finally, we also requested students how much useful they considered the Olympic problem-sessions had been for understanding, learning and mastery in the topics of the subject. Figure 3 (right) shows that 66.7% of students considered that the Olympic sessions had been useful in improving their comprehension and skills in the Data Structure course, since they scored the questions with 5 or more points.

4. Conclusions

This paper presents two gamification experiences performed in CS studies. In the first experience students first attended an online 3D class of 'Human Factors in Computing" course and then competed in the 'Game of thrones' activity. The goals were to teach the emotional design lesson while making the students protagonists of a gamified (emotional design) activity, and to give them the case study of TED to practice an usability evaluation method introduced in the course. Most students had a satisfactory experience (60% scored it between 7 and 10), and liked the novelty and the dynamics of the activity. The second experience was performed in "Data Structure" course. The design was based on the Olympic games, where students worked in different group sizes to improve their knowledge and skills on problem-solving in the subject. Considering that 66,7% of students scored their satisfaction higher than 6 (in a scale 0 to 10), we will repeat the DS Olympic games next course. To conclude, the big effort of designing a gamified activity worthwhile. Thus, those teachers who plan to do it should have the resources (time, tools, assistants). In our case, TED platform proved to be secure and scalable. Although further research is needed, it seems that online 3D platforms help with students' engagement. Moreover, in the case of short-duration activities, we recommend, if possible, to perform a pilot activity to evaluate timing and anticipate problems (e.g. technical, coordination, misunderstandings) and their solutions.

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'Don't feedback in anger': enhancing student experience of feedback

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Abstract

This research explores three iterations of the delivery of audio feedback in relation to formative assessments at the School of Law, University of Sheffield. The evidence base includes similar practice at Edge Hill University and collaboration on good practice between the two institutions.

This paper will set out the context for the implementation of audio feedback, namely to help address the difficult issues experienced with feedback from non-engagement by the student in the whole feedback process, to a lack of utilization of formative feedback for 'feedforward' purposes. Qualitative comments from both students and staff experiencing this model of feedback will be drawn upon, which include references to the perceived benefits and challenges of this mode of feedback by both sets of stakeholders.

This paper will then take participants through the methods addressed to engage student with feedback on formative assessments, in order to create and encourage proper 'feedforward' to summative assessments, and to provide effective, focused, consistent and constructive feedback.

This paper in particular aims to show how the provision of audio feedback has the potential to greatly enhance the student learning experience, and can provide a more positive attitude generally to the giving, and receiving of feedback from both staff and students alike.

Keywords: *audio feedback; assessment and feedback; student experience.*

1. Introduction

The complexity of learning and assessment makes a prescription for effective feedback problematic and even where feedback has demonstrated utility in one circumstance this may not be transferrable between groups (Sutton & Gill 2010). Even successful feedback may not be sustainable in terms of tutor time and effort – and the withdrawal of such feedback has a demotivating impact upon students (Kluger & DeNisi 1996). Nevertheless there is consensus in the literature that quantity, type and method of feedback differentially impact its effectiveness. Understanding these phenomena may provide guidance to tutors making decisions in their local circumstances (Sadler 1998; Hattie & Timperley 2007). The idea of audio feedback is not new, for example see Cryer (1987). However, screencasting includes both audio comments and visual cues such as the assessor highlighting text, moving their cursor and accessing resources. The student sees what the tutor sees and hears what they think, screencasting exposes the tutor's thoughts, presenting a number of potential advantages:-

1. It could increase the amount of useful, specific feedback provided.
2. The mixed modality of situated visual cue and audio comment may focus attention more effectively than written annotation.
3. It may increase the time students spend engaging with feedback.
4. Vocal cues (pace and intonation) provide additional information, helping students understand the tutor's intention.
5. It potentially models how assessment criteria are applied.

Here we focus upon how screencast and audio feedback might impact upon three aspects of feedback - clarity of language, student and tutor expectations and the crucial affective component of receiving feedback.

Clarity of assessment feedback is often problematic because students find the language used in assessment comments difficult to understand and decode (Macfarlane-Dick & Nicol, 2004, Carless et al., 2010). Boud & Falchikov, (2006) note the "systematisation and formality found within educational institutions" can in itself obscure meaning. In terms of screencast feedback literature, verbal comments appear to offer some communication gains. Feedback is reported to be easier to decode (Cullen 2011) and more personal (Marriott & Teoh 2012). Voice intonation helps students to focus and ameliorates problems with tutor handwriting, students also felt tutor voice conveyed authentic emotion such as enthusiasm (Marriott & Teoh 2012). Students experiencing written, audio and screencast feedback expressed a preference to receive feedback in screencast form (71%) citing the situational visual cue as useful additional information (Marriott & Teoh 2012).

There may be a mismatch between tutors' and students' expectations of assessment criteria, with students emphasizing low-level task oriented skills (Gibbs & Simpson 2004). This may lead to them expending effort which has a low-level impact upon their learning. It is therefore likely that feedback which explicitly references assessment criteria may improve feedback (ibid). Macgregor et al., (2009) suggests audio feedback may be more closely aligned with these pedagogical concerns than written feedback. Specific improvements included audio that established a personal relationship, clarified expectations, was detailed and easy to decode. Several authors draw direct parallels with tutorials, suggesting audio feedback could emulate these meetings, with the additional benefit of re-playability (Brearley & Cullen 2012; Macgregor et al. 2009; Marriott & Teoh 2012). What is less clear is the effect on learning outcomes which in some cases appears to match control groups receiving written feedback. In contrast (Ice & Richardson 2009) found that audio feedback increased both student involvement in the assessment process and retention of learning content.

Assessment is an emotionally charged process. Falchikov and Boud consider that in the worst cases assessment can have an impact that inhibits learning and lasts for many years. Student perceptions of "fairness" appear to be directly related with levels of student engagement with feedback (Sutton & Gill 2010). Therefore, it is likely that feedback which clearly communicates justification of comments or marks may be particularly effective. Students' feelings about feedback are mediated by their relationship with the tutor (Sutton & Gill 2010). Feedback produced by tutors perceived as "uncaring" may be perceived as a "lack of interest and dismissed" (ibid, p.9). Interestingly the perception of care (or lack of) may originate from the feedback comments themselves, with generic feedback perceived as a powerful signifier of an uncaring tutor and conversely specific individual feedback equated with notions of care (ibid). Dialogic feedback can help to make the intention of feedback clear and reduce some of the emotional charge inherent in assessment (ibid). This hypothesis is borne out in the screencast literature, where students were more likely to collect and use audio feedback and to request more tutorials than with written feedback (Macgregor et al. 2009; Lunt & Curran 2010). Students also report replaying such feedback on multiple occasions (Brearley & Cullen 2012). Recorded feedback therefore provides a mechanism to operationalize Macfarlane-Dick & Nicol's view of effective feedback, where "...comments should indicate to the student how the reader experienced the essay as it was read – 'playing back' to the students how the essay worked - rather than offering judgemental comments" (2004). Students' report that audio feedback was personalised to them and discrete – a factor likely to engender a sense of "tutor care" (Marriott & Teoh 2012).

Overall, the literature suggests that the majority of students preferred audio/screencast feedback to written, referencing clarity most frequently (Lunt & Curran 2010; Brearley & Cullen 2012; Marriott & Teoh 2012; Cullen 2011). For example in one study 85% felt that audio feedback was high quality, detailed and useful in identifying missing elements and

improving subsequent work; 75% felt this was better than in written comments (Lunt & Curran 2010).

2. Methodology

Prior to this study the three researchers had conducted individual pilots of various modalities of audio and screencast feedback, subsequently collecting a range of evaluative data. In general terms this involved producing formative assessment against a module rubric by recording a screencast or audio file summarising the main points of feedback and 'feedforward'. The feedback provided was semi-structured, focusing on achievements and improvements to take forward to the summative assessment. The audio files were attached to the electronic submission and returned to students via a VLE. Written comments were also provided on the scripts where appropriate.

In this research the authors maintained a range of screencast practices, whilst standardising the student perception data collection tool through a standard survey mechanism. Sutton & Gill's (2010) conceptual framework was adopted to focus on feedback's relationship to students at practical, epistemological and ontological levels. This framework informed the following categories of questions:-

- Student reaction and action when receiving feedback.
- Frequency that students revisit feedback.
- Whether feedback informs and affects the tutor-student relationship.
- Affective components – emotional reaction to specific feedback they have received and why this might differ between assignments.

The respondents' (N=35) comments were then analysed for common themes related to these aspects. Specifically, a thematic analysis was undertaken, based on a theoretical approach to qualitative analysis (Braun and Clarke 2007), the common themes sought in the data were informed by the relevant literature on audio feedback. Given this approach, there was an increased need for all three of the academics to remain independent throughout and not to generalise the data collected. In order to tackle this recognised risk of bias, a multiple analyst approach was adopted for the data analysis, in that all three of the academics engaged in the process of qualitative analysis. This allowed for robust triangulation.

3. Results and Discussion

From the qualitative data collected and analysed, a number of common recurring themes emerged which illuminated differences between text and screencast feedback modalities. The most prominent of these were - the perceived advantages of screencast feedback contrasted

against deficits of traditional feedback, students' subsequent use of feedback and student's emotional response to feedback (often related to their perceptions of tutor "care").

3.1. Students comparing Screencast versus traditional text feedback

Many of the qualitative comments focussed on the clarity of screencast feedback comments when contrasted with traditional text comments.

> *"With traditional feedback there can be a feeling that it is rushed if the comments are short / grammatically difficult to follow [this is] definitely a positive step. Avoids the misinterpretation of the written word on a feedback sheet. You can also obtain a lot more feedback in terms of volume and is not subject to difficulties in reading handwriting."*

> *"The audio feedback was exceptionally useful. It not only discussed generic advice, but also tailored specific advice to my paper and focused on areas that I had not quite answered correctly. This will be useful for the actual exam, as I will be able to focus my study on these aforementioned areas to strengthen my understanding."*

In addition, some students commented on the dialogic nature of screencast feedback and the efficiency of conveying a greater volume of information in the same timeframe.

> *"I think it is easier to digest, sometimes written comments lack meaning and need clarification by having a conversation with the marker, whereas this is a more colloquial conversation type feedback which can be more explanatory."*

> *"….it takes far less time to explain a point. What can be said in a few seconds would usually need a paragraph if written. Therefore, it is a more efficient way of giving feedback and also allows for more in depth feedback."*

It appears that voice intonation provides useful cues and reassurance as well as pacing information into manageable chunks.

> *"I prefer it as hearing the feedback in my tutors voice in a conversational style leaves little room for misunderstandings."*

> *"Excellent way of giving feedback as the comments were more detailed and I liked the way you were walked through your work and areas that could be improved were highlighted."*

Students clearly preferred the audio feedback. This seems to be due to a number of factors. Students perceive that audio comments have greater clarity than written comments both due to clarity of language and an amelioration of any difficulties with reading handwriting. The comments seem to indicate that the students receiving audio feedback would have little need to seek clarification from the tutor on the feedback given. It would be interesting to explore

whether audio feedback has the potential to be a time saving exercise in terms of follow up student appointments following the provision of feedback.

Increased efficiency in the audio feedback process allows time to be focused on more in-depth feedback. It is far quicker to speak than write so by providing audio feedback the tutor is able to spend the same amount of time producing the feedback, but has more time to convey more information. Students value the voice intonation in an audio recording, which cannot be replicated in the written word. This was not anticipated by the tutors prior to the research. It seems likely that greater clarity in the feedback would result in higher rates of engagement with the feedback in preparation for summative assessment. This can only serve to increase the effectiveness of such feedback.

3.2. Students' use of feedback

The mean number of occasions students reported listening to the screencast feedback was 3.0 (SD 1.8 occasions). There was wide variation, one student viewed the feedback more than ten times. Overall 88% of students reported viewing the feedback more than once. Unfortunately the authors do not have comparative quantitative data for other similar modules where students received traditional feedback. However students have reported anecdotally that they rarely view written feedback more than once:

> *"The screencast feedback seems to be more personal [...] again it is paper based then it is only checked, once received, then filed away."*

This project did not make use of analytics which would show the number of times content was viewed, the sections viewed, time of day and platform - this would prove useful data for any future research and would be an approach recommended for other researchers to adopt.

3.3. Students' emotional response to feedback

Student reactions were overwhelmingly positive though caution is needed around novelty or halo effects. Students positively evaluate this new method and report faith in its authenticity. It is important to note the student perception that the feedback is personal to them. All feedback should be personalised for that individual student, but in terms of written feedback there was a general perception that it was more generalized or boilerplate. The comments that audio feedback is more personal, may positively benefit the tutor-student relationship. Interestingly students were equally positive about negative and positive feedback messages:-

> *"Excellent, I could actually hear your disappointment in my work rather than just reading about it!"*

Many comments referred to the time taken by tutors to produce the feedback, equating this with notions of "care" about the work and for the student. Interestingly, the production of this feedback took approximately the same time as written feedback.

> *"It made me certain that the tutor had in fact looked at all of my work in a detailed manner as they made reference to key points chronologically."*
>
> *"It was also nice to know that the tutor has actually taken the time to record feedback to each student."*
>
> *"[I would prefer] Audio/screencast for sure - I think a lot of written feedback is copied and pasted and generic - it doesn't feel tailored whereas this definitely was."*

Some students made direct reference to the conversational elements of the feedback, which they saw as valuable:-

> *"It's amazing how the throw away comments sometimes give you the best understanding of where you went wrong."*

Overall 82% of students expressed a strong preference for screencast feedback in their future assignments, 12% expressed no preference and 6% would prefer written feedback. The latter group explained that they preferred to be able to skim feedback to reference a specific point which is certainly a limitation of screencast feedback. The data above also reinforces the desire by students and tutors that the feedback actually be fed forward to aid learning progression and improvement, specifically for any summative assessment. It is significant that the perceived emotional engagement of the tutor has been taken on board by students. The data above shows how audio feedback has developed student emotional investment in the feedback process leading to students spending more time reviewing their work.

4. Conclusion

Students expressed a strong preference for screencast feedback. They value the quantity of detailed feedback, its sequential narrative of situated comments and the voice intonation cues it provides. Students often felt screencasts represented greater tutor "effort" and equated this with notions of "care". In reality tutors expend equal effort, but screencasting exposed the assessment process directly. Once exposed to screencasting students expressed negative feelings towards written feedback. It seems likely that audio feedback can greatly enhance learning through assessment, and can impact the tutor – student relationship positively.

In future research it would be useful to consider whether audio feedback is scalable to larger cohorts. It would also be interesting to explore whether student self and peer assessment, combined with reflection would be a fruitful way to employee audio assessment in a student-led context. Finally it may be useful to focus upon an analysis of staff experience in providing feedback in terms of how modality of feedback affects quantity and type of feedback along with affective concerns for the tutors producing such feedback.

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Applying Test-driven Development to Evaluating Student Projects

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Abstract

Grading software projects submitted by students can become a heavy and time-consuming task, which for many students, can result in delayed feedback provided to them. Additionally, one would like to allow students to evaluate themselves early their projects before submitting the final version for grading.

This paper presents a solution that improves the grading process of student projects not only for lecturers, but also for students. In our approach, we adopt a test-driven development methodology to provide a clear benchmark of the course project implementation. Our approach allows students to self-evaluate their progress at any moment, while lecturers can use it to automate the grading process. GitHub Classroom is used as a supporting tool to allow students to retrieve and implement their projects from the same initial skeleton project including the tests, and lecturers to retrieve the student projects and evaluate them automatically.

The results show that test-driven development is a viable solution to be applied in an academic environment to improve the grading process. This study also shows that courses in Information Technology area could use our approach to increase learning and teaching efficiency.

Keywords: *Test-Driven Development; GitHub Classroom; automated testing; self-evaluation.*

1. Introduction

Grading assignments and course projects have always been an intensive process in higher education. Manual evaluation and grading do not provide the necessary scalability needed for courses with many students. As a concrete example, we refer to one of the courses on the master's level at Åbo Akademi University in Finland, called Development of Web Applications and Web Services (DEWAS). In this course, the students must implement individually a web application, which can contain between 1500 and 2000 lines of code depending on the coding practices and completeness of the implementation.

Evaluating a project in this course is done not only by downloading, building the project, starting the application and navigating through it, but also by inspecting the source code for checking how different features were implemented. On average, grading a project can take around 20 minutes. The course has a variable number of students each year, ranging between 50 and 100, which can result in a high workload for evaluating all projects and providing feedback by the teaching personnel. In addition, we would like that students are able to evaluate their own projects throughout the course, so that they can get an estimate of how many of the project requirements have been implemented and also the corresponding grade for the project.

Our approach applies Test-driven Development (TDD) (Ashbacher, 2003) in building an automatic grading process. TDD is a process in which requirements are turned into test cases, then the code is written to fulfill the tests. This process is usually applied to make sure that every implementation code written meets the requirements. A test case basically executes the system under test (or parts of it) with a sequence of inputs and it checks that the outputs provided by the system corresponds to the output specified by the specification of the system.

Basically, the teachers create a skeleton project with the initial settings and structure, including a set of tests and store it into a software version control system (Chacon & Straub, 2014). The students can download this project to their computers and start working on it. The set of tests should fully reflect the requirements in the assignment specification. Since the project implementation is empty, these tests will fail in the beginning. Students are required to implement the project in order to pass the tests. By continuously evaluating their implementation against the tests, students can track their progress and evaluate their corresponding grade before submitting the final version of the project for grading. After the deadline, lecturers will automatically download and grade all projects at once.

To provide tool support for the above approach, we used GitHub Classroom[1] online version control system, which is one of the tools provided by the GitHub initiative for education. GitHub Classroom provides a means to distribute material, give student feedback, and collect assignments.

2. Related work

Automatic grading of assignments is not a novel topic, many researchers have already addressed this topic in the past with similar approaches. Pilla (2017) utilized GitHub and Travis CI, a continuous integration (CI) service that integrates with GitHub, to build an automatic testing environment for students. Although the work was conducted on some simple C-code assignments, the preliminary results showed great potential. Comparably, Cai and Tsai (2019) applied a similar solution to an Android application development course with improved security.

However, neither of them used a starter repository in their solution. Our approach is also different from theirs because we follow TDD to create a starter repository. Students can download the repository and start working immediately. We do not use any continuous integration (CI) service; instead, we have implemented our approach to automatically download student projects, grade them and generate a detailed course-level report. From our experience, a continuous integration does not provide a global view on all students' repositories, and it requires students to commit code frequently to be relevant. With our approach, we can retrieve student projects any time we want and have all the information of those projects in the report. The approach also allows teachers to update the starter repository and even student repositories.

3. Approach

Figure 1 illustrates the general workflow of our proposed approach. Before the course starts, the teachers specify the project requirements that are directly related to the topics of the course. The system to be implemented has several use cases, for instance, the user should be able to sign up, sign in, sign out, create items, delete items, etc. Use cases can have different levels of complexity and can provide a certain number of points that contribute to the final grade. Each use case is broken into have several functional requirements, for instance the restrictions on the username or the password of the user account. One test will be created for each requirement and added to the test suite.

[1] https://classroom.github.com/

In order to implement the tests before the system is implemented, we need to fix the interface of the system and clearly specify it in a document. During the implementation of the project, the students will implement the behavior behind the specified interface. When the application programming interface (API) is defined and specified and the tests are created, they are both included in a skeleton project which will be delivered to students via GitHub.

GitHub Classroom is an online tool that allows teachers to create assignment repositories. An invitation link is provided to the students. By accessing this link, each student will trigger the automatic creation of a private repository to which both the student and the teacher have access. If a starter code is provided in the initial assignment repository, it will be copied to which of the newly created student repositories. When students download (clone) their assignment repository to the to their computer, they receive a copy of the started code, including the tests, and they can start the implementation of their projects.

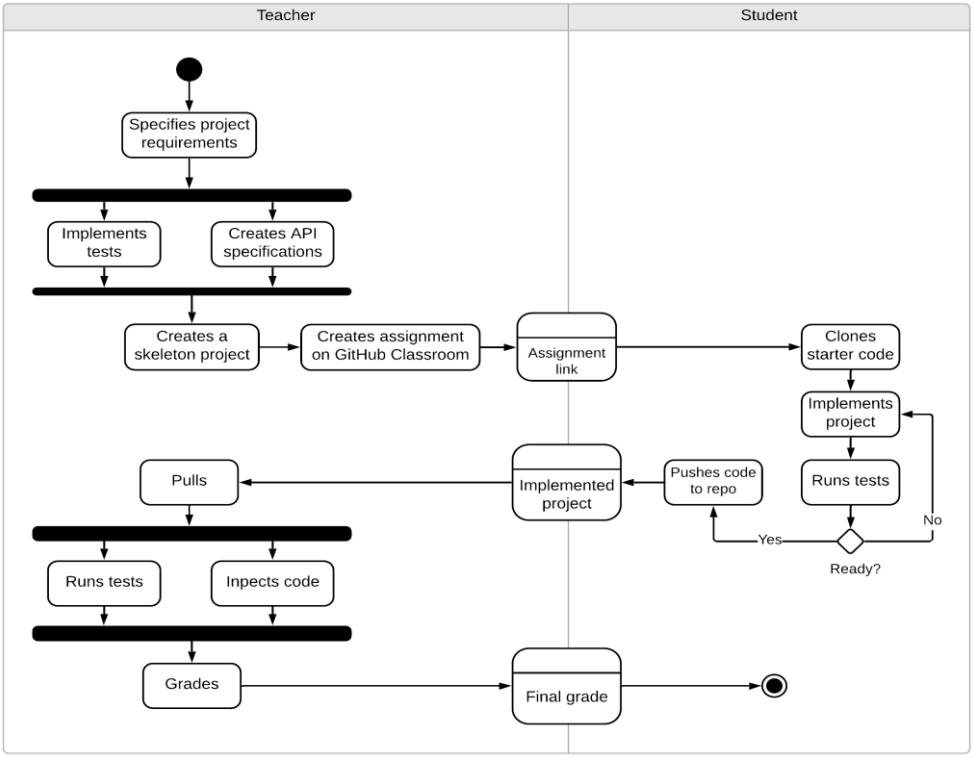

Figure 1. Workflow of the automatic grading process

During the implementation, students have the possibility to run the tests periodically to check what requirements they have implemented successfully and how many points they

currently have. The tests can be used as a self-evaluation tool to check which use cases have passed and which have failed. When they consider their implementation corresponds to the expected grade or before the deadline, students submit their projects by uploading (pushing) the code to the GitHub Classroom repository.

After the final deadline of the project, teachers will automatically retrieve (pull) all repositories, run all the tests for each of them, and create an overview report including the grades for all the students. Manual inspection of the code can still take place if the teacher considered necessary.

4. Example

For this concrete course, we use the Django framework (Holovaty & Kaplan-Moss, 2009) to develop web applications. Django is based on the Python programming and follows the principles of the *model-view-controller* (MVC) design pattern, which in Django is referred to as *model-view-template* (MVT). This pattern allows the separation of the user interface (template) from the business logic (view) and from the data (model) stored in the system.

The structure of a Django project follows the same pattern. A project can be structured into several applications (Figure 2-left) each with its own folder. There are several mandatory files inside a project folder, however we will only discuss the relevant ones for this paper.

Figure 2. Structure of a Django project.

At the top level of the project (Figure 2-middle), the url.py file specifies the interface of the web application as a list of links and what functionality of the application to invoke in order to provide a response to the client (browser). For example, in the code below, whenever a browser will send an HTTP request to an address *https:/myserver.com/signup/* the Django framework will map the request to a function called *signout_view()* which implements the business logic of the sign out feature of the application.

```
urlpatterns =[
   ….
   path('signout/', user.views.signout, name='signup_view'),
]
```

The implementation of the *signup_view()* function is located in one of the *views.py* files of the Django project folders (Figure 2-right). This function, similarly, to all the other business logic functions in the project, have an empty body in the project skeleton which should be completed by the students. After being implemented, the function will return a HTML page that will be sent back to the browser to be displayed.

A corresponding test for this function is shown below. The test verifies requirements REQ1.1 (lines 2-3) by sending a HTTP POST request to the *signup/* URL (line 9) and providing a set of parameters via the *context* variable defined at lines 4-8. The test expects (line 10) that the application will return a HTTP response message with status code 302, in which case the test will be marked as PASS otherwise as FAIL. When the test is successful (PASS), line 12 will be executed and the number of points scored by the entire project will be increased.

```
1       def test_sign_up_with_valid_data(self):
2         #REQ1.1 Sign up with valid username, password and password confirmation,
3         # should return status code 302
4             context = {
5              "username": "testUser3",
6              "password": "!@ComplicatedPassword123",
7              "email": "user1@mail.com"
8             }
9             response = self.client.post("signup/", context)
10            self.assertEqual(response.status_code, 302)
11            # calculate points
12            self.__class__.number_of_passed_tests += 1
```

With this approach, students can check the tests frequently to check their progression. After each run, a report will show what tests have failed or passed and how many points a student has currently earned. Students can go to each test case and test method to inspect the test failure in more detail. Figures 3 and Figure 4 show examples of failed and respectively passed test when using PyCharm IDE[2], a recommended IDE in the course. After each run the students can visualize the number of points received by the project.

[2] https://www.jetbrains.com/pycharm/

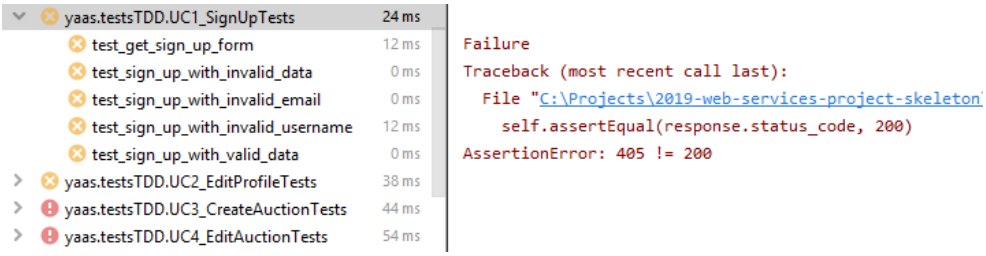

Figure 3. Example of failed tests.

As mentioned in the previous section, we have implemented a script in Python to support the grading process by the lecturers. When the project deadline has passed, the teachers will execute the script, which will run the provided tests on each submitted project and provide statistics with the use cases passed and how many points have been received by each project. A generic example is shown in Table 1.

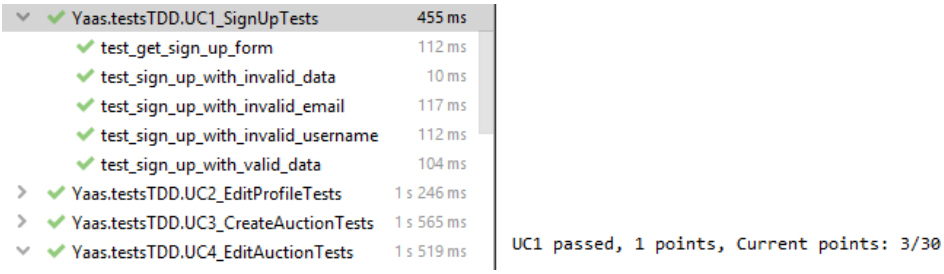

Figure 4. Example of passed tests.

In total, we have implemented 41 tests, covering 12 case studies. Having followed the TDD approach, where the tests have been provided before the project was implemented allowed the students to self-evaluate themselves during the implementation with respect to how many points the project is worth, which functions introduce errors, and what code needs to be improved. If the students commit their code regularly to repository before the deadline, teachers could check their progress status and give helpful feedback during the course rather than only acknowledge the final product.

Table 1. Example of the grading report.

Student	Date	UC1	UC2	…	Total	Repo link
Student A	16/01/2020	1	1	…	16	https://github.com/…
Student B	16/01/2020	1	0	…	18	https://github.com/…
Student C	16/01/2020	0	1	…	15	https://github.com/…

5. Evaluation

To this extent, most of the students provided positive feedback on the approach since it allowed them to understand and plan their programming tasks better.

The approach also has some limitations. In order to provide the automated tests from the beginning, we had to clearly specify the interface of the application, for which otherwise the students would have had complete freedom. Also, some of the features of the application could be implemented in different ways by the students, but the tests would impose that a certain way is followed, creating additional constraints.

Another negative aspect was that not all requirements could be translated into automated tests. For those we had the option of either removing them from the project requirements or manually inspect them when the project is submitted.

Some effort was spent in the beginning by the lecturers to implement the tests and clearly specify in the interface, however the benefits in terms of efficiency the new approach decreased dramatically the time needed to grade the assignments. As such, we were able to run the automated tests on all 60 projects submitted by students in around 110 minutes on a Windows 10 laptop featuring an Intel i7-7500U CPU with two cores at 2.90GHz and 16GB of RAM. This menas less than two minutes per project. Roughly 5 minutes of additional time was allocated in average to manual code inspection of the requirements that had no associated tests. Overall, we have observed a reduction of time of more than 65%.

6. Conclusions

In this paper, we presented an approach that uses test-driven development for automatic grading and evaluation of student projects in a programming course. The results show that TDD is a viable approach which in combination with automation tools provided by for instance GitHub Education can make the learning process more efficient. As future work we plan to evaluate our approach in other courses and also calculate its impact on the average grade of the students in the course.

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A pedagogic approach by contextual immersion

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Abstract

In several training institutions in sub-Saharan Africa today, the competency-based approach to teaching (CBA) has been adopted at the secondary school level. In Cameroon, based on our experience in teaching, we have found that this approach does not suit all categories of learners, generally the youngest. With the advent of Information and Communication Technologies (ICT), learners spend most of their time on ICT's gadgets (mobile phone, tablet, etc ...). In this paper, we propose a complement to the CBA approach through pedagogic differentiation. This differentiation takes into account the learner's environment and adds a playful and captivating aspect to the techno-pedagogic tools to be made available to them through the gadgets they use. We call this approach contextual immersion. It starts from real life situation familiar to the learner. The tool made available to the learner, which integrates this approach, guides him/her progressively towards the solution to the problem posed and a generalization that summarizes the course that will be transmitted.

Keywords: *contextual immersion; pedagogical differentiation; captivating ;playful; competency-based approach; techno-pedagogical tools.*

1. Introduction

Cameroon has adopted recently as teaching method, the CBA - ELS / EA (competency-based approach with entry by life situations / entry by activities) in which, the student is supposed to be at the center of learning. Based on our experience, we have noticed that students at the secondary level are more interested in games and very often do not find the lessons attractive, captivating or even having some fun. Also, they turn to look for shortcuts that may require less effort or time.

We carried out a survey on the importance of an approach linked to daily life and ICT tools through techno-pedagogy on a sample of 344 students in the 5th and 6th forms in literary classes. The outcome was that the CBA course was not captivating, but rather restrictive. Indeed, the activities outlined in the approach were not illustrative and contextual. On the other hand, with illustrations in the form of a series that we propose to the students, they would be captivated and available for learning in addition to the playful aspect that these would introduce. The challenge in the following is therefore to build a pedagogy that takes into account the current evolution of technology and learners' opinions.

A question that immediately follows is what kind of pedagogic approach, which at the same time takes into account the desired objective while integrating a playful aspect related to the electronic objects cherished by the learners can be implemented? It is clear that if the learner had the choice or an opinion on the teaching methods to be used for his lesson, we will have future men and women ready to live in harmony with their environment, highlighting their different talents. It is well known that one of the learning objectives is to promote the mastery of our environment. Based on these, we thought to bring added value to the CBA by accompaning learners who are immersed in their context, come out with the solution to a problem, and the general formulation of this type of problem. At the end, learners develop techniques of practical use of the acquired skill while having fun and saving time.

The rest of the document is elaborated as follows: In section 2 we present a background check on the most recent approaches. In section 3, we present our proposed approach and its experimentation. Section 4 and 5 are respectively reserved for discussions and a general conclusion.

2. Background check

The result of learning is usually not instantaneous. Learning is a long-term skill with well adapted approaches that can be extended or transferred to different contents or situations. A pedagogic objective consists in well orienting what is expected from the learner at the end of the teaching-learning process. This process requires the ability to transfer and to develop

the steps that lead to the desired competency. The two approaches most commonly used in Cameroon's education system are the objective-based approach (OBA) and the competency-based approach (CBA), which we present below.

2.1. Objectiive-based approach

According to Nguyen and Blais (2007), OBA, which stems from the increase in knowledge and clientele, consists of planning teaching activities that include needs analysis, goal setting and the choice of teaching strategies and evaluation.

Objectives state what is to be learned, represent what is expected of students, and express what the teacher values for the learners and the level of cognitive ability expected of learners. Thus, these objectives direct the way in which the learner can accomplish a certain self-assessment following the example of his teachers, develop the ability to set goals for himself that serve him during his lifelong self-study (Carrette and Rey, 2010). Education is organized and promotes a convergence of efforts towards the achievement of these objectives. This approach has been studied by several researchers as Nguyen and Blais (2007), Bloom et al. (1975), Bonner (1999), De Landsheere and de Landsheere (1989), and Fontaine (1989). Some limitations of the approach are:

- the non-operationalization of the objectives in terms of practical know-how;
- the failure to take into account the orientation of the learner towards activities for which he is naturally gifted (the objectives are the same for all at each level: no pedagogic differentiation);
- the learner, for whom the others decide on the objectives, is compressed in knowledge;
- Teacher-Learner communication is verticality downwards. The large volume of notes to be taken makes studying or revision tedious, which, according to the learner, is comparable to a chore;
- the absence of playful aspects that match the age of learners in the learning process does not always make learning captivating.

2.2. Competency-based approach

In the CBA, learning aims at resolving complex situations, and it is advisable to place the learner at the center as early as possible, while providing appropriate support which will gradually lead him or her to act independently. This approach has been studied in several forms by certain researchers, for example, Bosman et al. (2000), Boutin & Julien (2000), Roegiers (2001), Burns & Klingstedt (1973), and Burke (1989). The CBA is limited in that:

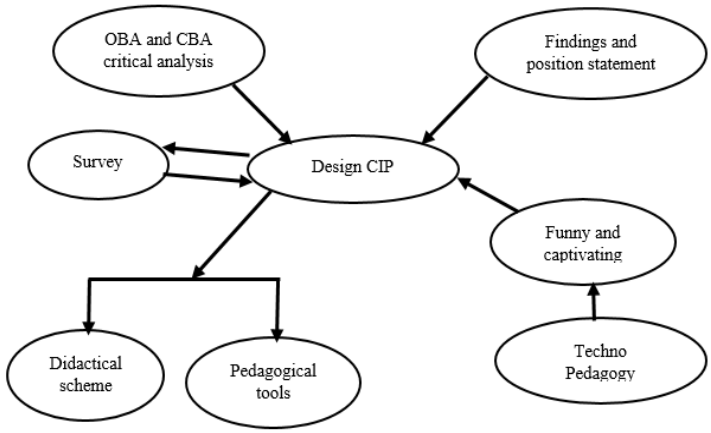
- the assumed skills of the learner are not always acquired due to the lack of interest of learners;
- mismatch between the time available and the volume of material to learn;

- not always suitable for the under-18 age group because they do not feel compelled to be productive;
- like OBA, it lacks the playfulness aspect.

Given the limitations of these two approaches, a more optimal approach would bring the learner to solve problems in his context, leading to course notes reduction and time gain. To get close to that, we intend to bring in ICT tools which makes learning captivating, easier and more objectively oriented towards exposing natural talents. This approach, which we henceforth call **"Contextual Immersion Pedagogy",** will be implemented in a techno-pedagogic environment with the application of pedagogic differentiation as indicated by the following authors: Avanzini (1986), Baluteau (2014), Burns (1971) and Cèbe et al. (2015).

3. Contextual Immersion Pedagogy: Experimentation

Our contribution in the design of this new pedagogic approach will focus on the Cameroonian context. the process is led by the following scheme.



OBA = objective based approach; CBA = competence based approach; CPI = contextual immersion approach

Figure 1. The design process.

3.1. Development of the new Contextual Immersion Pedagogy approach

a) Scripting of the course by the teacher (preparation of a lesson)

- Create a didactic situation where, using the lesson to be taught, learners find solutions to their daily problems by bringing in the playful aspect to better captivate them.

- Make a pedagogic differentiation that will take into account different categories of learners.
- Write the lesson in the form of the script of a series to make it available for video editing.
- Make sure that the video that will be edited for a lesson be short (about ten minutes).

b) Learning situation

- Install techno-pedagogic material beforehand.
- Project the video of the didactic situation for the lesson.
- Take 15 minutes for feedback from learners based on the projected situation.
- Conclude in 25 minutes with a brief summary of the lesson.
- Direct students to the bibliography.
- Make the video available to them after the lesson.

3.2. Experiences and results

a) Description of the experimental setting

The experimental environment we chose for this new approach is the 6th form in the ODZA Adventist School Complex in Yaoundé, Cameroon, during the 2019-2020 school year. A lesson was delivered in this class of 71 students following the steps in Section 3.1. In order to measure the impact of this approach, we chose a subject that the students of this class do not generally like, "Mathematics". A lesson on simple linear equations with one unknown was delivered according to the setting below:

1) Equipment used:
   - a laptop computer;
   - small speakers connected to the computer;
   - a video projector;
   - a projection plane tool;
   - a CD containing the video of the immersion situation.
2) Teaching situation:
   - We played the video for 12 minutes in the classroom with all the students.
   - A course summary was made with the students after the contextual immersion in 30 minutes.
   - Then we administered a questionnaire to have their opinions about this way of approaching a lesson.

b) Results on the two surveys

i) Survey on the importance of the approach based on techno-pedagogy in secondary education

The graphical representations below give us the trend of learners' opinions.

Would you like to improve your academic skills using ICT tools?

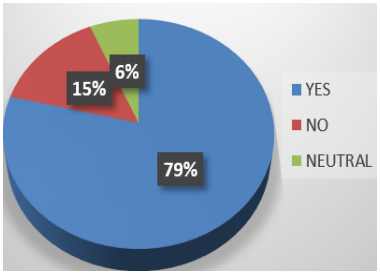


Figure 3. courses with ICT tools.

If your lesson was in the form of a television series (captivating with practical work and simulation example) where each chapter represents an episode, would that suit you?

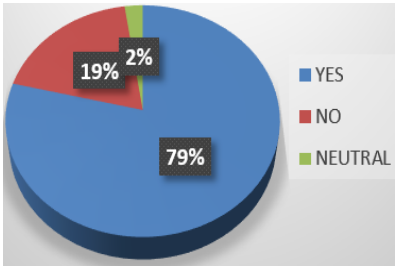


Figure 4. lesson as televisionserie.

Comments on the survey results:

- 79% wish to improve their academic skills using ICT tools.

- 79% wish to have a captivating course in the form of a television series where, for a discipline, an episode constitutes a chapter.

With these statistics of 79% favorable to a techno-pedagogic approach, the teaching team has developed an adapted tool.

ii) Survey based on the Contextual Immersion Pedagogy approach

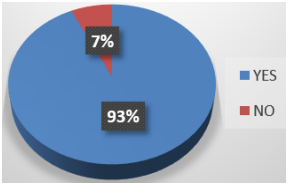


Figure 5 Did you like the video?

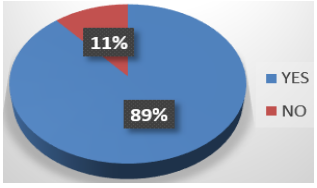


Figure 6 Is it necessary to make similar videos for all the chapters?

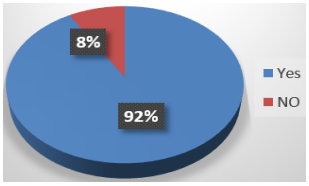


Figure 7 Would you like similar videos in other disciplines?

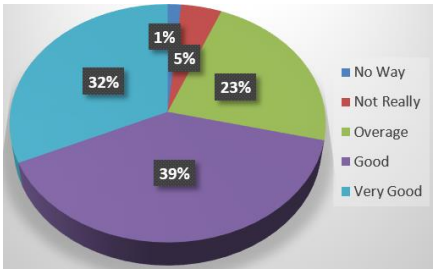


Figure 8 Did this video help you understand the course?

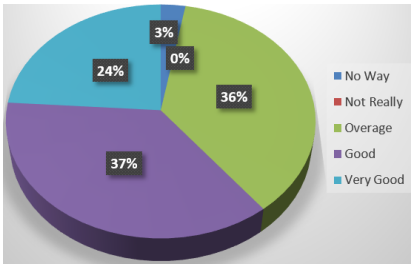


Figure 9 Do you think that this type of videos facilitates the understanding of mathematics chapters?

Comments on the survey results:

Students who like the video	Students who would like to have similar videos for all lessons	Students who would like to have similar videos in other disciplines	Students who did not understand anything at all about the course using the video	Students who did not really understand the course through the video	Students who averagely understood the course through the video	Students who understood the course well through the video	Students who understood the course very well through the video
92.95%	88.73%	91.54%	1%	5%	23%	32%	39%

3. Discussions

In a CBA situation for the same course, the learners are bored and more than 60% are present for fear of disciplinary reprisals. Others ask for endless exit permits to escape the constraint of learning a course with skills that they are supposed to have but that they do not have. With the approach that we proposed above, the results are opposite to those of the CBA because more than 92% of the class was captivated in front of this video so they recognized themselves as actors in similar situations. However we can also notice that:

- The design time is long compared to other approaches while the learning time is shorter. Then the learner saves the time lost by the designer
- The contextualization through pedagogical differentiation makes the task of the designer more complex but effective. This aspect is not always developed in other approaches (CBA and OBA)
- Production requires additional resources
- Learning, although easy, requires that the learner has ICT tools which are difficult to acquire for certain but essential nowadays

4. Conclusion

The objective of this work was to prove that a new approach based on techno-pedagogy implementing pedagogical differentiation was suitable for learners of a certain age (10 - 18 years old) due to their affinities with ICT gadgets. From the polls of an experiment in the classroom we noticed a particular interest of the learners to follow the course on this new form despite the fact that the subject matter for the lesson is often not affected by these learners. The results are very satisfactory and work continues in this direction to improve this approach which is like a contract between the learner and the teacher. They are given what they like and the educational objectives are attained at the same time.

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Motivations and concerns of outgoing Erasmus students

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Abstract

Internationalization of higher education is a priority in the European education policy. Since it began in 1987/1988, the world's most successful student mobility programme, the Erasmus programme, has provided over three million European students with the opportunity to go abroad and study at a higher education institution. Aiming to speed up this trend, for the next long-term EU budget 2021-2027, the European Commission has proposed to double funding for Erasmus to EUR 30 billion. In this way, it will make it possible to support up to 12 million people between 2021-2027. However, learning mobility barriers still exist and the shares of study abroad participants vary widely across Member States.

Within this context, the aim of this contribution is to investigate the motivations and concerns about the experience abroad of 1272 students of a medium size Italian university – the University of Bergamo – that apply for an Erasmus+ or Extra-EU Program. To analyse the data collected by an on-line survey we used the Principal Component Technique.

Keywords: *International study mobility; higher education; motivations and concerns; principal component analysis.*

1. Introduction

Internationalization of higher education is a priority in the European education policy. According to the strategic objectives of Europe 2020, "*an EU average of at least 20% of higher education graduates should have had a period of higher education-related study or training abroad, representing a minimum of 15 ECTS credits or lasting a minimum of three months*" (EU Council of Ministers of Education, November 29, 2011)[1].

Since it began in 1987/1988, the world's most successful student mobility programme, the Erasmus programme, has provided over three million European students with the opportunity to go abroad and study at a higher education institution or train in a company. Aiming to speed up this trend, for the next long-term EU budget 2021-2027, the European Commission has proposed to double funding for Erasmus to EUR 30 billion. With doubled funding, this programme will be even more effective in supporting key objectives. It will make it possible to support up to 12 million people to have a learning experience abroad.

However, learning mobility barriers still exist and the shares of study abroad participants vary widely across Member States.

Research in this area is expanding with the aim of understanding motivations and potential benefits of international students' mobility. The studies have mainly focused on the factors influencing the choice to spend a period of study abroad and on the effects that the international mobility can produce on the skills and on the employability (see, among others, Di Pietro & Page, 2008; Di Pietro, 2015, 2020 a,b; Lörz *et al*., 2015; Luo & Jamieson-Drake, 2015; Netz, 2015; Parey & Waldinger, 2010; Rodrigues, 2013; Schnepf & D'Hombres, 2018).

In the last decade, the intent to study abroad has been analyzed in some studies carried out on samples of European students. The approach has been two-fold. On the one hand, some studies have investigated ex ante the propensity of students towards an international mobility experience. Among them, the Eurostudent survey (2016-2018) showed how the international mobility involves still a relatively small number of students, characterized by a good socio-economic and cultural background (DZHW, 2018). On the other hand, other studies have focused on detecting ex post the impact of the experience of international mobility. Among them, the reports funded by the European Commission *The Erasmus Impact Study* (CHE Consult, *et al*., 2014, 2016 and 2019).

Within this context, the aim of this paper is to investigate mobility students' motivations and concerns about the experience abroad. We use a rich dataset based on students enrolled in a

[1] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/educ/126380.pdf

medium size university of the North of Italy (the University of Bergamo). We have conducted an on-line survey addressed to all the outgoing students in the a.y. from 2015/2016 to 2019/20 before the mobility experience. To assess the results of the survey, we apply a principal component analysis.

2. The questionnaire and the respondents

To asses motivations and concerns of the outgoing students of the University of Bergamo we prepared a questionnaire consisting of two sections: "Decision to study abroad" (section B) and "Concerns before the departure" (section C). In addition, we ask a few questions (section A) regarding the student's personal details: parents' level of education, parents' employment status, own or family's previous experience abroad, number of semesters abroad and type of internationalization program (Erasmus+, Extra EU Program).

In the first section "Decision to study abroad", we ask students to motivate their decision to apply to study abroad, i.e. to enhance future employability, to enrich their CV, to live a new experience, to improve foreign language skills, to get in touch with the culture of the host country. Furthermore, we analyse the factors that address the choice towards a given host country and university: i.e. alignment of study programs and availability of scholarships, prestige of host city and reputation of the university, knowledge of the language and culture of the host country, living costs.

In the second section "Concerns before the departure", we ask students to express their concerns about different teaching methodologies, attending courses and taking exams in a foreign language; but also in aligning their progresses and the average marks in the home university. Finally, we ask about the cost of living in the host country and living away from home.

Our survey involves 1272 students (66% females and 34% males) who applied to spend one/two semesters abroad for an Erasmus, Erasmus+ or Extra EU Program during the academic years from 2015/2016 to 2019/20. Students belong to all five fields of study offered by the University of Bergamo: Foreign Languages (41.9%), Economics (27.5%), Engineering (15.9%), Social Sciences (12.4%), Law (2.3%). They are mainly Italian (more than 90%) and apply to study abroad during the bachelor (57.1%).

Data after mobility shows that in the University of Bergamo the Erasmus+ students spend their credit mobility mainly in Spain (27%), Germany (17%), France (14%), United Kingdom (13%) and in the other EU countries (20%). Within the Extra EU Program, small groups of students leave to China, USA, Australia, Brazil, Mexico, Japan and Turkey.

3. The principal component analysis and the variables

The basic idea of principal component analysis (PCA) (Batholomew *et al*., 2008) is to replace q correlated variables by a smaller number of uncorrelated variables which contain most of the information in the original set. This simplifies the task of understanding the structure of the data since it is much easier to interpret a few number (two/three/four) of uncorrelated variables than a more complicated pattern of the original variables.

The central idea is based on the concept of the proportion of the total variance – the sum of the variance of the q original variables – that is accounted for by each of the new variables. PCA transforms a set of correlated variables or items $x_1, x_2, \ldots, x_q$, into a new set of incorrelated variables, $y_1, y_2, \ldots, y_q$, each of which is a linear combination of the $\boldsymbol{x}$ variables. The new variables are derived in decreasing order of importance in the sense that y_1 accounts for as much of the variation in the original data amongst all linear combinations of $x_1, x_2, \ldots, x_q$. Then y_2 is chosen to account for as much as possible of the remaining variation, subject to being uncorrelated with y_1, and so on. The new variables defined by this process, $y_1, y_2, \ldots, y_q$, are called principal components. In this way, the first few components will account for a substantial proportion of the variation in the original variables and can be used to provide a convenient lower-dimensional summary of these variables. The full set of q principal components fully explains the total variance: $\sum_{j=1}^{q} var(y_j) = \sum_{i=1}^{q} var(x_i)$.

However, if it turns out that the first few principal components account for a large enough part of the total variance, most of the variation in the $\boldsymbol{x}$s being explained by the first few $\boldsymbol{y}$s, and then the remaining principal components can be discarded without too great loss of information.

In our data analysis, we consider 1272 students and 26 items concerning:

- category of student: bachelor or master,
- gender of student: female or male,
- mother's and father's level of education (4 increasing levels),
- mother's employment: if the mother works or not,
- own or family's previous experience abroad,
- 7 items proxing the importance in motivating the decision to study abroad: to improve the CV, to improve foreign language skills, to learn about the culture of the country, curiosity towards a new experience, external influence (family or friends), to increase employability, economic condition of the family (with 4 increasing levels for each item),
- 5 items proxing the importance in motivating the choice of the host university: knowledge of the language and culture of the host country, economic importance of the host country, reputation of the host university, appeal of the host city, external influence (family or friends) (with 4 increasing levels for each item),

- 8 items proxing the concerns before the departure: different teaching methodologies, attending courses and taking exams in a foreign language, having relationships with students of other nationalities, worsening mark average, difficulties in aligning the progresses in the home university, to live away from home, living cost of the host country (with 4 increasing levels for each item).

To analyse the data, we used the open-source R language (Everitt, 2007).

4. The results

In the preliminary analysis presented in this paper, we consider the first four principal components (PC), together explaining 37% of the total variance:

First PC: concerns before the departure (PC1)

All items (except the living cost in the host country) expressing worries belong to this first PC: different teaching methodologies, attending courses and taking exams in a foreign language, having relationships with students of other nationalities, worsening mark average, difficulties in aligning the progresses in the home university, to live away from home. The degree of concern decreases if we consider a student of master level or male.

Second PC – specific interest in the host university and country (PC2)

In this second PC we see that the economic condition of the country, the reputation of the university and the appeal of the city are important factors in motivating the choice of the host university, but we also find future employability and the possibility of improving foreign language skills. These aspects become more important for male students.

Third PC – non-academic interests (PC3)

The non-academic items that motivate the choice to study abroad are the desire to know the culture of the host country and the curiosity about a new experience.

Four PC – social and family background (PC4)

This PC is characterized by the mother's and father's level of education, the mother's employment and own or family's previous experience abroad.

By a plot it is possible to better understand the relationships between the PCs and the field of study of the student.

In Figure 1, the *x*-axis (PC3) and the *y*-axis (PC1) divide the students (dots) in the Cartesian plane into four quadrants, numbered counterclockwise: in the first quadrant (top right) there are the students showing high concern and curiousity for a new experience; in the second

quadrant those who show high non-academic interests, but are not very worried. Below the PC3-axis in the third quadrant, we find students neither particularly concerned nor curious; finally in the lower right quadrant, we find subjects with worries, but few non-academic interests.

The scatter plot of PC1 versus PC3 in Figure 1 shows that the concerns component takes high values for Foreign Languages' students. Moreover, these students emerge as more motivated by non-academic interests, than Engineering students for which both PC1 and PC3 seem to have a low impact on the decision to go abroad. Looking at this plot, it is also possible to analyse the position of the Human and Social Sciences students that are allocated in the first and second quadrants, showing that, as Foreign Languages students, they are concerned, but they are also more curious and very interested in the culture of the host country, in line with their educational background. Most Economics students are located at the bottom of the plot, so they show little curiosity about the new experience and the culture of the host country.

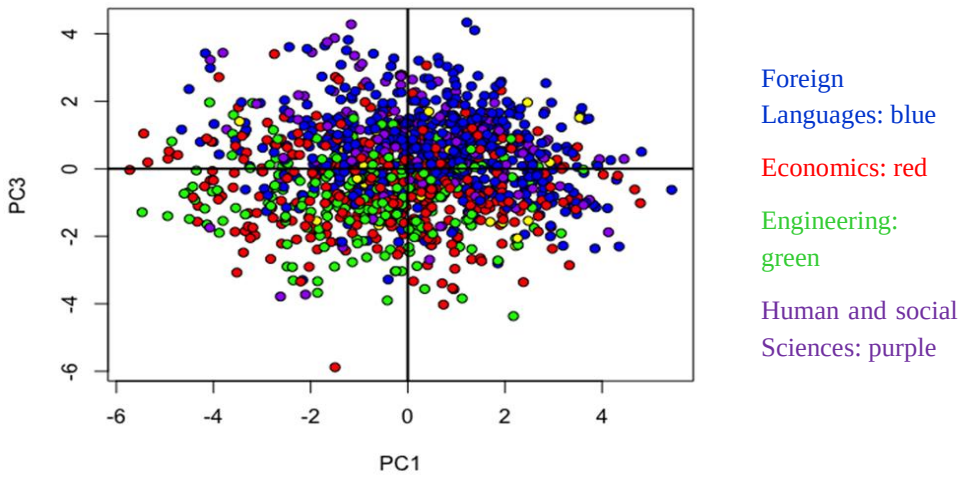
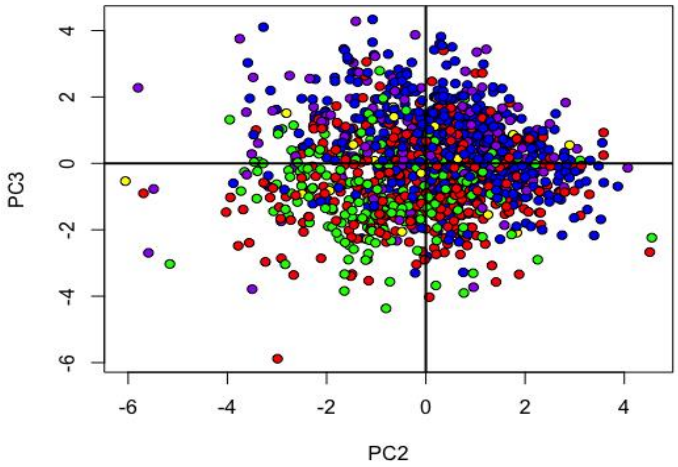


Figure 1. The relationship between PC1 and PC2.

The scatter plot of PC2 versus PC3 (Figure 2) – specific interest in the host university and country versus non-academic interests – shows that there is a clear distinction between Engineering and Foreign Languages and Human Sciences students. Foreign Languages and Human Sciences students (mostly allocated in the first quadrant) emerge as very motivated by the reputation of the host university and charm and culture of the host country. In contrast Engineering students are mostly in the third quadrant, characterized by a lower interest in a specific university and country and by less curiosity.



Foreign Languages: blue

Economics: red

Engineering: green

Human and social Sciences: purple

Figure 2. The relationship between PC2 and PC3.

5. Conclusions

There is a widely shared perception among politicians and higher education institutions that studying abroad is beneficial to university students' personal development, foreign languages skills and employability. However, data indicate that international mobility varies widely across students by field of study, by gender, by socio-economic and educational background. Evidence of this heterogeneity emerges also in our analysis, where motivations and concerns towards a study experience abroad characterize in different measure students belonging to different groups (by gender, degree, ..). A better understanding of these factors could help higher education institutions to design policies suitable for facilitating greater student access to study abroad opportunities.

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Socrative in the Language Classroom: Tackling Classroom Anxiety and Encouraging Participation

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Abstract

In second language teaching and learning the building of trust relationships and the creation of a mutually supportive atmosphere can be fundamental: It is well recognized that affective concerns, such as anxiety and communication apprehension, are more salient in the language classroom (Hernández & Rankin, 2015). Practitioners have long been aware of the importance of reducing learner anxiety and one way that has been shown to be effective is motivation (Gardner, 1985). This paper will consider how the use of the smart personal response system Socrative *can help address learner anxiety, foster motivation and encourage participation. It will examine theoretical approaches to foreign language anxiety, as well as reviewing motivational factors in language-learning. It will also present qualitative evaluations of using* Socrative *in the third-level language classroom in both small and larger group settings. The introduction of* Socrative *has thus far yielded encouraging results, increasing student engagement, promoting interaction, L2 production and more effective learning, alongside a more comprehensive evaluation of student understanding and knowledge retention. As regards its effectiveness in addressing FLA, initial qualitative results suggest that it can be an effective tool in helping to foster a mutually supportive identity and a low-anxiety atmosphere in the classroom.*

Keywords: *Foreign Language Anxiety (FLA); motivation; interaction; trust networks; personal response systems.*

1. Introduction

Levels of student stress and anxiety are reportedly on the increase at all levels of education in the UK and is of particular concern to third-level educators, with the number of students declaring a mental health problem having more than doubled in recent years (see Office for Students, 2019; Universities UK, 2018). Not only is this concerning for reasons of general mental health and wellbeing but anxiety has also been shown to have a significant detrimental effect on learning, impairing attention control, information processing, decision latencies, inductive reasoning and memory recall and retention, resulting in situational avoidance, mal-performance and non-achievement (Ellis, 1990; Gower, 2004).

Foreign Language Anxiety, or FLA, is considered to be "a distinct complex of self-perceptions, beliefs, feelings, and behaviours related to classroom language learning arising from the uniqueness of the language learning process" (Horwitz, Horwitz & Cope, 1986, p.128). It is a specific type of anxiety – a situation-specific anxiety – specific to the foreign language-learning context and prompted by a specific set of conditions unique to that context. It can include such things as communication apprehension, test anxiety, social anxiety, performance anxiety, fear of negative evaluation and self-esteem and self-confidence issues. This is of concern to language teachers because it has been shown that language anxiety, according to Krashen (1985), "inhibits the learner's ability to process incoming language and short-circuits the process of acquisition" (cited von Wörde, 2003, p.1). Furthermore, FLA "can interfere with the acquisition, retention and production of the new language" (MacIntyre & Gardner, 1991, p.86); so FLA can interfere with both the development of language proficiency and students' ability to produce and reproduce the language they have already learned (MacIntyre & Gardner, 1991). However, some research in this area has shown that a certain level of anxiety can be beneficial or motivational (see Marcos-Llinás & Garau, p.95-96), though one should here distinguish between facilitative and debilitative anxiety. Facilitative anxiety motivates students to learn more, affecting individuals in a positive or excitatory way, whereas debilitative anxiety has a negative or inhibitory effect and impedes learning. Most studies in this area agree that FLA is debilitative and impedes foreign language acquisition and production and therefore has a detrimental impact on student engagement and achievement. Therefore, the alleviation of FLA has important implications for language teaching and learning.

2. Personal Response Systems (PRS)

PRS have been in use in an educational context since the 1990s. They allow students to respond to questions via PRS handsets, usually in the form of a wireless TV-style remote control or clicker. For instructors, these response systems can be used to gauge student understanding as well as to identify knowledge gaps or misconceptions. They can also be

useful for eliciting instant feedback and for encouraging teacher-to-student and student-to-student interaction, by, for example, opening up a discussion or encouraging students to problem-solve as a group before responding. PRS can also be useful tools for keeping students motivated and engaged as they can be used to switch the focus of a lesson, to bookend or review a topic, or to introduce a different medium to help break up the pace or direction of a class.

For students, PRS help in validating their own learning, progress and understanding. Students can see if they have understood the concepts to which they have been introduced, and they can also gauge where they stand in comparison to their peers, but without being exposed, put on the spot, singled out, or asked to 'perform' in front of the class. For instance, students can receive visual feedback allowing them to see that they are not the only one who does not fully grasp the material. Furthermore, and perhaps more importantly, PRS are fun to use. In my experience, students react to this tool as if it were a game rather than a drill, test or assessment.

Socrative (https://socrative.com), the PRS tool which is the focus of this paper, is a smart personal response system which is freely available online (subscription required for higher-level features), runs on smart devices and is quick and easy to set up and use.

2.1. Socrative: Functional Considerations

Socrative offers a variety of functionalities and activities, including polls, quizzes and quick on-the-fly questions, which can be easily personalized to pedagogical needs. Users can create and deploy activities from a personal bank or import activities shared by other users, and can select from a variety of delivery methods.

For my purposes, I have found that Teacher Paced delivery works best: It offers more control over student responses and provides opportunities for students to measure their performance against their classmates and benefit from guided discussion. The Instant Feedback setting would initially suggest a more user-friendly and less anxiety-inducing option as students can work at their own pace; however, in my experience, it is not as effective as students find it harder to make peer comparisons and teacher guidance is impeded. Teacher Paced delivery provides students with a better sense of their own learning, along with guidance as to where and how to improve, and the teacher with a better sense of the understanding and progress of the entire group. It also allows for more interactivity, particularly if you use a short answer quiz where students can see answers appear on the big screen, in real time, as they post them. Inevitably, as soon as they realise this, they do play with the medium, posting silly answers and cute messages, but I have found it best to engage with this, up to a point. It shows that students are enlivened, engaged and are interacting; they have become autonomous actors within the learning environment. The exercise becomes a game, rather than a grammar drill, for example, and students enjoy being able to post and share messages that everyone can see.

As regards other functionalities, ensuring students provide and retain an identifying username, which also preserves anonymity, is key. Each activity generates a report enabling tutors to review student and group performance. Having an assigned username helps both tutors to measure performance and students to identify themselves when responding in class or when receiving focused guidance on answers.

3. Practical Considerations & Theoretical Context

In the language classroom, *Socrative* provides a quick and universal method of assessing student understanding which can be invaluable, especially in larger group settings. Normally, language groups are limited in size. However, as Hernández and Rankin (2015) point out, since the 2008 financial crises "universities are having to do more with less" (p.2), the impact of which on the teaching of lanuguages has been larger class sizes and fewer contact hours, neither of which is ideal. Technology can be mobilised to help address these issues, allowing educators to create more capacity and do more things more quickly and more effectively, but it cannot completely replace other methods, nor should it. Nevertheless, technology can help alleviate some of the current issues and this was initially why I introduced *Socrative* into my practice at the National University of Ireland, Galway in 2014-15 with the Beginners Spanish cohort of circa 90 students, who came together for a weekly grammar lecture.

I chose PRS as a way to deal with a large-group language class as these systems allow the instructor to test group understanding, not just a few chosen individuals, and to do so rapidly and more comprehensively than traditional, individual Q&A methods, invaluable when faced with a larger group, particularly in a space not conducive to language learning, such as a lecture theatre. It is also a tool that is less anxiety-inducing, as students are not put on the spot, which helps to build and maintain trust and foster a mutually supportive atmosphere. In second language pedagogy this can be fundamental, as "teaching and learning a language poses unique challenges since, unlike almost all other disciplines, its subject matter is so often also the vehicle of instruction. Thus, it is frequently recognized that in learning languages there are more affective concerns such as anxiety and communication apprehension that are not so salient in other disciplines" (Hernández & Rankin, 2015, p.1).

As Horwitz *et al* (1986) say: "Many people find foreign language learning, especially in classroom situations, particularly stressful" (p.125) and this is the case even if they have chosen to study a language. Guiora, in developing the idea of the language ego, argues that language learning is "a profoundly unsettling psychological proposition" because it directly threatens an individual's self-concept and worldview. In part this is because the development of the language ego is considered to directly parallel that of general ego development (Guiora, Brannon & Dull, 1972, p.422). Therefore, learning a second language means taking on a new identity as learners develop a new mode of thinking, feeling, acting and expressing

themselves. At the same time, language learners often find themselves unable to express who they are in the L2 because they lack fluency – they are reduced to very basic or infantile forms of expression – which can be threatening not just to self-esteem or status but also to a person's sense of who they are. Horwitz *et al* (1986) concur, suggesting that any L2 communication entails risk-taking and vulneration: "Because complex and non-spontaneous mental operations are required in order to communicate at all, any performance in the L2 is likely to challenge an individual's self-concept as a competent communicator and lead to reticence, self-consciousness, fear, or even panic" (p.128).

Second language teaching practitioners have long been aware of the importance of reducing learner anxiety and one way that has been shown to be effective is motivation: "positive attitudes and motivation are related to success in second language learning (Gardner, 1985). Motivation is a complex phenomenon, which for second language learners, has been defined (Lightbown & Spada, 2004) in terms of two factors: 1) learner's communicative needs; 2) their attitudes towards the second language community. If learners want or need to learn the L2 to fulfil professional ambitions or career goals – that is for a particular purpose – they will focus on the communicative value of the L2 and will therefore be motivated to become proficient in it. If learners have a favourable attitude towards the L2 community and/or culture, they will desire more and better contact with them. Gardner and Lambert (1972) coined the terms integrative motivation, to refer to language learning for personal growth and cultural enrichment, and instrumental motivation for language learning for more immediate or pragmatic goals. Other terms that have been used are extrinsic motivation – doing something for its external rewards – and intrinsic motivation – doing something because it makes you feel good or fulfils you. Research has shown that both types of motivation are linked to success in second language learning and that mobilising both types of motivation should be embedded in teaching delivery to truly engage students and achieve deep learning.

In language teaching, there are additional key motivational factors at play in the classroom, not least of which is the social context. People are sensitive to social dynamics and power relationships and "the fact that languages exist in social contexts cannot be overlooked when we seek to understand the variables which affect success in learning." (Lightbown & Spada, 2004, p.57) This brings us back to the issue of learner anxiety once more, particularly as it has been shown (see Trang, Moni & Baldauf, 2012, p.9) that despite strong motivational drivers, particularly extrinsic ones, students can still suffer from high levels of FLA which can lead to feelings of low self-esteem, avoidance and withdrawal, including abandonment of language study altogether. Reducing anxiety, on the other hand, seems to increase language acquisition, language retention and learner motivation (von Wörde, 2003, p.12), while enhancing intrinsic motivational drivers as part of this process can help students better manage their anxiety, along with making the language-learning process more enjoyable.

In the language classroom, what are the situations or activities that cause learners to feel most anxious? Research in this area by Young and von Wörde have shown that oral presentations and oral responses are some of the most anxiety producing activities in the language classroom; this includes when the teacher calls on a student to speak or answer a question. The most anxiety-provoking situation is having to speak or perform in front of others. So it seems that one of the drivers for FLA is the fear of self-exposure. Students, however, feel less anxious when they feel that they are not the only person answering a question, or when they can volunteer rather than being put on the spot or called on to give an answer. Research also shows that students would be more willing to volunteer answers if they were not afraid of saying the wrong thing; that is, they would be less self-conscious if it were commonly understood that everyone makes mistakes. Error-correction is another area that can cause high levels of anxiety, particularly when students are interrupted by an instructor or feel that they are being reprimanded or over-corrected. Nevertheless, studies show that students clearly understand the purpose behind corrections and that they *do* want their errors corrected.

Tools like *Socrative* can therefore help alleviate some of the anxieties that learners face in the language classroom because students are not 'put on the spot' as individuals to answer in front of the class, yet they are still asked to provide an answer, not in front of but *alongside* their peers. The answer is also anonymous, so they can avoid self-exposure. They can see that they are not the only person who makes mistakes, and if they are, well no-one but them (and the teacher) knows, and they can answer and receive the necessary correction, feedback and guidance in a less anxiety-provoking manner.

In general, reducing anxiety in the language classroom comes down to the promotion of certain approaches and methods: a.) The creation of a low-anxiety classroom atmosphere; b.) Instructors who are friendly, relaxed and patient and who therefore make students feel comfortable; c.) A classroom where students are encouraged to speak out and to engage but are not constantly being corrected or put on the spot and exposed; d.) Correction that is not harsh and does not spotlight students in front of their peers; and e.) Classes that are interesting and fun – that promote gamification. Saunders and Crookall (cited Young, 1991, p.433) suggest that playing games with and in the language can reduce anxiety as play scenarios provoke less inhibition; social norms are relaxed, destabilized or circumvented and therefore players "can be more easily forgiven for errors of judgement and poor communication." As Young (1991) concludes: "Language games with an emphasis on problem-solving […] can be an effective way to create interest, motivate students, encourage participation and reduce language anxiety" (p.433). As mentioned, students react to *Socrative* as if it were a game, reducing the anxiety experienced around assessment, performance and error correction. The other area that students highlight as important in reducing anxiety is the creation of a sense of community or communality – a supportive group identity - or what Terrell called "target language group identification" or Krashen's "club membership". As von Wörde (2003)

states: "Anxiety may decrease within the classroom context if students interact in activities that contribute to a feeling of group identity and support" (p.11).

4. Conclusions

The introduction of *Socrative* into my teaching has yielded some interesting and encouraging results. In 2014-15, qualitative observations indicated a marked improvement in student engagement, with students asking to use the tool, becoming more animated and interacting both verbally and via the PRS interface, correcting each other and/or discussing responses. Interactions were largely student-led or student-to-student, not teacher-to-student, promoting a sense of supportive group identity which continued beyond the grammar class: Students became more ready to engage in group activities, volunteer responses and speak out in other language classes which helped develop a low-anxiety classroom atmosphere and encouraged gamification. This was highlighted in feedback questionnaires, where students commented on how much they had enjoyed the grammar classes, how they had experienced improvements in self-confidence and had felt encouraged to continue their language studies. This suggests a reduction in anxiety levels and a mobilisation of key motivational drivers.

As a result, the usage of *Socrative* and the evaluation of its effectiveness in reducing FLA has been embedded within a wider strategy. For example, during induction workshops in 2018-19 and 2019-20, students were asked to complete the Beliefs About Language Learning Inventory (BALLI), developed by Horwitz (1988), as a springboard for discussions around FLA. Students' responses to certain beliefs (related to self-confidence and self-consciousness in particular) were noted – e.g. B28: *I feel self-conscious speaking the foreign language in front of other people* where 67% (2018-19) and 58% (2019-20) of respondents expressed (strong) agreement – and used as a focus for related discussion, since one way to alleviate anxiety is to acknowledge its existence and share responses. At the end of the academic year, students revisited the BALLI in follow-up workshops and discussed their experiences. Student feedback stressed the value of sharing their concerns and of the approaches taken by different tutors to error correction, noting that they felt less anxious when able to engage without self-exposure via PRS and that it encouraged active participation which had a motivational effect in that it made lessons more engaging and enjoyable. Similar feedback was also received via Module Evaluation Questionaires in 2017-18 and 2018-19 where both language modules in which *Socrative* was used received 100% student satisfaction ratings. A further benefit is that the instructor review function also allows for a more comprehensive and effective evaluation of student understanding and knowledge retention, enabling tutors to pinpoint problematic areas and to address them with focused instruction or guidance, making for a more effective classroom, thus facilitating the language acquisition process.

These qualitative results indicate that the system does increase student engagement and promote interaction and more effective learning. As regards its effectiveness in addressing student anxiety, again initial qualitative results suggest that it can be an effective tool in helping to foster a mutually supportive atmosphere in the classroom while also reducing FLA and increasing motivation, engagement and participation.

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The role of internationalisation in students' cultural literacy and intercultural communication

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Abstract

The internationalisation of studies is one of the most current trends in higher education, aimed at improving the quality of higher education and preparing students for the global labour market. Student mobility is one of the most common forms of internationalisation. As part of the given study, an interview with the groups of exchange and local students at a regional university was conducted in order to clarify their views on the role of internationalisation in the educational process, general cultural literacy, promoting intercultural cooperation and building a global world view. The study took place in a bachelor's degree-level programme at a regional university in Latvia, using the qualitative method. A thematic analysis of the interviews was undertaken using an iterative, inductive approach to the generation of codes and themes. Coding was established using NVivo 12. In general, the internationalisation of studies (particularly student mobility) was evaluated very positively by both local and exchange students. The advantages of internationalisation are associated with the possibility of obtaining specific cultural expertise and learning life-friendly soft skills. In the future, the respondents see themselves employed in international teams taking as an advantage the experience gained in the internationalisation process. In addition, exchange students pointed out that the mobility experience specified in Curricula vitae could be considered by an employer as added value thus enhancing the opportunities to get a better job.

Keywords: *internationalisation of studies; cultural literacy; incoming mobility; exchange student; regional university.*

1. Introduction

The globalisation of the modern world has led to the intensification of international contacts, which in its turn is associated with the shifts in cultural identity and the need to simultaneously recognise and disseminate one's cultural values, to be able to operate in the international cultural environment, as well as to be tolerant and knowledgeable with regard to other cultures. The rapidly evolving international labour market demands not only highly qualified specialists in a specific field but also multicultural workers. Globalization is defined by Altbach and Knight (2006) as the "economic, political, and societal forces pushing 21st century higher education toward greater international involvement" (p.1). The internationalisation of studies is one of the most effective ways of preparing the specialists required for the global labour market who can work in international teams.

The need for internationalisation is increasing, by changing university development strategies and turning national and regional universities into global educational institutions. Rizvi (2001) writes that "a global university must now be characterised by its engagement with the processes of globalisation, its international networks and its internationalized curriculum. The field of international education has matured in recent years, with the greater recognition of how it uniquely spans the cultural, economic and interpersonal dimensions of global relations" (para 3).

Although there is no single common definition for the internationalisation of higher education, the EU's (Bologna Declaration, Lisbon Strategy, EU 2020) strategic orientations for education policy and the growing international nature of higher education point to the need to build a common knowledge-based society. In recent years internationalisation awareness has grown significantly from initially the outgoing mobility of students and academic staff to a comprehensive approach in higher education, including international and intercultural dimensions into the course of studies (Beelen & Jones, 2015). Higher education professionals consider that today there is a need to reconsider study programmes by introducing internationalisation mechanisms, to meet new global-diversity learning needs (Woolf, 2007) and to create learning that is comparative, integrative, interdisciplinary, contextual, and global (Green, 2007).

Internationalisation covers the following areas: attracting exchange students and teaching staff, cooperation in the student and academic staff exchange, development of programmes in foreign languages (commonly English), international cooperation in science, development of joint programmes and degrees, global research projects, etc. The added value of internationalisation has the economic impact on the region and university concerned (Sweeney, 2019), as well as on the extension of students' cultural literacy, networking, culture awareness, and acceptance of cultural diversity, cosmopolitanism, promotion of social

equality, etc. (Fielden, 2007; Foster, 2013; Hartwig et al., 2017; Knight, 2003; Sweeney, 2012).

One of the most common forms of internationalisation is student mobility. Due to some objective reasons regional universities often face a lack of incoming learning mobility; hence, it is successfully implemented in some individual study programmes. As part of the given study, the focus groups of exchange and local students were interviewed with the aim of finding out their views on the role of internationalisation in the educational process, general cultural literacy, promoting intercultural cooperation and building a global world view. The researchers point out that trends in globalisation and internationalisation, open information space, wide opportunities for mobility, and development of the Internet have changed a person's view on themselves and their place in the world (Romanovska, 2019). In this context, the present study has its focus on the way regional and global (international) cultural levels interact in the course of development of students' cultural and world perceptions. It was also important to identify how the internationalisation of studies, namely the incoming mobility experience, can influence students' views on building future careers in international teams. The findings of the study can be useful for building an international learning environment and improving cooperation between exchange and local students in higher education institutions.

2. Methodology

The study was conducted at the regional university in Latvia engaging foreign and local students enrolled in the Bachelor study programme "Philology". In order to carry out the tasks of the research a fieldwork strategy was developed and the questions of a partly structured interview were formulated. It envisaged commencing work on October 1, 2019 and finishing it on December 20, 2019. When selecting respondents, the "theoretical sampling" (Breuer et al., 2019) approach was employed. The main method of the research is a qualitative method, namely, focus group interview. To ensure free exchange of opinions it was decided to conduct separate focus group interviews with the local and exchange students, respectively. In total, six focus group interviews were conducted: four interviews with the local students, and two interviews with the exchange students. The total number of the respondents was 20 people, of which 13 were girls and seven boys aged 20 to 24. The exchange students who participated in the interview come from France, Italy and Turkey. The fieldwork was carried out by two researchers, and the interviews were conducted in Latvian, English, and Russian. The local students preferred to speak Latvian or Russian, but exchange students English.

The interviews were fully transcribed in the respective languages. A thematic analysis of the interviews was undertaken using an iterative, inductive approach to the generation of codes

and themes. Coding was established using NVivo 12 for qualitative data analysis. To create initial codes, two reviewers independently read one interview, results were compared, and agreed codes were developed through discussion to create a coding matrix. Further coding was performed by one researcher.

3. Student mobility as a way of improving cultural literacy

3.1. Evaluation of the incoming student mobility from the point of view of local students

The students of the regional university who took part in the interview acknowledged that internationalisation is an important aspect of study, which contributes not only to successful acquisition of different courses but also promotes the development of the skills needed for life and provides sufficient cultural expertise. In general, students' experience communicating with foreigners was evaluated as successful. They appreciate such an opportunity and willingly engage in conversations with exchange students. The respondents described their attitudes to other cultures and nations as positive or neutral. Many students feel delighted having foreign students in the city, moreover, they feel happy about their studies at university, as this provides them with the opportunity to get communication experience that cannot be otherwise achieved. Moreover, the communication experience with exchange students was regarded by the students as more important than their own studies. The respondents emphasised that it is of utmost importance to consider the cultural knowledge which they can acquire when communicating with foreigners directly.

According to the respondents, the study environment opens way to easier communication with exchange students. It makes communication more open, safer, allows conversation to be opened easily, as well as determining the topics for further discussions. To open a conversation with exchange students in the university is relatively easy, commonly it happens during a break time, when discussing a particular study task. The respondents pointed out that they do not waste time on general questions such as "How are you?" etc., but rather focus on specific topics of their interest. Studies make the main topic of conversation, which gives an opportunity to enter into further discussion and develop informal relations outside the study environment.

The motivation to communicate with exchange students is determined by two factors: (1) ambition to learn English better (the respondents have admitted that the level of English knowledge in exchange students is generally better than in local students) and (2) ambition to learn more about one particular culture, represented by an exchange student.

In the course of the study process, academic staff pay special attention to the successful cooperation between exchange and local students; for example, by organizing mixed work groups (where there is one or two exchange students and several local students), providing a

mentorship (addressing a particular student(s) with a request to explain specific educational and cultural realia to another student.) etc. It is noteworthy that the respondents did not notice that the academic staff were working deliberately and purposefully on the development of networking between local and exchange students. It means that they see such cooperation promoting strategy as perfectly comfortable and appropriate. The students were delighted with exchange students in their work group because they were forced to discuss particular topics in English, not in their native language. And it provides for other advantages: (1) there is a broader understanding of a particular topic, owing to the fact that exchange students express the ideas, which are determined by their affiliation with their own (different for local students) culture and different cultural literacy; (2) there is an opportunity to practise English. Local students pointed out that they are trying to do their best to make exchange students feel involved and comfortable, by interpreting jokes, explaining incomprehensible cultural realia, etc.

Extra curriculum activities such as Halloween party, Christmas Celebration, Fukshu Ball, etc. were reported by the respondents as the most successful forms of cooperation between local students and exchange students. Students admitted that these events allow them to develop informal relations, yet the most important topic of conversation remains the studies.

The respondents emphasized that they recognise many worthy features in exchange students they would like to learn or take over. These features are not limited to language or culture-specific knowledge. They are related to foreigners' perception of life in general. The respondents pointed out that one of the positive features of exchange students is a constructive way of thinking focused on problem solving. In contrast, local students often tend to focus on the problem itself, thus creating a pessimistic world view. Thus both a positive global approach and the ability to assess a situation from different perspectives can be considered advantages of internationalisation of studies.

The respondents acknowledged that their worldview, including the perception of foreigners, is determined by lifestyle in a small regional city. To give an example, although in general the attitude towards exchange students is “very positive”, “rather positive” or “neutral”, it may, however, be “reserved” towards representatives of certain cultures (Muslims, Arabs) until the person is seen closer. Such attitude, according to the students, is determined by the “specific nature of regional life”, which is characterised by fears of everything alien and unwillingness to expand one's outlook.

3.2. Exchange students' opinion on student mobility

Internationalisation as a main issue suggested for the interview discussion arosed great interest among the exchange students, respondents of the second focus group in the given study. From the first minutes of the interview it was evident that the students were open to discussion and ready to share their opinion with much enthusiasm.

For the major part of the focus group participants it was their first experience of student mobility, though it does not signify that they had a lack of expertise in international communication. Some of the respondents referred to their active involvement in joint projects and other activities back home when they were forced to cooperate with representatives of different cultures. They also gave feedback on receiving exchange students at their home universities. In both cases they evaluated that experience very positively, pointing to fruitful international communication. The latter explains the range of their expectations from the present mobility: to meet new people, learn new cultures and places, get new study experience and develop language skills.

They described their attitude to other cultures and internationality very positively, not differentiating between nations, religions etc. However, they described some cases, gained from the present mobility, when cultural illiteracy could lead to curious situations, even offence. Thus, they concluded, one should be aware of cultural differences when communicating in international environments.

In their reports they specified some particular personal traits that can promote successful communication. Friendliness and openness play the most important role in promoting internationalisation in students' cultural literacy and intercultural communication.

The choice of mobility location, in favour of a small regional university, was determined by the admission criteria set by the host universities; the submitted applications had been rejected by some universities as not complying with some programme criteria, namely academic performance. So, the students had not much choice but to accept invitation from a more flexible university. Surprisingly, a small regional high school turned as an advantage; flexibility is determined by the need to bring more incoming mobilities which is a characteristic feature of all regional high schools.

The respondents confirmed that they were more than satisfied with the study programmes and study environment provided by the host university. In contrast to their home universities, studying in small groups showed many advantages, ensuring a more individual approach and exchange of information between local students, exchange students and academic staff. It proved very advantageous for language learners, e.g. English as a language of intercultural communication.

Students noticed that in most cases the academic staff were very effective in promoting successful cooperation between local and exchange students. If the topics suggested for discussion by the academic staff in the classroom were in students' competence, communication turned out to be very successful. Exchange students echoed the local students in that the studies serve the starting point for developing communicative network in a multinational environment.

It was also revealed that exchange students anticipated more initiative from the locals. They would appreciate more attention to their needs; for example, they expected to be introduced to the local culture and environment by the locals. The respondents did not face any difficulty when in the city; however, their contact with the people from the city was limited.

Similar to the local students, the foreign students also agreed that they observed some cultural peculiarities of the regional city, such as relatively passive social and cultural life, students' passivity, peculiar features of national character such as restraint, a lack of cafes and clubs where students might spend their time communicating with the locals, etc. The said features were evaluated by the foreign students negatively. As to language, language was not a barrier for any communication with the locals.

In contrast, the positive features of a small regional city include the following ones: a small university with easy-to-orientate environment, small groups of students, which provides much easier communication between the academic staff and students, as well as promoting better knowledge acquisition. Moreover, student mobility is a great opportunity to travel to different countries, the opportunity that is given only once in a life, as attested by all respondents. Whatever the experience, the respondents admitted that the mobility experience opens new gateways for future career, broadens one's outlook and develops people's cultural literacy. Student mobility mentioned in their CVs, they believe, adds value to their prospects.

4. Conclusion

The internationalisation of studies at a regional high school has its own features, which are related to both the number of foreign students and their level of knowledge, as well as to the peculiar life style of the regional city, which also shapes the outlook of the population. However, these regional features under the impact of globalisation tend to decline wherein the internationalisation processes facilitate this reduction.

Promotion of cooperation between local and foreign students at university is implemented in a variety of ways. The formal study environment provides mixed groups and introduces a mentoring system for recently arrived students. With regard to non-formal events, students have the opportunity to strengthen relationships by finding new topics for discussion and implementing joint projects.

To sum up, the internationalisation of studies (particularly student mobility) has high positive evaluation by both local and foreign students. The respondents' opinions on the gained advantages largely coincide. The advantages of internationalisation are associated with the possibility to obtain specific cultural expertise and acquire life-friendly soft skills. The respondents pointed out that by contacting representatives of other cultures, they improve their English language skills and broaden their general cultural literacy, which will be useful

in their future life. Moreover, they learn to work in international teams and learn how to open communication with unfamiliar or little-known people, think broader, take a constructive approach to problem solving, and build positive world views. The foreign students highlighted another significant advantage that was not specified by the local students: it is not only the experience and knowledge gained through mobility that matters, but rather a reference to the mobility specified in their Curriculum vitae. It helps them to find a better job in the future. It is noteworthy that the majority of the respondents spoke about their ambition to work in international teams in the future and take advantage of the experience gained in the internationalisation of studies. It means that the internationalisation of studies is successful; students in the international environment feel comfortable and see prospects for further development.

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Advancing understandings on students' mobility as a tool to reach 2030 Agenda

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Abstract

This paper interrogates the role of students' mobility within the framework of 2030 Agenda, specifically, the prospects of reaching Sustainable Development Goal 4, a quality education for all by 2030. Empirical data draw upon a report that analyzes mobility's figures over the last five academic years at the University of Évora, Portugal. Important insight can be gained from 2030 Agenda when looking at the strong imbalance observed between IN and OUT mobility, countries of origin and destination, gender and age distribution of the students' missions. The paper claims for a call for action in order to use academic mobility as a tool to meet the 2030 Agenda for Sustainable Development. While academic mobility can and should be understood as part of a broader strategy aiming the dissemination and internationalization of knowledge and skills, acquisition and transfer of good practices, it should not neglect a commitment that through SDGs unites us all: to reduce inequalities and to improve the quality of life among individuals around the world.

Keywords: *Students' Mobility; Higher Education; Portugal; Sustainable Development Goals; 2030 Agenda.*

1. Introduction

This paper interrogates students' mobility as a tool to meet the goals set by the 2030 Agenda for Sustainable Development, specifically Sustainable Development Goal 4, which calls for a quality education for all by 2030.

International student mobility is a key for understanding how students become mobile within their present educational and future working lives (Cairns, 2014). Moreover, international organizations such as UNESCO and OECD are unanimous in recognizing the importance of international mobility of students as part of a quality education goal (OECD 2019; UNESCO 2019). As the United Nations underlines, "the 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future" (UN, 2020). According to the same source, the 17 Sustainable Development Goals (SDGs) constitute an urgent call for action by all countries, interacting in a global partnership. Working for sustainable development isn't about being focused on economic growth, rather to spur it while improving the life conditions of individuals, ending poverty and other deprivations, reducing inequalities, improving health and education, and, at the same time, tackling climate change and working to preserve oceans and forests.

Having these assumptions as a backdrop, this paper summarizes some conclusions drawn upon an internal report that analyses recent mobility data at the University of Évora, Portugal. While the report comprehends a broad analysis of the data available for the academic years between 2014/15 and 2018/19, with regard to both student and staff mobility, this paper focuses only in the students' mobility.

Despite confirming much of what we already knew, the following findings also shed light on a set of aspects that deserve close and deep reflection. Academic mobility is not just an episodic event in the life of the individuals without further consequences. Securing an exchange abroad is part of improving the quality students experience in higher education (QS 2019). Academic mobility can and should be understood as part of a broader strategy for the dissemination and internationalization of knowledge and skills, acquisition and transfer of good practices. At the same time, it should not neglect a commitment that through SDGs unites us all: to reduce inequalities and to improve the quality of life among individuals around the world (Independent Group of Scientists appointed by the Secretary-General, 2019).

2. Data and Methods

According to official data, a total of 1877 students' mobility missions were registered in the last five academic years at the University of Évora.

The University of Évora is a small scale university located in Évora, a medium-sized city in the south of Portugal. The University was established on the initiative of the Crown, under a Jesuit management in 1559. Following the Jesuits' expulsion in 1759, the University was closed, without, however, being extinguished. It was restored, two centuries later, in 1973, under the name "Instituto Universitário de Évora", and at the end of the 70s, the original designation of the University was recovered. During the 80s and the 90s, the University has consolidated itself in its teaching and scientific activity and gained its administrative and financial autonomy. The first decade of 2000 was marked by transformative events that were instrumental in the current structural, teaching and scientific setting of the University of Évora. By now, the University comprises four thematic core Schools (School of Social Sciences, School of Science and Technology, School of Arts and the School of Nursing), plus a doctoral school, the Institute for Research and Advanced Training, which aggregates several research centres and Chairs. Currently, the University counts more than 7000 students in bachelor, master and PhD courses (UE, 2019).

The information provided by the University services was compiled by the author into a single database and completed whenever possible using data confrontation and triangulation (e.g. between country of origin and nationality, study cycles and organic units, program and duration, etc.). The analysis was carried out using IBM SPSS Statistics software (version 24, UÉvora licence). All data were anonymized and worked on in compliance with the ethical and deontological principles that guide the good practices of scientific research, namely by adherence to the International Sociological Association Code of Ethics (ISA, 2001).

3. Findings

3.1. Balance In/Out

In total, 1877 students' mobility missions were registered in the last five academic years at the University of Évora. In the period considered, incoming mobility (IN) (total of 1311, annual average of 262.2 missions) almost doubles outgoing mobility (OUT) (total of 566, annual average of 113.2 missions), with a difference of more than 149 missions on average, favouring IN mobility. Despite the growing trend of recent years, the proportion in 2018/19 is still approaching 70/30 (Figure 1).

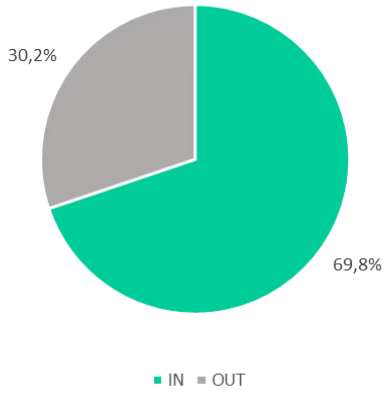

Figure 1. Students' mobility missions by type (2014/15-2018/19). Source: Own elaboration.

3.2 Origin and destination

Compared to IN mobility missions, the number of countries involved in OUT mobility decreases to about half (40 vs. 23). Consequently, also decreases the geographical and cultural reach of such a type of mobility. Data shows the relatively recent attractiveness of countries in eastern, central and south-eastern Europe such as Poland, the Czech Republic, the Slovak Republic and Bulgaria, which come to compete with the so-called traditional destinations, based on the relations of linguistic, geographical or historical proximity between countries, such as Spain, Italy or Brazil. A set of fewer numerous missions, but nonetheless, quite iconic due to the cultural specificity or geographic distance of the destinations they contemplate, is explained by the existence of specific programs aimed at expanding mobility opportunities in institutions from non-European partner countries. However, OUT mobility aiming those countries is scarce (e.g. Malaysia, Thailand, Turkey, Vietnam) or even non-existent (e.g. Ecuador, Philippines, India, Laos, Mongolia, Myanmar, Nepal, Pakistan, Tibet, East Timor) (Figure 2 and Figure 3).

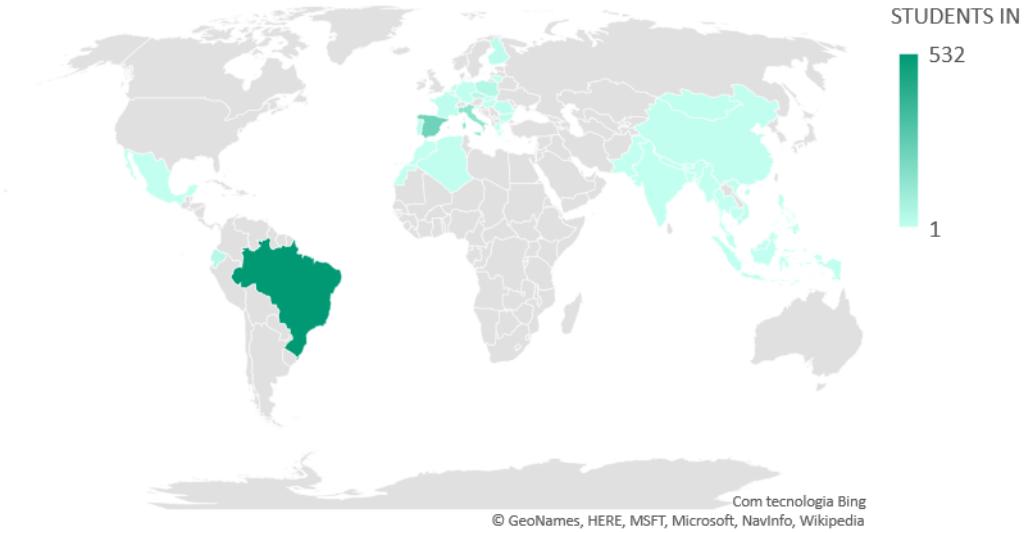

Figure 2. Countries of origin involved in students' mobility missions (2014/15-2018/19). Source: Own elaboration. n=1311

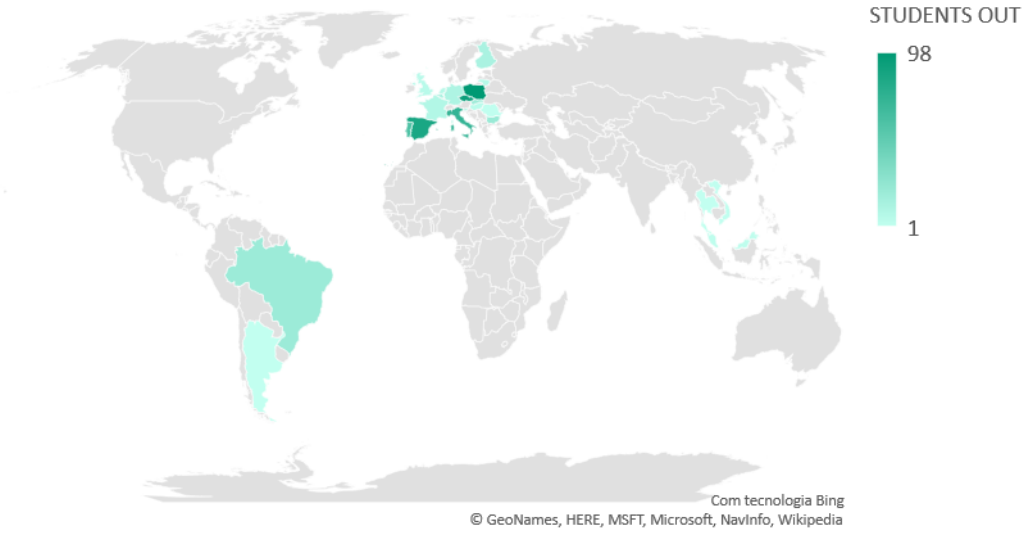

Figure 3. Countries of destination involved in students' mobility missions (2014/15-2018/19). Source: Own elaboration. n=566

3.3 Age

The age at which students carry out the mobility experience is very similar in both IN and OUT mobility missions. Nonetheless, when analysed by degree, age differences assume greater visibility. The average age of students increases with the progression through the study cycle also increases. In other words, the average ages are younger, in ascending order, in bachelor, master and PhD degrees. When comparing the average ages of IN and OUT mobility missions, data shows that bachelor students experiencing IN mobility are older than the OUT (average age 23.69 and 22.55 years, respectively). This difference also corresponds to a greater range of ages in the case of IN mobility, ranging from 19 to 59 years old in the case of undergraduate degrees, whereas students experiencing OUT mobility do it later and for a smaller period of time: between 20 and 34 years old. It is also observed that the Masters and PhD students experiencing OUT mobility are older than those experiencing IN mobility (mean age 29.65 and 40 years and 25.44 and 31.95, respectively) (Table 1).

Table 1. Statistics for students' age by type of mobility and degree

		IN			OUT		
		BSc.	MSc.	Ph.D.	BSc.	MSc.	Ph.D.
N	Valid	935	107	39	325	31	2
	Missing	1	2	0	106	5	0
Mean		23,69	25,44	31,95	22,55	29,65	40,00
Mode		22	25	29	21	25[a]	28[a]
Standard Deviation		3,550	2,963	7,736	2,213	6,275	16,971
Minimum		19	21	25	20	22	28
Maximum		59	46	55	34	46	52
Percentile	25	22,00	24,00	27,00	21,00	25,00	28,00
	50	23,00	25,00	29,00	22,00	28,00	40,00
	75	25,00	26,00	35,00	23,00	32,00	.

a. There are several modes. The lowest value is shown.

3.4 Gender

Altogether, data show a feminization of student mobility, with 62.8% of the missions being carried out by women and 37.2% by men (Figure 4).

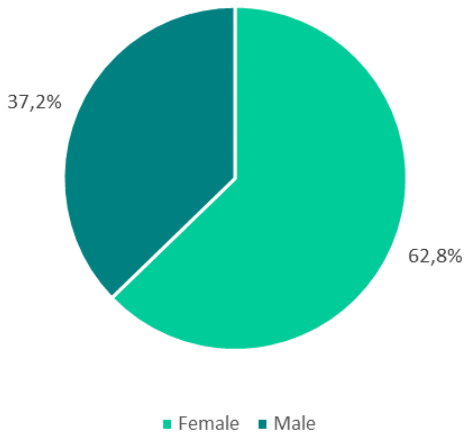

Figure 4. Students' mobility missions by gender (2014/15-2018/19). Source: Own elaboration.

A detailed analysis by gender reveals that there is a greater proportion of OUT mobility in men than in women, namely 34.3% against 27.7% (Figure 5).

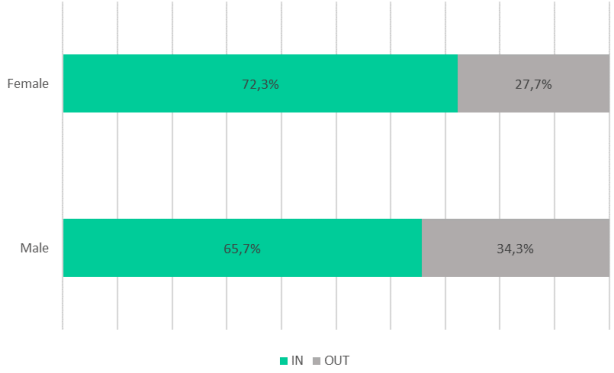

Figure 5. Students' mobility missions by gender and type (2014/15-2018/19). Source: Own elaboration..

4. Conclusions

In this paper, students' mobility was analysed within the prospects of Sustainable Development Goal 4, a quality education for all by 2030. Important insight can be gained from 2030 Agenda when looking at the strong imbalance observed between IN and OUT mobility, countries of origin and destination figures, as well as across gender and age. While nothing can be done to change the past, a call for action is needed to change the

future. Moreover, there is also an ethical commitment which entails us all for sustainable development in higher-education institutions (Freitas et al., 2019).

There is a need to increase and diversify awareness actions in order to find manyfold candidates able to engage in mobility missions abroad, despite gender and age. Using a non-gendered and non-aged biased language appears to be crucial in reaching a more diverse audience. Additionally, it is important to increase awareness for students interested in an outgoing mobility experience focusing on the diversity of countries and cultures. Doubtless, academic mobility can be a tool to meet the 2030 Agenda for Sustainable Development, yet we have to move more assertively and faster, otherwise we will fail to meet the SDGs targets.

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Reforming Higher Education in India: In Pursuit of Excellence

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Abstract

Higher education has emerged as one of the most critical factors for the Nation's economic, political, social and cultural growth and development. Reforming the higher education sector has become an emergent norm across the globe, especially in the developing world. India is one such emerging Nation, witnessing a significant shift in its ideological, pragmatic and policy directions in the last few years. The higher education sector in India has seen unprecedented expansion. However, given the distinctive social-political-economic context and its complexity in India, expansion in higher education is often linked with ensuring equity and access. Whereas in the developed world, expansion is often associated with quality or excellence in higher education, i.e. creating world-class universities. Further, excellence in higher education is arguably the most critical component for the survival, sustenance and growth of the sector.

To this end, the paper examines the convergence and divergence in policies and practices related to the pursuit of excellence in higher education and its institutions in India vis-à-vis the dominant global reforms in higher education. Erstwhile policies related to quality in higher education and the current draft National Education Policy-2019, provide a reference to the local-distinctive strategies for seeking excellence at the systemic and the institutional level, with an aspiration for global reputation. For instance, National Institutional Ranking Framework, University Grants Commission's graded autonomy, Institutional restructuring, National Accreditation and Assessment Council and Quacquarelli Symonds - India rating, and so on. The paper also sets direction on how local strategies for global aspirations could unpack a series of issues regarding the reforms in education and delineate in what ways that these emerging global reforms, strategies are effective and appropriate to the local higher education system and its institutions.

Keywords: *Excellence, Systemic and Institutional Level, Internationalization and World-Class University.*

1. Introduction

Globalization and internationalization have been one of the key factors in changing the landscape of higher education in India. When the Nation is revisiting its national education policy, after more than three decades, it is important to analyze the role and relevance of higher education for a developing economy and society. Since independence, higher education in the country has witnessed unprecedented expansion and demand amongst stakeholders and has led the institutions to compete and sustain. In the last half-a-decade, quality and excellence have been the core parameters for institutions to compete and sustain.

Critical reforms to ensure equity, expansion and excellence (Ramaprasad and Singai *et al*., 2016) have transformed the higher education in terms of access, practices and governance. Universities and higher education institutions are involved in constant aspiration to emerge as world-class universities. Several policy reforms and institutional arrangements have further aided to integrate into the process of quality assurance and quality enhancement. Internationalization and globalization of higher education both at the regional and national levels is one such instance. Such approaches often include measures to harness competence, cooperation, collaboration and creativity in research, teaching and service amongst the HEIs. Further, the global and national ranking, rating and national accreditation systems have a substantial impact on the decision-making ability of institutions and the stakeholders in higher education. OECD studies (2014) have found that 63 percent of responding institutions have taken strategic organizational, managerial, or academic actions in response to accreditations, rankings and ratings.

1.1 Defining a world-class university

Attaining quality improvements and embedding a quality culture could be concentrated around one of the core activities of universities (Lomas, 2004) such as teaching, research and extension. World-class universities are mainly characterized as a research-intensive university with world-class capacity. An emerging international knowledge economy often depends on 'world-class universities capacity' to harness competitiveness.

Reforms to achieve research excellence is mainly carried out to develop the universities' governance, in terms of administration, management, and staff capacity. Along with this, the concept of a world-class university cannot exist without the 'internationalization' (Li and Chen, 2011). Fitness for purpose in higher education has been considered the most widely adopted approach to evaluate quality. Today, global and national ranking, rating and accreditation systems assert a pivotal role in influencing the choices of stakeholders in higher education. These mechanisms may assist in planning future directions, develop and review the courses and academic programmes, handle student assessment, enhance the

quality of information, academic standards and achievements. Quality evaluations often emphasize on meeting the objectives, documentation and using institutional quality mechanisms to determine and maintain standards, all of which are reflections of quality and accountability, which could foster excellence.

In the last few decades, assessment and evaluation of Higher Education Institutions (HEIs) have taken myriad forms. For instance, national and international accreditation, ranking and rating are the most dominant forms at the national, regional and international levels. The primary objective of such an assessment is to ensure the evaluation and implementation of quality assurance processes or excellence in HEIs.

Higher education across the globe has evolved into an industry and service, appealing to masses and respective government and non-government entities. The notion of accountability is central to HEIs, and the value for money is closely interlinked with the ideology that education should contribute to the scientific, technological, informational, social and cultural advancements. In this context, accreditation, ranking and rating systems have been the main instruments of measuring quality and standards among HEIs. Rating and the process of accreditation differ in their methodology, outcome and orientation. Both rating and accreditation in higher education assign a particular grade to an institution based on certain thresholds and pre-defined criteria.

To this end, an institution can undertake a self-assessment by itself; however, the legitimacy and objectivity of such an assessment ought to be problematic for the institution per se and the milieu. To avoid internal prejudices and stakeholders' undue influences, generally, an external agency, which is supposed to be autonomous and trustworthy, is entrusted with the responsibility of assessing the quality of an HEIs. The term "External Quality Assurance" refers to all forms of quality monitoring, evaluation or review (Martin and Stella 2007). Given this procedure, HEIs could engage in examining their strengths and weaknesses along with core drivers and barriers for achieving excellence.

The concept of quality and excellence can be used as a competitive tool, which could result in a profit and the culture of consumerism. For instance, the internationalization of higher education would act as a link between the labor market and HEIs. Given the competition, run-of-the-mill institutions will try their level to become the best, and those who eventually fail to respond to the competition will have to eventually close down. For instance, students being one of the main stakeholders would often prefer to chose institutions based on their performance in teaching, research and/or service. In such a competitive environment, every institution would aspire to improve their quality, which eventually precedes to an improvement in the perfoance of the institution in particular and the overall landscape of the higher education sector. To this end, national and international accreditation, rating and ranking are preferred means of determining institution's excellence.

However, despite its reputation over the past decade, global university rankings and ratings have been critiqued on data, methodological and local relevance flaws from many academicians (Bekhradnia 2016; Soh, 2017). Their measure of excellence lays emphasis on high impact research and internationalization, which may not be appropriate to the countries in the developing world. Existing ranking, ratings and assessment mechanisms are crucial for examining the status- quo of HEIs and ought to be functional for long in the Indian context. Further, given the distinct methodologies and outcomes of these mechanisms, HEIs ought to adopt both. While ranking benchmarks an institution globally, regionally and locally in a comparative perspective for the stakeholders, rating givens an in-depth understanding of an institution's quality parameters. Hence, HEIs should perceive that both the ranking and the rating methodology as mutually inclusive entities.

2. Higher Education in India – In Pursuit of Excellence

The Indian higher education system one of the most significant systems in the world. Since independence, there has been a substantial expansion in Indian higher education. The Nation has witnessed enormous growth in the number of Higher Education Institutions (HEIs) across the country. The number of Universities in the country has increased from 32 in 1950-51 to and 993 in 2018-2019, which denotes more than a forty-six folds increase. Similarly, the number of colleges has gone up from 695 to 39931 (UGC, 2003; Agarwal, 2007; AISHE, 2019). National policies such as the 'Right to Education Act', which insist on compulsory and free education to all children within the age groups of 6-14 years, has resulted in an upsurge in enrolment at the secondary level in the last decade. In other words, students successfully completing secondary education is considered as a primary reason for the increasing demand for enrolment in higher education. As a result of this, the country has witnessed an unprecedented expansion of higher education institutions across the country (Shaguri, 2013).

The last decade has witnessed a massive enrolment in higher education, and it has increased from 29.8 Lakh in 1980-1981 to 373.9 lakh in 2018-2019. Also, over 70 percent of HEIs in India is managed by the private sector, and they cater to more than 70 percent of student's enrolment (AISHE 2019). It also aims to increases its gross enrolment ratio to 30 percent by 2020-2021from the current 26.3 percent. Post-independence, the Government of India has focused on expansion and equity in higher education. Despite the substantial and astonishing improvement in the past decade, the Indian higher education sector still deals with significant challenges in qualitative terms. For instance, the National Knowledge Commission's "Report to the Nation" reckons that the 'crisis in Higher education in India runs deeper' and suggests the need for improving its overall quality (NKC, 2006).

In India, quality assurance mechanisms in higher education in India is undertaken by a few popular agencies listed below:

a) National Assessment and Accreditation Council (NAAC) – established in 1994
b) National Board of Accreditation (NBA) – established in 1994
c) Quacquarelli Symonds and Times Higher Education World University Rankings established in 1990 and 2010 respectively
d) QS I·GAUGE Ratings – established in 2018

At the local level, the process of accreditation, rankings and ratings are strongly driven by data and evidence. These methodologies have a set of indicators, which can be assessed quantitatively, often claiming objectives in their assessment and evaluation. The scores obtained for each of these indicators contributes to the overall grade/rank obtained in accreditation, rankings and ratings. For instance, the Revised Accreditation Framework 2017 (RAF) of the NAAC has 70 percent weightage for data submitted and 30 percent for peer judgment. Similarly, other rankings and rating methodologies have 50-90 percent weightage for data. These methodologies are often exposed to criticisms from the academia that there is very little flexibility and adaptability to measure their unique best practices followed by HEIs, locally. Some of the best practices, such as interactive classroom sessions, remedial classes, etc., which enhance the learning experiences of students, are not taken into account by the assessment methodologies. Further, additional roles and responsibilities of faculty members in managing administrative activities, for instance in addition to teaching they are engaged as in self-directed roles as career advisors, take voluntary responsibilities to be available students beyond formal contact hours, etc., are not reflected in assessment methodologies, hence, ignored from the overall pursuit of excellence. Additionally, student experiences of what they actually learn beyond the curriculum, activities they involve, moral support received from faculty and peers, how well they are preparing for their career and higher studies, engagement with regional or local communities to bring awareness in social and environmental issues and its impacts on learning outcomes cannot be quantified, hence are left out. Such subjective attributes or values practiced by each of the stakeholders in their unique ways are often overlooked by ranking, rating and accreditation methodologies.

3. Excellence with Relevance

Education is an instrument of social change and mobility, the institutions in India have the onus of empowering and emancipating women, learners from marginalized communities; and so on. Additionally, the Indian higher education system which is further complicated given the existing system of affiliation. The majority of the students are first-generation learners coming from diverse socio-economic, linguistic, rural backgrounds. These students

represent the internal and active stakeholders of affiliated colleges and institutions (around 78 percent of students in India are studying in such colleges). Thus, the HEIs have focused on excellence from a student-centric perspective; hence teaching has been predominantly prioritized; while activities of research and extensions have taken the back seat, Given this current scenario the existing global and national accreditation, rankings and rating models may not be useful to measure excellence and could fall short of capturing the local, regional perceptions, perspectives and practices of excellence across the HEIs

In India, every HEI wants to be a world-class university, but none of the HEIs knows what excellence is. Thus, the best way is to assess their excellence. However, it is a known fact that there is no universal recipe for excellence; there might be some generic conceptions. We must not lose sight of that fact are several parallel pathways to excellence, and again, we must be flexible enough to recognize each of these pathways leading towards excellence. An absolute guiding principle for world-class university may not be useful because of specific challenges that are specific to the Indian context. At the same time, it is important to be cognizant of myriad institution-specific interpretations regarding excellence and the means to pursue the same. Thus, HEIs do not need to get stuck on getting an international ranking, but to look at some of the innovations that are happening in the country, some of them are unique (Altbach, 2003).

Historically, India has a long and admired reputation for higher education. In ancient times, universities of Takshila (now in Pakistan), Nalanda (in the present-day condition of Bihar) and Ujjaini (in modern Madhya Pradesh) were present. They were renowned and captured the attention of students from India, Central Asia, China and South-East Asia and considered as world-class universities. After the diminishing of these universities, the British raj established modern formal university education. Post-independence, it continued to grow in response to expanding demand for access to higher education, giving birth to a large number of teaching centric HEIs. Thus measuring them on criteria of excellence based on international ranking, rating and accreditation might not be appropriate to the local context. The pursuit of excellence across HEIs ought to be a thoughtful balance between local and global aspirations and practice.

4. Conclusion

Quality evaluations often emphasize on meeting the objectives, documentation and using institutional quality mechanisms to maintain standards. Further, the meaning of excellence has been a bone-of-contention in Higher Education. Elton (1992) opines that the quality "E's: Empowerment, Enthusiasm, Expertise and Excellence well defines the overall quality of HEIs. Harvey and Green (1993) have described five distinct, interconnected paths to define quality. They are excellence, consistency, the fitness of purpose, value for money

and transformation. For the government, factors such as efficiency, cost-effectiveness, stakeholder satisfaction, accountability, Similarly, for institutions, quality, of course, learning process, outcomes, management and staffing, while for students cost, accessibility and career opportunities can be measures of quality (Borden and Bottrill, 1994).

The paper indicates the limitations of global and national rating, ranking and accreditation methodology. There is a need to evolve the methodology to appreciate both quantitative and qualitative indices and while appreciating the diversity and distinctiveness of HEIs and its milieu. The system should recognize a broad range of indicators across teaching and learning, research, innovation, engagement, etc.

The draft National Education Policy (2019) attempts to develop a balance between freedom and regulation, between autonomy and decentralization on the one hand, and gentle guidance and resource allocation on the other. It is not a simple task. However, if implemented correctly, this can evolve as the ideal model of the relationship between the government and autonomous educational institutions. As a way forward, devising and implementing quality mechanisms that encourage HEIs to collect data, which will enable them to measure progress in critical areas and establish benchmarks. Accurate, timely and relevant data can be of great assistance in timely decision making. Thus, fostering them to become world-class in the local context.

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Gamification in Online Educational Systems

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Abstract

The usage of gamification in online educational systems hasgrown considerably over the last several decades. This has been in response to reports of low completion and retention rates in online educational systems such as MOOCs. The usage of gamification and the application of social and educational networking to online education systems has been found to increase student satisfaction with the system. However, it has been shown that as students become more familiar with the gamified educational system, the initial boost in motivation diminishes. Efforts made in order to increase the personalization of gamified educational system, however, indicated an increase in student motivation over the duration of the course. Suggestions for further work include the usage of smarter leaderboard systems, as well as the potential for personalization in peer to peer online tutoring platforms.

Keywords: *e-learning, gamificationas, MOOCs .*

1. Gamification

Before diving into the applications of gamification in the world of education, it would be wise to first understand what gamification entails. Deterding et al (2011) coined the term gamification as the use of game design elements in non-game contexts. They argue that gamefulness can be seen as a distinct but complementary term to playfulness. Looking at Caillois (2001) concepts of paidia (or "playing") and ludus (or "gaming") as poles of play activities, there is a clear distinction between the act of playing and gaming. Games are typically characterized by clear rules that govern the possible interactions and capabilities the user has within the game, as well as clear objectives which the user aims to accomplish. In addition, games often involve some sort of limitation, manifested in many different forms such as time or resource constraints, which the user must overcome.

Playing, on the other hand, lends itself more to free-form, improvisational and expressive behaviors and meanings. Playing, in other words, is a much broader category, which encompasses gaming. The fundamental characteristics of games include selfrepresentation with avatars, three-dimensional environments, and narrative context among others (Reeves et. al 2009). However, any of these characteristics can be found outside of the context of games and would not be characterized as 'gameful'. Therefore, a game can be defined as an amalgamation of these characteristics, through the lens of an environment bounded by rules and limitations. Gamified applications are clearly distinct from full-fledged games however, as these applications tend to incorporate some characteristics of games but cannot be classified as complete games. Moreover, this distinction can be subjective, as the definition of a 'game' tends to go beyond the properties of the game itself and includes the socially constructed meanings situated in the game. The definition of gamification can be restricted to the application of the fundamental elements thatare characteristic of games, or those that are readily associated with games and play an important role in gameplay, such as badges, leaderboards, and achievements, in a non-game context. In addition, another distinction between gamified applications and games is that the state in which the gamified application is used lives on the boundary between a game context and non-game context. In other words, gamified systems often transition between gameful experience, and other modes of engagement with the system. Games are only experienced in a gaming context, while gamified applications can be experienced in both a game and non-game context simultaneously.

Hence, the purpose of gamification is to improve user experience and user engagement in non-game services and applications, through the utilization of fundamental game design elements. Gamified applications have been used in a variety of different fields including education, finance, health, and sustainability, and has also been a key point in research for the development of engaging workplaces as well as mass-collaboration projects.

2. Online Education

Over the last decade, the number of students utilizing online education platforms has been steadily increasing. Bates (2018) defines the term online course as "A form of distance education where the primary delivery mechanism is via the internet. These could be delivered synchronously or asynchronously. All instruction is conducted at a distance.", where distance education refers to classes that are not held in a classroom or on campus. Canada is considered to be a specifically mature market, as most institutions have been offering online courses for over 15 years (Bates 2018). While conducting a survey to determine the number of students taking some form of an online course in Canada in 2017, Bates concluded that approximately 16 percent of all course enrollments were for online courses. In addition, the number of universities offering online courses has increased by 11 percent from 2011 to 2016. The delivery mechanism of online education by universities has been diverse in nature. Approximately 25 percent of institutions utilized technologies for synchronous delivery, in the form of interactive lectures or webinars. However, more advanced technologies such as adaptive learning, artificial intelligence, and competency-based learning have yet to been implemented in Canadian institutions.

Surprisingly, Massive Online Open Courses (MOOCs) have not been widely implemented in online education by universities in Canada, with under 20 percent of institutions offering a MOOC in 2017. MOOCs have shown a rapid increase in growth and utilization since 2008. MOOCs typically involve short video lectures, computer-graded tests, and online discussion forums. Over 35 million students have enrolled in a MOOC in 2015, according to a study conducted by Kim (2016). Coursera, which is the most well-known MOOC platform, accounts for almost half of the students enrolled in MOOCs. The guiding principles by which MOOCs operate push forward the idea of democratized education, in which everyone has access to free education with unlimited participation and open access. Students also now have the option to earn degrees and certificates through MOOCs, as many major MOOC providers offer course credits through paid credentials, moving away from the free model established earlier. However, one of the main issues that plague MOOCs is the lack of personalization afforded to students on the platform. This depersonalization of education has given way to low student motivation and retention, generating low course completion totals in MOOCs.

The remainder of this paper will discuss current efforts by researchers to gamify online education platforms, as well as efforts made to personalize gamified educational systems. An analysis of the advantages and disadvantages of such systems will be conducted in the following section, followed by suggestions for future work in the field.

3. State-of-the-Art

As mentioned previously, there is a significant difference between instructional games, and gamified educational systems. Creating instructional or educational games is a difficult, costly, and time-consuming process, which is limited in effectiveness as only a single set of learning objectives can be targeted by the game designer. In gamified educational systems however, game thinking and game design elements are utilized to improve learners' motivation and engagement with a regular online learning system. Game design elements, such as badges and ranks have been used prior to their usage in games, particularly in the military, where these badges were often used in place of monetary incentives. These game design elements have been shown to have the capacity to shape user behavior in a desirable direction, as shown by Dicheva et al. (2015).

According to Dominguez et al. (2013), since games motivate players by impacting their cognitive, emotional, and social areas, gamified educational systems should target these areas as well. In regard to cognition, games provide a series of cycles of expertise, in which the user is faced with a series of short-term objectives that they must complete in order to gain the necessary skill level required. In addition, the ordering of different tasks is non-linear, giving the user freedom to decide their path towards accomplishing the objective. Similarly, these cycles of expertise can be utilized in course design.

Games tend to impact the emotion of their players by encouraging them to complete tasks which involve overcoming difficulty, where players often fail. Hence, reward systems are implemented to give players immediate recognition for their efforts, in the form of awards or points. If the difficulty of the tasks a user faces is balanced, this leads to high motivation towards the completion of the objectives. Finally, socially, games offer a multitude of avenues for players to interact with one another to cooperate and accomplish different objectives. These interactions allow players to build in-game identities which contribute significantly towards participation in the game. The effect of games on these three areas can be translated into gamified online educational platforms to increase student motivation and participation.

Dominguez et al. attempted to incorporate these areas into the design of a gamified educative experience for the “Qualification for users of ICT” course. In order to stimulate the cognitive area of students, a hierarchy of course topics and optional exercises was established. The first layer of the tree included the student's list of topics, while the second layer included optional exercises for each topic. The third layer matches specific tasks for each exercise, while the fourth and final layer includes specific steps to complete each task. As students complete their path through this tree, different trophies are awarded to the students based on the difficulty of the task. Direct evaluation of the completion of a certain task was done through students uploading screenshots of their work, as the tasks completed

Figure 1. Special achievements represented as medals

were done using an external software, rather than non-immediate feedback where teachers evaluate student progress.

To incorporate the stimulation of the emotional area of students into the design of this course, Dominguez et al. utilized achievements as the form of reward system used in the course. In addition to regular achievements that are earned through completing the tasks defined by the system, special achievements in the form of medals were also incorporated to represent excellence in a certain task. Hidden achievements are also awarded by surprise when special tasks are completed. An example of the achievements awarded in the system can be seen in Figure 1. Finally, in regard to the social area of the system, Dominguez et al. created a leaderboard system to be used in the course, which ranks students based on the number of achievements they have completed. This leaderboard allows students to compete towards higher rankings by completing more tasks and exercises, which allows students to challenge themselves to obtain the most difficult and exclusive achievements.

Results from this experiment indicated that students who were part of the experimental group had significantly better results on all tasks that involved a practical application of the concepts taught in the course. However, these students also had lower scores on written examinations and participation than students in the control group. This drop in participation when using the gamified educational experience can be attributed to the idea of alienation through technology. Activities that build individual competence acquisition also cause students to separate from reality, thus lowering their interactions with other students. This, according to Heidegger (1977) only occurs when technology enframes the student or treats them as an object rather than a subject.

4. Discussion

While the usage of game design elements in educational settings have generally proven to improve student engagement and motivation, some researchers suggest that this increase in motivation is extrinsic rather than intrinsic in nature. Intrinsic motivation occurs when a student's desire to learn comes from within the student, rather than occurring as a result of an outside force. Offering badges and trophies as a result of completing a task may shift the

motivations of a student from intrinsic to extrinsic. The result of such a shift is that once the reward is removed or completed, there is no longer a reason to perform the same behaviour again. This specifically occurs in the case that one completes a task that they would already freely choose to do as rewards are seen to be controlling and a hindrance of intrinsic motivation.

In addition, due to the utilization of leaderboards in gamified educational systems, social comparison is a regular occurrence. However, when individuals compare themselves with those who are worse or better than themselves, this can lead to feelings of superiority or low self-esteem respectively. However, leaderboards can also foster competition between individuals, which can lead to an increase in motivation. The negative effects of leaderboards and competition depend on the context by which the competition is viewed. Constructive competition occurs when the challenge is fun and allows for the individual to grow positive relationships with others, while destructive competition can lead to a decrease in intrinsic motivation. However, since leaderboards naturally highlight those at the top, they often lead to destructive competition and negative outcomes (Fülöp, 2009).

In an effort to study the negative effects of gamification, Hanus and Fox (2011) conducted a longitudinal study to determine the effect of gamification elements such as leaderboards, badges, and incentive systems on student satisfaction, motivation, enjoyment and grades over time. The results from this study suggested that these game design elements may be harmful to some educational outcomes. Students who participated in the gamified class were found to be less intrinsically motivated, which caused lower final exam scores. Since the class used in this experiment was an elective class, which students voluntarily enrol in at their own interest, the addition of these game design elements was found to be controlling and forced. Hence, students in the gamified class were less confident, and less satisfied with the course overall.

It should be noted that the gradual decrease in motivation that has been highlighted in the mentioned studies can likely be attributed to the novelty of gamified educational systems. Since this type of system is new to many of the students who participated in these studies, motivation and engagement is likely to drop as students become more familiar with the system.

5. Future Work

One of the newer types of online educational systems is the peer to peer online tutoring systems, which connects students with teachers on a one-to-one basis. Such systems include the “Tutorful” system, based in the UK. The system allows students and teachers to either complete a tutoring session in person, or online via video conferencing. Since this system aims to connect teachers to students directly, there is great potential for personalization,

since the social and educational dynamic of one-to-one learning greatly differs from the dynamics of classroom-based teaching environment or a many-to-one environment exhibited in many online educational platforms. One possible way for personalizing such a system is a matching system which connects students and teachers together. Learning styles can be classified into more categories including: Activists, Reflectors, Theorists, and Pragmatists (Pritchard, 2013). Since different students optimally learn in different ways, if students and teachers were to take a cognitive assessment test, in order to determine their cognitive styles, the learning and teaching style of the student and teacher respectively can be matched optimally in order to enable the best possible learning environment for the student.

Such a system, given its relative novelty, could invoke many research questions, such as studying the effect of different matching algorithms on the performance and satisfaction of students, or an assessment of the different teaching styles that can be used to cater for individual students. In addition, the optimal number of students to teacher in a synchronous educational system could be studied, in order to determine whether the benefits of one-to-one education, such as real- time question answering and personalization, can be extended to one-to-many effectively. Such a system would also be able to cater to students with learning disabilities, such as Dyslexia or Autism, automatically matching them with teachers who have the necessary qualifications to teach them.

One of the possible research questions that should be analyzed is the effect of different types of leaderboards in a gamified educational system. Currently, research has been done in order to embed game design elements into educational systems to increase student motivation through competition, however, this implementation can be improved by shaping the context in which the leaderboard exists in the system. The competition that is bred from the usage of a leaderboard is two-fold, depending on the perception of the user to the leaderboard. If the user views competition through the lens of "wanting to win", this affects their levels of motivation positively. However, if the user views the competition as "wanting to avoid losing", this has been found to have a negative effect on goal completion.

6. Conclusion

The application of game design elements into online educational systems has been shown to have temporary positive effects on student motivation and participation rates. Similarly, the implementation of social networking elements in gamified applications have also been found to encourage student motivation and cooperation within the online course. Several frameworks have emerged that specify the design process of gamified educational systems, with an emphasis on task design, which has been used in many gamified online applications.

However, as the novelty of the gamified educational system diminishes, the participation rates of students tends to regress towards the mean. Many efforts have been made in order to improve student retention, including the personalization of the gamified course experiences through classifying students into different groups by their personality types, which has been shown to increase student retention rates.

Future work in this field of research includes the capacity for more intelligent personalization mechanisms, particularly in more novel educational systems such as peer to peer tutoring platforms. In addition, more research can be conducted to study the effect of different implementations of leaderboards on student motivation rates, including the implementation of seasonal leaderboards.

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Faculty management after higher education reforms – exploring the organizational structure of faculties considering their contextual factors

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Abstract

With the implementation of the new steering model (NSM), universities should align themselves more closely with management principles. Especially, the heads of faculties must cope with higher demands of management tasks. As a result, more management positions are established and organizational structures are changed. To shed light on how structures change, we investigate the faculties of one comprehensive and one technical university within Germany – which are similar in many factors – using the contingency approach. Information about contextual factors and the number and type of established positions is gained from a systematic analysis of their homepages. Dimensions of the organizational structure are used to interpret the results. Our comparison shows that the technical university, which has established itself as an entrepreneurial university, orients its organizational structure more towards the NSM than the comprehensive university, which is reflected by more support positions in faculty management. Thus, the profile and type of the university seem to be crucial contextual factors, while our study revealed that the number of students of the faculties and the number or type of degree programs are less crucial contextual factors.

Keywords: *Higher education organization; faculty management; contingency approach; organizational structure; managerial university; new steering model.*

1. Introduction

Universities are undergoing organizational change triggered by the new public management and the start of the Bologna Process in 1999 (Lüthje, 2010, p. 265), which aims at aligning universities toward management principles like effectiveness and efficiency. Effective organizational structures are relevant for goal attainment because they created good conditions for research and teaching and make the faculty competitive. The extent to which the new control model is implemented in the German state higher education laws varies (Lanzendorf & Pasternack, 2009). Also, differences within a federal state can be observed although the university laws are identical within a state. This implies that there are other factors beyond university laws influencing the organizational form of the NSM. This article aims to show differences in the organizational structures of faculties from two empirical cases using a homepage analysis to identify possible contextual factors influencing the organizational structure. To achieve this goal, we transfer components of the contingency approach to higher education institutions and apply them to two selected universities: Ludwig-Maximilians-University (LMU) and Technical University of Munich (TUM).

2. Foundation

2.1. The new management model

The NSM is shaping German administrative modernization as part of the global New Public Management reform movement, which aims at increasing effectiveness and efficiency in public organizations (Brüggemeier, 2004; Christensen, 2011). Problems such as scarce state funds and higher demands on the extra-scientific benefits of research and teaching are to be solved (Lange & Schimank, 2007). New organizational and decision-making structures aim to increase effectiveness (Pasternack, 1998). Organizational structures are defined in this work as rule systems aligning the behavior of employees with superordinate goals (Frese, 1992). The reduction of state control extends the organizational, personnel, and financial autonomy (Ziegele, 2005) and thereby strengthening university management (Krausnick, 2012). As a consequence, deans as faculty heads must cope with more complex and diverse tasks concerning administration, research, and teaching (Kehm, Merkator, & Schneijderberg, 2010).

For this reason, new positions for deans and managers are created (Leichsenring, 2009). Scientifically qualified persons increasingly prepare management decisions and provide services (Teichler, 2005) so that new areas of responsibility have to be created, such as marketing, profile, and strategy development (Lange & Schimank, 2007). The idea of a "largely homogeneous public administration" (Budäus, 1994) is criticized by the NSM approach. Instead, it demands situation-specific organizational forms and steering

instruments (Brüggemeier, 2004). In each faculty, individual solutions must be found depending on size and equipment (Leichsenring, 2009).

2.2. Contingency research

According to contingency approaches, there are no universally effective organizational structures; instead, organizations must adapt their structures to the respective situation. Despite the discussion on whether to consider organizational size as a situational factor or organizational characteristic, it is one of the contextual factors most frequently used to explain structural differences (Blau & Schoenherr, 1971). Several studies have found a positive correlation between size and specialization (Pugh et al., 1969). So far, mainly industrial enterprises have been analyzed using a contingency approach, whereas public organizations have only been considered occasionally (Tahar & Boutellier, 2013; Andrews, Beynon, & McDermott, 2016). In this work, we analyze the organizational structure and situation of faculties using a homepage analysis.

3. Methodology: A situative view on faculties

In the following, the organizational structure and situation of universities are analyzed. Despite higher education institutions as organizations having specific characteristics (Hüther & Krücken, 2018) and deviate in parts from completely bureaucratic models, universities are bureaucracies (Schneijderberg, 2017). Our analysis of their organizational structure is based on dimensions referring to Max Weber's bureaucracy model (Ebers, 1992) – this view is common in the context of contingency approaches (Schulte-Zurhausen, 2014, p. 28). Table 1 explains the examined dimensions concerning their significance for faculties.

Table 1. Dimensions of the organizational structure.

Dimension	Meaning in the faculty
Specialization	e.g., marketing or public relation advisor, course coordination, faculty manager/director
Formalization	organigram, job descriptions, documented processes
Centralization	high with a full-time dean who delegates few, low with a part-time dean in addition to other deans and support positions
Configuration	management positions with leadership function, speaker/assistant positions on staff positions (Leichsenring, 2009)

Source: Hagerer (2017), p. 397

The analysis of the situation is based on the assumption that contingency factors are influencing the organizational structure (Ebers, 2004, col. 656-657). Concerning universities, size, measured in the number of degree programs and students, as well as profile, are examined as situational contextual factors at the university and faculty level. By logic deduction, the organizational structure and situation are evaluated.

4. Results

The examined universities are within a German federal state to ensure comparability regarding the state higher education law. To identify the effects of particular factors, we selected universities that are as similar as possible, except in the considered factors. Table 2 illustrates the context of the universities.

Table 2. University-related contextual factors.

Contextual factor	LMU	TUM
Profile	Tradition, equality, internationality	Innovation, internationality, entrepreneurial university
Type of university	Comprehensive university	Technical university
Number of students[1]	51.918	42.000
Number of degree programs[2]	224	148

The higher education law prescribes number and type of deans, such as vice-deans (VD) and deans of studies (DS), which are specified in the basic regulations on the base of the course and subject structure. At both universities, it is possible to elect a dean of research (DR) (GO LMU, 2007; GO TUM, 2018). The results of the survey of faculty-related factors and deanery characteristics are presented in Tables 3 and 4.[3]

5. Interpretation and discussion of the results

For different combinations of organizational structure dimensions and contextual factors, faculties are selected and interpreted using dimensions of the organizational structure.

5.1. Faculties of LMU

Most of the support positions are located at the faculty of physics due to a rather large number of students and study programs. There are a managing director and several employees, among others, for budget, third-party funds, personnel, and travel. These employees are not very student-oriented, but rather support the internal staff. The level of configuration and specialization is high.

[1] http://www.uni-muenchen.de/ueber_die_lmu/zahlen_fakten/index.html, https://www.tum.de/die-tum/die-universitaet/die-tum-in-zahlen/studium, last accessed: 11/2019

[2] Numbers of Bachelor's and Master's programs without teacher training: https://www.uni-muenchen.de/studium/studienangebot/studiengaenge/liste_vollstaendig/index.html, https://www.tum.de/die-tum/die-universitaet/die-tum-in-zahlen/studium, last accessed: 12/2018

[3] Plausibility-based group formation: With up to 1.900 students, the faculty is small, medium-sized with 1.900 to 4.000, large with over 4.000. A small faculty has up to 8, a medium-sized 9 to 20, a large over 20 degree programs. A dean's office is small with up to three offices in addition to the dean, with four medium-sized, from five large. The dean's office is small with five support offices, medium with five and large with twelve.

Table 3. Results of LMU.

Large **Medium** **Small**	**Contextual factors (number)**		**Deanery characteristics (number)**				**Department characteristics**		
18 faculties LMU[4]	Students	Courses	VD	DS	DR	Positions	Number	Positions	Positions total
Linguistics, literature	11.876	71	1	1	1	2	3	9	11
Mathematics, informatics, statistics	5.984	37	1	3	-	1	3	9	10
Medicine	5.850	7	1	3	1	14	-	-	14
Legal studies	4.817	2	1	1	-	6	-	-	6
Social sciences	4.502	15	1	1	-	1	3	11	1
Cultural studies	3.833	28	1	2	1	5	2	4	9
Psychology, education	3.676	44	1	1	1	3	2	10	13
Business administration	3.465	15	2	1	1	7	-	-	7
History, art	3.254	26	1	2	-	1	2	12	13
Physics	2.687	16	3	1	-	20			20
Chemistry, pharmacy	2.440	12	1	2	-	2	3	20	22
Geoscience	1.856	13	1	2	-	1	2	21	22
Philosophy, science theory, religious studies	1.852	12	3	1	1	6	-	-	6
Biology	1.786	11	1	1	-	5	2	10	15
Veterinary medicine	1.607	1	1	1	1	2			2
Economics	1.575	4	1	1	1	1	1	4	5
Catholic theology	502	8	1	1	1	4	1	4	8
Protestant theology	215	7	1	1	1	4	-	-	4

Even having medium to large size of contextual factors, the humanities usually do not have too many positions in the sense of the NSM. Even the largest faculty of LMU, linguistics and literature, has only three dean's positions and eleven support offices, including a managing director. Due to the management position, the degree of configuration is relatively high. The faculty is subdivided into three departments, among them the there is an office manager with further employees as well as the heads of departments for budget or studies and teaching, which increases the configuration degree and counteracts centralization. These positions indicate a high degree of specialization

[4]Faculty-related data in table 3 and 4 are collected 2016 from the faculty homepages. Faculty related numbers of students are taken from case numbers from the student statistics (2016). Major and minor subject students are counted to ensure meaningful information about the faculty's capacity. Multiple counts are possible. Teaching study combinations were omitted in the number of degree programs, as the high number of combinations is not related to the workload.

Table 4. Results of TUM.

	Contextual factors (number)		**Deanery characteristics (number)**			
13 faculties TUM[4]	Students	Courses	VD	DS	DR	Positions total
Weihenstephan science center	4.776	29	2	6	-	32
Mechanical engineering	4.683	13	2	1	-	29
School of management	4.297	9	1	3	1	5
Informatics	4.153	13	1	1	-	3
Faculty of engineering, construction, geo, environment	3.877	15	1	3	-	4
Electrical engineering and information technology	3.208	4	1	3	-	21
Sports and health science	2.219	9	1	2	-	38
School of education	1.944	23	1	2	1	28
Medicine	1.784	2	2	1	-	18
Chemicals	1.600	8	1	1	-	12
Physics	1.402	5	1	1	-	4
Architecture	1.204	8	1	1	-	13
Mathematics	1.023	6	-	1	-	14

In summary, it can be stated that LMU, as a comprehensive university, does not have many support positions. Also, the contextual factors of faculties hardly seem to influence the number of support positions. Although faculties with low sized contextual factors tend to have few support offices, even medium-sized or large faculties usually have only a rather small number of dean's positions and support positions. Faculties of natural sciences tend to have more positions. It is noticeable that more than half of the faculties have a research dean. This corresponds to the research strength.

5.2. Faculties of TUM

The technical profile of TUM with entrepreneurial orientation requires establishing economic contacts. The variables of Weihenstephan science center, the largest faculty of TUM, are highly pronounced concerning organizational structure and contextual factors. A matrix structure characterizes the faculty consisting of research departments and six study faculties, which support interdisciplinary cooperation. The science center has six deans of studies, two vice deans, 32 support positions, and a position for gender/diversity management. Several staff members for course coordination and counseling are assigned to each dean of studies. The degree of configuration is high. Due to the size of the faculty, many tasks are handled by a wide range of specialized staff. The study faculties should ensure flexibility by enabling the adaptation of teaching to the requirements of the working world.

The faculty of sports and health science has three dean's positions, 38 support positions, two deans of studies, and 14 employees work in the department for study and examination

organization. The faculty has a medium size of contextual factors. Many advisory positions, among others for personnel and finances, are signs of specialization. The organization chart provided on the homepage is a sign of formalization. Together with differentiated job profiles, this indicates excellent service for students and a superior competitive position through appropriate positions. Several hierarchical levels are a sign of a high degree of configuration. The faculty is therefore very well equipped.

In summary, it is remarkable that in most cases, the faculties of the TUM do not only have many support positions in the sense of the NSM with large but even with minimal sized faculty-related contextual factors. The faculties of the LMU do not tend to have so many support offices, even in the case of large-sized faculty contextual factors; the natural science faculties tend to have more support positions. TUM commits itself to establish an entrepreneurial spirit. Profile, type of the university, and subject areas of the faculties seem to be crucial contextual factors on the organizational structure of faculties, while this applies to the number of students of the faculties and number/type of degree programs to a lesser degree.

6. Limitations and outlook

To enable an internal view, it is necessary to enrich the present findings with further results of expert interviews. This way, it is possible to investigate how far existing or new variables are relevant and to uncover their more profound significance for faculties. The assumption that size is a vital influencing factor on the organizational structure is only empirically confirmed to a limited extent based on only examining two universities.

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The faculty development model of the University of Milan-Bicocca: towards an integration of general and disciplinary didactics

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Abstract

The contribution presents the faculty development program of the University of Milano-Bicocca, called "Teaching large classes". The objective of this paper is to illustrate the training structure of this project (launched in 2016 with a series of pilot actions that became fully operational the following year) and its recent developments. The paper intends to provide a detailed description of the three main principle that shape the structure of the training program: the continuum of immersion and distancing in training methodologies; the isomorphism between learning contents and teaching methodologies; the focus on the didactic transposition and education reconstruction process. The analysis of these principles shows that the inter- and trans-disciplinary approach of the training program is a crucial condition to the interconnectedness of the three principles in a consistent training structure. Furthermore, the multi- inter- and transdisciplinary approach allows for the development of the project with a broader scope.

Keywords: *Teaching large classroom; faculty development; didactic transposition; interdisciplinary approach; teacher training.*

1. Introduction

This contribution is intended to present the faculty development project of the University of Milan-Bicocca, with particular focus on the workshop “Teaching large classes" which is designed for the faculty members of the University of Milan-Bicocca and coordinated by a group of researchers from the Department of Human Sciences for Education “Riccardo Massa” (Nigris, Balconi, Passalacqua, 2019; Nigris, 2018).

The aim of this contribution is to illustrate the training structure of this project, which was launched during the 2016/2017 academic year with a series of pilot actions that became fully operational the following year, and, at the same time, to present the developments that arose during the last annuity of the project. With regard to the structure of the paper, we intend to focus on three main principle that shape the structure of the training program: the continuum of immersion and distancing in training methodologies; the isomorphism between learning contents and teaching methodologies; the focus on the didactic transposition and education reconstruction processes.

2. Genesis and structure of the training proposal of the University of Milan-Bicocca

The faculty development project promoted by the University of Milan-Bicocca started with the realization of professional development’s complexity and its debt to the disciplinary domain of scholars and faculty members. Both the habit of teaching specific disciplinary areas and also the epistemology at the basis of the research activity of the individual teachers play a crucial role in guiding and influcining the transformation conditions of teaching practices (Nigris, Balconi, Passalacqua, 2019); based on the consideration of this disciplinary specificity, the University of Milan-Bicocca has entrusted the development of the project to a team of teachers, coordinated by Prof. Nigris and to a group of researchers coming from different disciplinary fields and departments. This team was established during the 2016/2017 academic year with the involvement of scholars who shared a decade of experience in teacher training, specifically at the primary and secondary levels. The purpose of creating such team was to set up a working group capable of continuously supporting the training needs of scholars belonging to 14 different departments and to facilitate the dialogue between colleagues pertaining to didactic issues, taking as a reference the model of communities of academic practice (Barret et al., 2009)

Consistent with this general framework, the training proposal of the program was structured on three levels - listed below - to offer a gradation in faculty members’ professional development process.

1. First level workshop "Teaching large classes", full immersion, 12 hours. Since the workshop started in June 2017 (first pilot edition) more than 200 professors have participated. Starting from January 2018 and thanks to a participatory evaluation process of the pilot edition, this workshop has also been addressed to newly-entered researchers.

2. Second level workshop "Student learning and formative assessment" aimed only at professors who participated in the first level workshop, full immersion, 8 hours. During the various editions, more than 50 teachers participated. The workshop starts with a small group analysis of the participating professors' teaching documentation, in particular exams given to students, and then focuses on specific aspects related to formative assessment and monitoring of learning.

3. Individual consultations to teachers who request it and who participated in the first level workshop. These consultations mainly concern aspects related to the design of individual courses and the monitoring of students' learning. Over the three years of the project, more than 30 consultations have been offered to scholars from 7 different departments.

3. The three principles of the training program

The faculty development program of the University of Milan-Bicocca revolves around three design elements, briefly presented below. These elements have been progressively explored during the various years of the project by investigating the training impact

3.1. From the teacher's to the student's perspective (part I): the immersion/distancing continuum of teaching methodologies

The teaching methodologies that structure the two main training proposals of the course (workshop of first and second level) are designed to be arranged along the immersion-distancing continuum (Rossi, 2011). In fact, there are immersive-simulation methodologies (watching videos of didactic activities; simulations of didactic situations; role-play) which have the function of facilitating an immediate recognition of the topics covered by the training and of mobilizing the implicit didactic knowledge of the participating teachers. The distancing methodologies (such as debriefing or large group discussions), on the other hand, play a role of progressive re-reading of teaching practices through the interpretative schemes offered by the course. This immersion/distancing recursion also responds to the objective of offering participants the opportunity to take the students' point of view. This process, which aims to facilitate the transition of teachers from a teacher-centred to a student-centred approach to teaching, is dependent on a second principle, defined as isomorphism between learning content and teaching methodologies. The debriefing activities, in particular, serve to make participants analyse the training course on a double

level: a) the learning contents and teaching methods used in the training course; b) the choices and actions of the teacher-trainer made during the workshop.

3.2. From the teacher's to the student's perspective (part II): isomorphism principle between learning contents and teaching methodologies

The thematization of this double level for which "the teaching-learning process constitutes at the same time the object of the lessons, but also the medium through which future teachers experience the relational, communicative and teaching methods that they will propose to their future students" (Nigris, 2006), is implemented during the workshop through a continuous and explicit meta-cognitive reference to this interweaving of levels. The purpose of this reference is to encourage participants with a dual perspective: as students, immersed - from within - in the learning process and focused on the content to be learned; as teachers, asked to consider the choices of the teacher-trainer and led to observe the evolution and effects of the training process from the outside. This double level refers to the principle of isomorphism (Baldacci, 2006; Porlan, 2017) between the content taught and the didactic methods adopted, and it allows us to understand the choice of entrusting the faculty development training actions to teachers who have substantial experience in teacher training.

3.3 From the teacher's to the scholar's perspective: the role of transposition and education reconstruction in facilitating the student's conceptual change

A further objective of the training proposals is the reflection on the selection of disciplinary contents and on the methods of learning by non-experts in a specific disciplinary area (as are the students and, during the training course, the teachers who participate). For this reason, training activities are intended to focus on some variables of the didactic transposition (Chevallard, 1985) and the educational reconstruction process (Duit et al., 2012), mostly related to the knowledge of the discipline and the exploitation of the students' pre-knowledge. Studies on the conceptual change in the teaching-learning process (Pozo, 1999; Vosniadou, 2009) recognize the active role of the students' pre-knowledge in the construction processes of new concepts and, therefore, the need to make that pre-knowledge visible (Ritchhart, Perkins, 2008) in order to be able to progressively modify it. Furthermore, such knowledge is fixed to an "articulated cognitive structure", using the definition offered by Quinn and Holland (1987), in folk theories or in "implicit theories" (Pozo, 1999) since they possess interpretative functions that allow us to analyze the phenomena of reality, elaborate hypotheses and make inferences (Pozo, Del Puy, Sanz, Limon, 1992). To develop competences of accompanying the conceptual construction, teachers, as a prerequisite, are required to know how to recognize such prior knowledge in order to understand and structure a concept. A preliminary step for the development of this competence is to deepen the communication aspects that govern the interaction in the

classroom between teachers and students, especially in the context of large classes. In this learning environment, it is essential that the teacher is able not so much to ask students general questions, but rather to formulate specific questions that can activate complex reasoning (Selleri, 2016) and conduct collective reasoning and discussions (Pontecorvo, 1993) that can enhance the heterogeneity and the numerousness of the group of students.

3.4. Multidisciplinarity, interdisciplinarity and transdisciplinarity as conditions for the training of university teachers

The principle that guides the implementation of the faculty development program responds to the idea that the multi-, inter- and transdisciplinary training approach can facilitate the development of didactic skills for university teaching. In particular, it is believed that the dialogue between different disciplinary areas and epistemologies is able to favour the development of these skills by guiding the didactic transposition and educational reconstruction of the teacher. In this sense, higher education teaching skills are not only dependent on the communication skills of the professors and on their ability to engage students, but above all they concern the ability to accompany students' conceptual construction and, before that, the ability to identify the conceptual issues of greater relevance to a specific disciplinary area and to relate these issues to the knowledge already held by students. To encourage the development of these skills, the team of researchers who initiated the faculty development program established a training structure based on different levels of disciplinary interaction:

1. Multidisciplinary level: a) The team of researchers from different disciplinary areas coordinates the University's educational program. These scholars have the role of privileged interlocutors in the analysis of training needs of the different departments; b) Groups of teachers participate in the training interventions (the main criterion for the formation of the groups relates to the disciplinary origin of the participating teachers).
2. Interdisciplinary level: The activities that structure the three modules of the workshop "Teaching large classes" are defined and require participants to enter into a dialogue with colleagues from different disciplinary fields.
3. Transdisciplinary level: The objectives of the training interventions concern the development of didactic professional skills of the participants. In this sense, reference is made to a disciplinary area that does not belong to a processing previously implemented by the participating teachers.

As illustrated in a previous work, (Nigris, Balconi, Passalacqua, 2019), the data collected at the end of each different edition of the workshop, regarding the training impact perceived by the participants, shows that the activity of the third module (see Table 1) was appreciated by the teachers for having favoured a reflection on the didactic choices in the

selection of the conceptual keys of their discipline. In particular, data taken from pilot training assessments show that participants greatly appreciated the multidisciplinary composition of the training group, the dialogues with colleagues from other departments on specific content of teaching and the consideration of students as “non expert scholars”.

For example, see some excerpts from the participants' comments which highlight the role of the comparison between different disciplinary perspectives in allowing unprecedented ways of reading the teaching variables.

> Working with people from other disciplines is very interesting in my opinion, it gives you a lot of ideas. And not only because you don't have that competence, but also because it shows you another way of seeing things (...). Yes, she managed to put the content in the right wrapping.

The feedback of the participants underlines how the interdisciplinary comparison helps us to elaborate an epistemological reflection that facilitates the recognition of the didactic specificity of the different disciplinary teaching areas.

> This work of debate between colleagues from different disciplines served to focus on conceptual passages that I took for granted; it helped me to understand what a priority is in our disciplines. (...) For example, check what the real problem that you want to consider is.

It can be said that the participants in the workshop "Teaching large classes", through the activity of explaining to a colleague a difficult concept of their discipline, began to question their own didactic planning and the choices related to the selection of learning contents. From this point of view, it can be seen as a first step from a teacher-centred approach to a student-centred approach in the choice of learning contents.

> As the problem seemed to be the students' prior-knowledge, my colleague helped me to think about how this knowledge was managed during the course. For example, to find some background questions a few days before discussing the concept ... in order to start from there. I have a lot of experience in teaching physics, I must say that now I understand well what it means to teach physics to opticians and physics to physicists. It changes a lot, especially compared to what students know before starting the course and how they think about the experiments I often do.

4. An outcome of the three-year program: the definitive structure of the first level workshop

Now take a closer look at the training structure of the first level workshop "Teaching large classes" that is the result of the research conducted on the workshop over the course of three years of the faculty development program. This training intervention, which includes three consecutive 4-hour modules (arranged over two days), is designed around three main activities. Each activity is initiated as a module with the aims to promote both immersive

and experiential learning methods and processes of reflective distancing (debriefing activities).

Table 1: Structure of workshop modules "Teaching large classes"

Module	Activity
First module (4hrs)	Video analysis of a lesson in a large classroom context: individual and pair activity of analysis of two lessons conducted in different disciplinary areas. Debriefing conducted by the teacher trainer.
Second module (4hrs)	Analysis of didactic communication in a large classroom context: simulation of an interaction activity between teacher and student (conducted by the teacher trainer) focused on the use of questions to elicit the students' previous knowledge and mis-conceptions. Debriefing conducted by the teacher trainer.
Third module (4hrs)	Simulation of a didactic activity in pairs: the members of the couples, selected on the basis of a criterion of disciplinary diversity, are asked to explain to their colleague a topic of their respective research and teaching areas considered difficult for students. Debriefing conducted by the teacher trainer.

The objectives that we intend to pursued in the "Teaching large classes" workshop can be summarized in the following four points: a) promoting a greater awareness in faculty members of their own teaching style and of the teaching models proposed in the classroom; b) sensitize professors to the different profiles of students and to the need to decline educational paths and mediators according to the recipients of the teaching-learning process and to their level of disciplinary knowledge; c) guide professors in the transition from teaching content to identifying and constructing complex concepts relating to different disciplinary areas; d) focus the attention of professors on the relationship between the epistemology of the discipline and the teaching methodologies. While the first outcome is related to a general objective of the program, the latter three outcomes refer to a development area that could be called "disciplinary awareness on the teaching and learning process". Within this area, the three modules of the workshop are directed to guide faculty members to reflect on the interconnection between their disciplinary research and teaching activity and, more precisely, to support them in thinking about teaching not as an isolated professional requirement, but rather as a direct result of conducting research.

5. Expansion of the training project

At the end of the first three years of the project, the interdisciplinary team that has been coordinating the faculty development proposals of the University has developed some new

actions, to be implemented during the current year, that aim to extend the effectiveness of the ongoing program:

- In-depth groups: The questionnaires given at the end of the first and second level workshops highlight the participants' requests for in-depth meetings on some specific issues (in particular with respect to group work in the context of large classes and the design of the teaching structure). This action has been implemented as a part of the community of practice framework (Barret et al., 2009).
- Tutor training: Thanks to the work of the multidisciplinary theme, a specific training project to facilitate the quality of learning for the students of the three-year degree courses in science and economics has been launched for academic staff with tutoring roles. This action is aimed at developing professional figures who are able to identify the specific training needs of students with reference to the contents of disciplinary learning and to prepare teaching strategies to support the modality of large classes.
- Further adjustment of the first level workshop structure: In order to encourage continuous support in improving the teaching practices of the participants, a fourth module has been introduced to the workshop "Teaching large classes". This module, to be carried out two months after from the first three, intends to foster a comparison of the didactic innovation experiences developed by the participants and aims to support the professional training project with a more focused analysis on individual teaching practices.

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Integrated disciplines and future competencies: A blueprint for ethically aligned curriculum for IT, CS, ITC & beyond

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Abstract

Autonomous and intelligent technical systems are specifically designed to reduce the necessity for human intervention in our daily lives. In so doing, these new computer-based systems are also raising concerns about their impact on individuals and society. Because of their innovative nature, the full benefit will be obtained only if the technology is aligned with society's defined values guided by ethical principles. Through the proposed ethically aligned curriculum (ETHIKA) for computer sciences (CS) and information technology (IT) specialties we intend, therefore, to establish frameworks to guide and inform dialogue and debate around the non-technical implications, in particular related to ethical dilemmas. Hereby we understand "ethical" to go beyond universal moral constructs, such as trust, harm, good or bad, and include ethical designs for AI-based technologies, socially-oriented computer sciences, and ethical risks of digital society. As digital economy prospers, more CS/IT-professionals realize the power of education-driven intellectual capacity (InC^{ED}). It is hypothesized, that InC^{ED} has direct impact on learning competencies of students, warranting future successful management of professional and life ethical challenges. ETHIKA elucidate, through both methodological and experimental inquiries, the impact of global digitalization and related ethical risks on learning and professional competencies in both professional CS/IT-community and the University students.

Keywords: *CS/IT-community, integrated disciplines, future competencies, life-long learning, digital world, professional expertise.*

1. Introduction: ethical design for innovative breakthrough technologies

In the new millennium innovative digital technologies trigger more controversies then any technological advances in previous eras. The very structure of our societal processes, shaped by the computer science and its practical applications, is changing dramatically. Emerging digital society requires timely resolution of ethical dilemmas, now materialized through AI technologies and the Internet-of-Things (Schwab, 2019). The ethical component of innovative technologies already have a very specific value in digital world, resulting in emerging concepts such as CyberEthics or Digital Ethics (Libin, 2019), and AI-For-Good (ITU, 2019). Development of AI-based technologies calls for a new social contract between computer sciences (CS) community, including ITs, ICTs, programmers (aka IT specialties), mathematicians, and R&D developers, and digital society stakeholders such as consumers, customers, users, and other participating individuals. Ethical regulations are becoming a common place for the innovations and related production process. In the same way, traditional education is transformed by new learning practices focusing not only on knowledge acquisition, but efficient knowledge implementation expressed through learning and professional competencies.

As digital technologies and digital economy prosper, more professionals realize the vast power of ethics that regulates education-driven intellectual capacity. The cumulative learning outcomes can be defined as generalized intellectual capital in education (InC^{ED}), expressed through an algorithm comprised from four different factors: ethical reasoning, academic achievements, coping with complex professional and life situations, and digital proficiency. It is hypothesized, that InC^{ED} has direct impact on learning competencies of students warranting future successful management of professional and life challenges.

2. A blueprint for ethically aligned curriculum (ETHIKA) for CS/IT specialties

The proposed ETHIKA curriculum framework addresses the existing gap in teaching ethics as an integrated disclipline for CS/IT students. An ethically aligned education process is grounded in the following learning modes:

- ***Education through research mode*** focuses on providing a methodology and metrics for aligning AI-based technologies with digital ethics values, and also to enhance higher education with R&D components across traditional and innovative University disciplines. This ETHIKA curriculum module explores the nature of ethical reasoning and decision-making in the context of AI technologies, through conceptual synthesis, conducted via systematic reviews, and traditional qualitative methods appropriate to the equivocal content of ethical reasoning and decision-making: semi-structured, key informant interviews, and focus groups. Result can

provide materials for developing a set of tools, e.g. an Ethical Reasoning Toolbox (eREASON), further implemented to guide ethical design of innovative technologies;

- ***Ethical reasoning & instructional design mode*** addresses implementation of critical thinking to learning process through examining moral problems and ethical dilemmas. Many models exist but prior to the development of the CyberAnthropology Moral Dilemmas (C^aD) Model (Libin, A. & Libin, E., 2003) no approach specifically examined ethical reasoning in the cyberspace defined as a transformative shaping force of the human nature. The C^aD was developed from examination of the patterns of ethical problem-solving engaged in by technology naive experts from several disparate cultural traditions (see for details on a joined project - Libin, E. 2017). Technical knowledge and ethical knowledge were key inputs to reasoned decisions. Decisions were further informed by a wide range of "justifying" criteria such as professional codes, probabilities, and consequences. Acting on a decision finally, was subject to attitudes, conflicts between parties, and consequences of action.
- ***CyberPsychology learning mode*** engages students with the science of digital humans, a recent phenomenon that emerged as a direct result of human multilevel engagement with artificially designed computer-generated reality (Libin, 2001). The CyberReality is not just a replica of our earthly world, it exists through specific physical embodiment formed by the ever-growing body of the hardware and software; psychological space, shaped by peoples' computer-mediated interactions; and societal factors defined by the impact the information makes on global society.
- ***Societal risks of global digitalization mode*** is a conceptual program focused on the global digitalization consequences for the most important areas of human life including education, professional activities, family, mental health, and social communities. Systematic efforts are needed to recognize, minimize, and, when possible, prevent societal risks accompanying the development and implementation of emerging technological innovations. Thus this ETHIK mode is mainly focused on life activities that are grounded more heavily in societal, rather than economical, industrial, or geopolitical factors. Ethical, or moral, dilemmas, serve as a focal point of building both a conceptual foundation and practical implications of risk studies as they relate to digital transformation of modern society.

2.1. ETHIKA guiding principles

The term "*ethics*" can be understood in two ways. It refers to the body of well-considered standards of right and wrong that serve as guideposts for human interaction. It also refers to

the process of continually re-examining how personal and institutional beliefs and actions both live up to and shape those standards. In 1978, the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research issued the Belmont Report, a document defining basic ethical principles to guide the conduct of research and any kind of technological development involving human beings (National Commission..., 1978). These principles have come to be known as the three pillars of protection of human subjects in research. For the same token, those principles build the theoretical foundation of the guiding framework for the IEEE initiative of ethically aligned design (The IEEE Global initiative…, 2019).

The first principle is respect for persons, who sometimes are defined as "users of technology". This principle is grounded in a fundamental respect for human dignity to which there is virtual universal ascription. Respect for persons and their natural right of self-determination is the source of guidelines for informed consent. The second principle is beneficence, which requires that technology developers maximize the potential benefits to the users, and minimize the risks of harm. Finally, the third principle is justice, fair distribution of the benefits and burdens of research and development (R&D), which considers the question of who receives the benefits of R&D and related products, and who bears its burdens.

Ethical dilemmas occur when principles compete. The principle of self-determinism supports the autonomy of an individual in, for instance, consenting to submit private data for public use. The vulnerability that is inherent in individuals with lower levels of digital literacy however, interferes with autonomy and has moral significance. Moreover, in persons with limited cognitive and/or social resources, one's choices are circumscribed by the demands of one's individual condition, reducing the range of choices that still support safety and related well-being. As demonstrated in the context of compliance vs. non-compliance with treatment regimens, individuals with chronic conditions have been shown to redefine themselves in juxtaposition to the conditions with which they live. This constitutes a decisional autonomy, but rationality of decisions cannot be assumed out of hand (Scanlan, Stewart, Kerridge, 2019). Beauchamp and Childress (2001) distinguish agency from autonomy with the former defined as the capacity to rationally guide one's reasoned desires into actions. If an individual with unmet physical, cognitive or social needs choose available technological innovation for the wrong reason, neither justice, nor beneficence, which promotes trust between user and technology developer, is served.

2.2. ETHIKA curriculum implementation via outcomes modeling

Implementing ETHIKA curriculum in real-world educational setting would result in a set of activities serving as in interface between engaged students, CS/IT community, and R&D

professionals. In this section we model the outcomes while building a blueprint for ETHIKA enterprises.

Education through research mode results in developing educational digital ethics modules (eETHICS) integrated with the University learning management system (LMS). A manual on tracking the University educational ethical competencies is implemented as part of L&D (learning and development) module with the potential to be replicated nationally and internationally. Ethical online education modules developed as part of the University LMS might provide a foundation for future commercial R&D capstone projects.

Ethical reasoning & instructional design mode focuses on developing an ethical framework methodology (see *Figure 1*) enhanced with the assessment instrument and associated algorithm called an Ethical Reasoning Tool (eREASON) that is used to guide ethical design of innovative technologies.

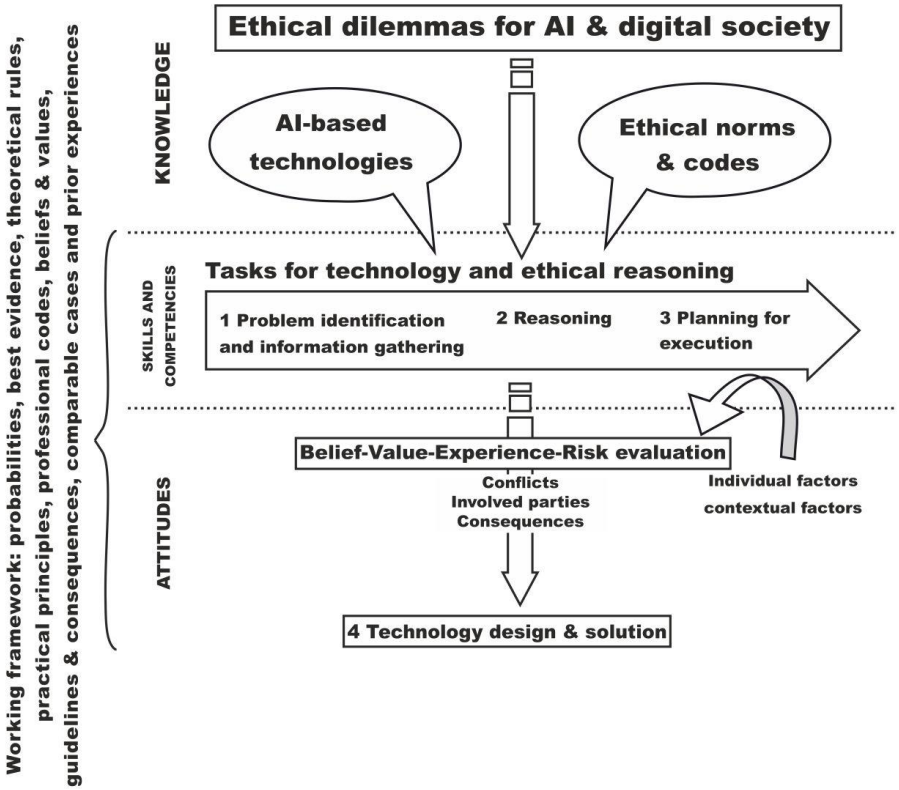

Figure 1. ETHIKA curriculum: Ethical dilemmas in digital era.

CyberPsychology learning mode builds on educational activities based on evidence-based analytics derived from more than 3,000 peer-reviewed articles, research reports including think tanks outcomes disseminated as books and white papers, diplomas and PhD thesis, industry reports, and mainstream news narratives in English, Spanish, Russian, French, German, and Chinese on the subject of physiological, psychological, and sociocultural effects produced as a result of computerized technologies impact on individuals, groups and large communities. This is an ongoing crowdsourcing effort originated in 1983 and continued through network-based open source international collaboration. Four distinct patterns emerged, describing the following core elements of the CyberPsychology as a scientific inquiry, university discipline, and everyday reality framework: psychosocial competence including self-management of one's own identity, coping with negative consequence of digital immersion, CyberSecurity as it relates to personal and societal safety, and CyberEthics.

Societal risks of global digitalization mode outcome focuses of exploring the interface between 4 factors of generalized intellectual capital (InC^{ED}): ethical reasoning, academic achievements, coping intelligence and digital proficiency over time. Quantifying ethical risks of digital society would provide, for the first, quantified algorithm based on a multi-level modelling of digitalization risks stratified by the primary and secondary factors. Indicators of learning competencies in four areas of InC^{ED} are explored in the context of ethic risks prediction. An experimental model provides metrics for enhancing the educational and research practices at the University.

2.2.1. Prospects for further research (R&D) and learning & development (L&D)

ETHIKA curriculum core team will capitalize on project findings and products by building a digital ethics in AI/IS international network to foster collaboration between relevant exchange programs at the participating Universities, academic and industry partners. The next phase, which will follow the completion of the described phase of ETHIKA project, would involve the development of several projects aimed at exploring the mechanisms underlying successful vs. non-successful adaptation of AI/IS technologies to everyday life, as well as routes for transferring the ongoing trends in disruptive innovations into ethically aligned R&D and L&D routes.

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International Collaboration on a Sustainable Forestry Management OER Online Program – A Case Study

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Abstract

Over time, forest education has had to adapt to keep up with global changes and to accommodate the needs of students and society. While facing pressing global issues like climate change, deforestation, illegal logging and food security, the role of higher forest education has shifted away from traditional teaching approaches and practices to methods that emphasize sustainable development, community-based management and environmental conservation in forestry. In doing so, forest education has cultivated human expertise that understands the complexity of ever-changing environments, masters state of the art technologies to manage forests and natural resources, and is capable of creating, communicating and implementing related policies in global communities and societies. In this context, educational technology and online learning enable flexible, accessible, effective, and high-quality forest education. A case study of a Sustainable Forest Management Online Program led by the Faculty of Forestry, University of British Columbia (UBC) shows that appropriately integrating educational technologies into an internationally developed and recognized high quality curriculum is an effective way to create accessible and affordable forest education in meeting the demand of evolving societal and environmental conditions.

Keywords: *forest education; online learning; educational technology; international collaboration, open educational resources*

1. Introduction

1.1. Higher Forest Education in a Changing World

The multitude of pressing global issues, including climate change, deforestation, and illegal logging, has underscored the need for forestry education to strive supporting sustainable forest management practices that accommodate natural cycles and ecological systems to promote the long-term health of the land and the people (CCIED, 2016). These practices often emphasize community-based management approaches and environmental conservation (Temu, Rudebjer, Kiyiapi, & Lierop, 2005). Given the complexity of these practices, today's forestry graduates must be internationally strategic thinkers with a variety of skills (Längin, Ackerman, & Lewark, 2004). In the dynamic context of globalization, advancing technologies, economic uncertainties, and changes in society values, higher education requires to meet the demand of emerging new field of forestry while for graduates, education will mean lifelong learning, and may need support from technology-based distance education to fulfill the needs of society (Owusu-Ansah, Neill, & Haralson, 2011).

1.2. Online Learning in Forestry Education

The advantages of online learning are many including flexible hours and location, cost-effectiveness, borderless collaboration, as well as access to current information and educational resources (Allred & Smallidge, 2010). Even online, educators can maintain synchronous instruction through webinars, videoconferencing, and blended or flipped approaches. However, development costs, accessibility, and concerns from faculty members, may hinder integration of web-based technology in higher education (Owusu-Ansah, et al., 2011). Despite the adoption of online learning, webinars and learning technology in many subject areas in Canada (Bates, 2017), and in American and European forest education (Bogdanou, Starr, Weatherall & Leslie, 2013; Gleason, 2015), these technologies have yet to be fully utilized in higher forest education. As discussed by Längin, et al. (2004), the dearth of forestry online learning might be due to small student target groups, or the apprehension that computer-supported learning only trains theorists in a very practice-oriented field of science. Yet online learning may allow forestry universities to meet the new demands in forest and environmental education (Längin, et al., 2004).

1.3. Purpose of the Paper

This article attempts to discuss the effectiveness of a sustainable forestry management online open education resources (OER) program developed and implemented through international collaboration. The experience and lesson learned from the practices can be used for colleagues in developing online learning programs and OER during this challenging time amid global COVID -19 pandemic.

2. Planning and Practices

A joint educational online program entitled *Innovative Sustainable Forest Management Education in the Asia-Pacific Region*[1], started being developed in 2014, is a series of online courses in sustainable forest management (SFM) with its content as OER. The program has been led by UBC Forestry in partnership with Beijing Forestry University (BFU), University of Melbourne (UM), University Putra Malaysia (UPM), and University of the Philippines Los Baños (UPLB) under the framework of the Asia Pacific Forestry Education Coordination Mechanism (AP-FECM) sponsored by the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet). The goal of the program is to improve access to education in the field of SFM, targeting to enhance teaching quality, curriculum enhancement and research capacity among forestry universities, policy makers and practitioners in the Asia Pacific region (Innes, Wang, & Zeng, 2018). The AP-FECM sees the OER concept to be pivotal to the success of this endeavor.

As the only SFM online program of its kind, the joint educational program provides world-class forestry education resources created and supported by leading professors and experts from internationally recognized universities around the world to over 10,000 students and professional learners from over 90 international economies since 2016.

2.1. Program Development

Forming an international content expert team, with central instructional design support from UBC, the program followed a modified ADDIE (Analyze, Design, Develop, Implement, and Evaluate) instructional design model to employ Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPCK) framework ensuring effective integration of technology into the content and pedagogy of course design and development.

The program aims to introduce updated SFM topics to global learners in an open learning environment. The course topics (changing landscapes of SFM, governance policy, community development, sustainable use of forest ecosystem services, forest resources management, ecosystem restoration and protection) were widely consulted with regional forestry universities and identified from reviews and surveys conducted by the AP-FECM, which demonstrated solid needs and interests of learners and larger societies. Content experts from regional forestry universities in the AP-FECM network were then invited to develop coursework. Together, these subject matter experts form an international collaborative development team with a broad knowledge in diverse approaches to management, ecosystems and forest-types. While developing contents, the international

[1] http://apfecm.forestry.ubc.ca/sfm-online-courses/

experts worked on contents related to theory and local, regional and global practices as a case related to their assigned course, which has wider learning scope. Before course development, a three-day on-site course development workshop was held by UBC Forestry and UBC Centre of Teaching, Learning and Technology (CTLT) to conduct curriculum and course mapping, discuss applicable pedagogy, and introduce design principles for online learning using educational technologies. A team-based approach to content development, learning design and project management was established to support the entire program development combining knowledge of content, pedagogy and technology. During course development, instructional design and educational technology support were provided to help content experts in developing their online courses by providing content templates and through reviews and feedbacks on course outline, schedule, assessments, and module content.

As a result of these efforts, the final course design came to fruition. Each course features self-directed learning with content as Open Educational Resources (OER). Learning modules break down to topics for easy repurpose and typically consist of background information, video lectures, supplemental readings, self-tests, self-directed reflection questions, and self-directed discussions. With module-based format, it allows instructors to easily incorporate appropriate content into their own courses and allows institutions to customize and integrate the entire or 'parts of' each course to fit into their own education curricula and programs. This pedagogical model allows both self-paced learning and instructor-led learning to improve flexibility and learner engagement.

2.2. Program Implementation

The OER Course materials have been widely utilized or repurposed either partially or entirely by AP-FECM, participating universities, member universities of AP-FECM, and individual users in their learning, teaching, and research since 2016. Some examples of innovative pedagogical approaches of online teaching using the existing OER course materials include the following. In Course 3 (International Dialogue on Forestry Issues), learners were asked to preview the course content and bring questions to a classroom discussion held in a video conferencing session led by instructors at UBC as a part of undergraduate course. In Course 5 (Restoration of Degraded Forest Ecosystems and Forest Plantation Development), the lead professor in Australia blended the course materials into the University of Melbourne's Master of Forest Ecosystem Science. Graduate students experienced a combination of self-paced SFM online lectures, in-class discussions and hands-on fieldwork at a wide range of forest sites with fellow classmates. In 2017, 2018 and 2019, Course 1 (Sustainable Forest Management in a Changing World) and Course 5 (Restoration of Degraded Forest Ecosystem and Forest Plantation Development) were held as the open enrolment pilot courses. Learners were asked to study course materials and share localized practical experience in group discussions. They also conducted field work

and present visual materials of local practices in relation to sustainable forest management and restoration of degraded forest, therefore exchanging practical and applicable knowledge have enriched experiential learning across the boundary.

3. Key Outcomes

The SFM online program demonstrates the benefits of international collaboration on using online educational technologies supporting teaching and learning practices which enrich the learning experience and initiate international collaborations to shape higher forest education. Since 2016, the SFM online program has attracted over 10,000 learners including students, faculty members and professionals from over 90 countries around the world. Realizing the innovative approach employed, the program was awarded the CNIE-RCIE Award 2016 in the category of Excellence and Innovation in the Integration of Technology in Educational Practices/Collaboration. Recognizing the contribution of forestry education in Asia-Pacific region, the program was the winner of the International Union of Forest Research Organizations (IUFRO) Best Forest Education Award-Tertiary in 2019. These awards recognized the excellence in innovative educational practices and the use of technology to support and advance learning in forestry education. These awards also advocate the importance of multi-national multi-university collaborative efforts in today's dynamic education landscape which enhance local, regional and global awareness of forest sustainability for educating future generation scientists, policy makers and practitioners.

Positive results were shown by two external program evaluations. The first evaluation was based on the user survey (70 completed responses) which analyzed the user experience on course design, learning outcomes, learner assessment, course materials, learning activities, lecture resource preferences, and course look-and-feel. The second evaluation covered the impacts of the SFM online courses, the online platform and the program on forestry education in the region, and its sustainability and feasibility for future development. Based on an analysis of the program evaluations, independent external report concluded that the development of a series of SFM courses for delivering essential knowledge and skills in sustainable forest management to global audiences was largely successful in achieving its objectives (Bigsby, H., 2016), and there were solid evidence showing the existing courses are viable with high quality (Xi, W., 2017).

Successful delivery of the repurposed the SFM online OER program could be found in sample post-course surveys. The program was designed to encourage and assist globalization and global cooperation in developing students' careers in forestry and the post-course surveys indicate that this was successful as over 80% of respondents reported that the course advanced their knowledge of SFM in both their home country and abroad (Fig. 1a). The program has met these outcomes as over 90% of respondents reported a

deeper understanding of SFM and feel they can apply their knowledge in their careers (Fig. 1b).

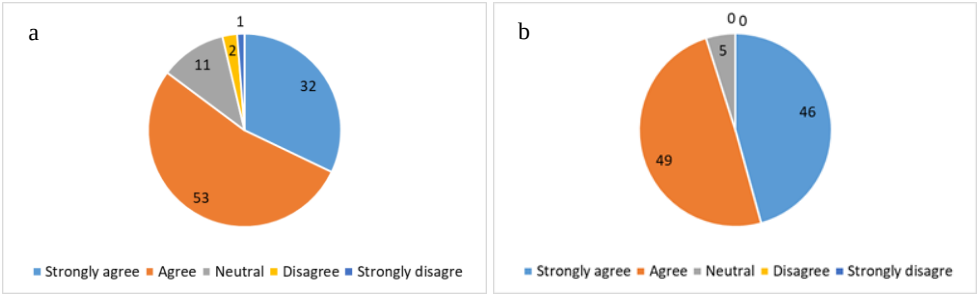

Figure 1: Learner Satisfaction on Knowledge Transfer expressed as % (N=81). Source: Post Course Survey (2018).

Overall, more than 80% of respondents felt satisfied with the course and reported the online activities effectively enhanced their learning (Fig. 2a). Over 90% of respondents expressed their interest on pursuing another e-learning course (Fig. 2b). Thus, these experience of the users of SFM online program prove the effectiveness of online learning as a platform for forest education.

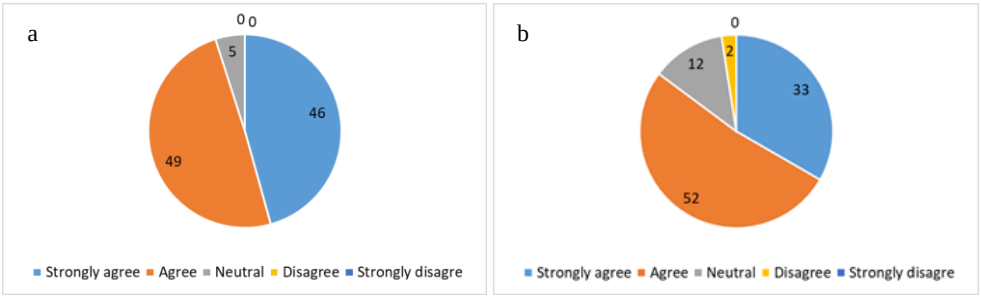

Figure 2: Learner Satisfaction on Knowledge Transfer expressed as % (N=81). Source: Post Course Survey (2018).

4. Conclusion

The case study of the SFM online program showed that the integration of online technology, content and pedagogy is an effective way to produce new teaching and learning methods in higher forest education, which fulfills ever changing societal and environmental condition enriching student's learning experience ensuring wider public access. In this case study, it reveals that online educational technology could facilitate the cost-effective development of internationally recognized accredited forest education. Subject matter experts from the Asian–Pacific Region contributed their knowledge of multiple forest types and practices, providing learners with a more global understanding of forestry and SFM.

The combination of educational technology, content and online pedagogy generates an improved form of forestry education that can access current information on global issues and support the interaction of peers and professionals around the globe without the constrains of geographical location and time. However, a significant amount of time and resources must be invested in the development and involvement of effective online courses. A team-based approach, sufficient preparation for course development and operation, ongoing financial, instructional and technical supports are critical components for the success of the international collaborative forest education program. We hope this joint effort is realizing a forestry lecturer's dream, described by L Längin, et al., (2004), to discuss [and learn] with a group of motivated students from different regions of the globe in one virtual classroom.

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Factors affecting Cloud Computing adoption in Higher Learning Institutions in South Africa: A case of Matjhabeng TVET Colleges

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Abstract

Cloud Computing is one of the most important trends and newest area in the field of information technology in which resources (e.g. CPU and storage) can be leased and released by customers through the Internet in an on-demand basis. The adoption of Cloud Computing in Higher Learning Institution is a real opportunity. Although Cloud computing has gained popularity in the world especially in education and industry, but its impact in colleges is still unexplored. This exploratory qualitative research seeks to identify the factors affecting the adoption of Cloud Computing in South Africa, focusing on Matjhabeng TVET colleges. 35 IT stakeholders from two TVET colleges was interviewed. Thematic analysis was utilised to analase data. After data was analysed, the findings revealed that data security, lack of internet access and lack of infrastructure resources are key factors that affects Cloud computing adoption in Matjhabeng TVET colleges. This paper contributes to the literature on Cloud Computing adoption in Higher Learning Institutions in South Africa.

Keywords: *Cloud Computing; Higher Learning Institutions; Information and communication Technology; Adoption.*

1. Introduction

Higher Learning Institutions (HLIs) in South Africa (SA) and across the world are in the historic era. Information Technology (IT) abilities are said to be significant cost centres to many promoters, even though an institution relies on technology in every aspect of its operation, it is difficult to perfectly calculate the return-on-investment (ROI) from the cost of information technology. Similarly, it is challenging to attribute the benefits of technology in a straight line to the institution's vision, mission and goals. An innovative technology that promises cost saving and better service delivery for any organization is Cloud Computing (CC) (Alharbi, Atkins & Stanier, 2016; Tarig, Tayyaba, Rasheed & Ashraf, 2017; Krauss & Va der Schyff, 2014).

Cloud computing is a rapidly evolving model that enables institutions to access computing resources as a service directly over the Internet (Almajalid, 2017). This model is radically different from current on-premise deployment strategies in part because it shifts the burden of owning (licensing) and operating (support and maintenance) the often complex computing environment to a third party called a cloud service provider (CSP) (Gangwar & Ramaswamy, 2015). Currently, the public higher education sector in South Africa is composed of 26 public universities and 50 technical and vocational education and Training (TVET) colleges spread across the country's nine administrative provinces (Krauss & Va der Schyff, 2014; Le Roux & Evans, 2011). Adopting the cloud computing model for selected tasks can bring huge benefits to these institutions. For example, sharing resources such as expensive hardware, software and technical expertise can significantly lower the overall IT costs because available resources are better utilized and delivery costs can be shared among multiple institutions (van Biljon & van der Merwe, 2018).

Cloud computing may also make it easier for smaller colleges and universities with limited resources and in-house capacity to gain access to cutting edge IT resources that they would otherwise not be able to procure and operate on their own (Ali, 2018; Almajalid, 2017). A further argument is that public universities and colleges share many similar operational processes such as course offerings, admissions, enrolments, bursaries, research and graduations that can be standardized across the higher education sector, and offered as a set of services to the many colleges and universities in a more cost effective way than is currently the case (Akin, Matthew & Comfort, 2014; Seke, 2015). Granted, cloud computing is not without its challenges and risks, but it is argued here that its benefits and opportunities far outweigh the risks. Even as cloud computing continues to make inroads into South African Universities, its adoption in South African colleges remain unclear (Krauss & Va der Schyff, 2014; Le Roux & Evans, 2011).

This paper uses semi structured interviews to identify the factors that affects CC adoption in HLIs in SA, specifically at Matjhabeng TVET colleges. The paper is organized as follows:

section 2 presents the literature review; In section 3, the state of art in Matjhabeng TVET colleges is asserted. Research methodology is presented in section 4. Section 5 reports the research findings. The limitations of this paper are stressed in section 6. The paper concludes with recommendations in section 7.

2. Literature Review

The conceptual, logical and architectural development over Networking, Internet and Grid computing has given birth to the third (3rd) technological revolution after Personal Computer (PC) and the internet known as cloud computing (Alharbi *et al*, 2016; Olabiyisi, Fagbola & Babatunde (2012). Cloud computing can be described as a composite three-tier delivery, development and application platform . As a delivery platform, it uses an on-demand cloud-based infrastructure to deploy an infrastructure or applications, for example, the Amazon Elastic Cloud (Saidhbi, 2012).

The on-demand cloud-based development environment provides a general purpose programming language (for example, Bungee Labs, Coghead, google sites) as a development platform. As an application platform, it is used to develop and deploy end-user applications (for example, Salesforce.com, NetSuite, Cisco-WebEx and google docs).

Ali (2018) defined cloud computing as an elastic and scalable utility model that offers flexible, ubiquitous, on-demand network access to a shared pool of configurable computing resources (for example, servers, data centers, networks, applications and services) that can be rapidly provided and released with limited interaction of service provider or the management. It provides shared infrastructure, self-service, dynamic and virtualized pay-per-use platforms which put it on high demand. Cloud computing implies a level of dynamic, flexible resource sharing and allocation of assets.

Matthew (2015) conducted interview with a panel of the world's top technologists discussing new technologies changing higher education especially "education in the cloud" trend. Shel Waggener, the senior vice president of Internet and former Chief Information Officer (CIO) at University of California in Berkeley, Ted Dodds, Chief Information Officer and Vice President at Cornell University, Ron Kraemer, the vice president and CIO at Notre Dame University and Bill Wrobleski, Director of infrastructure services for information and technology services at University of Michigan discussed issues relative to benefits of cloud adoption, risk factors and risk management practices. A great number of advantages of using cloud computing in education were highlighted and techniques for mitigating the risk of cloud adoption were explained.

Seke (2015) conducted a survey on the adoption of cloud computing among public universities and FET colleges within Africa. The authors argued that public universities and

colleges share many similar operational processes such as course offerings, admissions, enrollments, bursaries, research and graduations that can be standardized across the higher education sector and offered as a set of services through cloud to the many colleges and universities in a more cost effective way than is currently the case. The results of the analysis shed some light on the current state of cloud computing adoption within the South African public higher education sector, the main factors that fuel its adoption, the main barriers that impede its adoption and the direction it may take in future as it matures.

Akin et al. (2014) argued that cloud computing is the solution to ICT in higher education in Nigeria. The authors identified scarcity of ICT infrastructure and lack of access, high cost of ownership, unsteady and inadequate electrical power supply as factors that are limiting the infusion of ICT in Nigeria higher education. They claimed that the prospect of a maturing cloud of on-demand infrastructure, application and support services is important as a possible means of driving down the capital and total costs of ICT in higher education, facilitating the transparent matching of IT demand, scaling ICT, fostering further ICT standardization and accelerating time to market by reducing ICT supply bottlenecks.

3. The state of art at Matjhabeng TVET colleges

South Africa as a developing nation has suffered by limitation of educational budgets. HEIs are being builtin very high speed. Currently there are around 26 government owned universities and many private colleges. Without quality education establishing educational institutions by itself cannot give the solution we seek for economic development and poverty reduction through education. Education should be supported through up to date technologies and services. Ethiopian government has been investing millions of dollars every year to support education in higher education institutions with technology. However due to struggling economy it is not able to supply full ICT infrastructure requirements of all universities.

Currently, colleges in Matjhabeng are still utilizing a paper notice board to communicate with the students. The method of communication is not efficient as students needs to be on campus premises to access available notices. Furthermore, their IT services is still locally managed which requires constant maitainance and upgrade.

4. Research Methodology

This research is an exploratory qualitative based study. Semi-structured interviews were utilised to collect primary data. Open-ended questions were asked to respondent in order to capture qualitative data.

4.1. Population and Sample

The target population are Higher learning Institution in South Africa that have some experience of using a cloud solution and its benefits. Based on the literature that the researcher reviewed, some South African Universities have already adopted and used CC in the past, University of Cape Town and University of Pretoria. However, these two Universities have adopted some of CC serves and models not all of them. After observing other HLIs, there was another University in the Free State that have recently adopted the cloud, and no previous case studies for TVET colleges in SA. Therefore, this research interviewed 35 TVET college stakeholders. All the interviews were recorded and varied between 45 to 60 minutes each. Since there are limited case studies in the South African context, the previous South African Universities on cloud computing were compared to the results discovered in this paper in order to discover the factors that affect the adoption of CC in Matjhabeng TVET colleges in SA. With respect to ethics, the respondent's names were kept anonymous and were referred to as alternative pseudonyms e.g. respondent 1.

4.2. Data collection

HLIs in SA represent the research population. The sample of the research was also drawn. Olabiyisi et al. (2012) states that HLIs are considered a potential customer or consumer of cloud services as opposed to an actual vendor. The data collection tool was semi-structured interviews. The student interviews were conducted in a private room on-campus. A total of 35 interviews were conducted (out of an initial sample of 40), thus yielding an 88% response rate. Five interviewees failed to turn up for the interview. Therefore, a total of 35 valid responses were analysed.

4.3. Data Analysis

Thematic analysis was used to analyse the research data. Following verbatim transcription, the data was analysed. Descriptive accounts of the research data were presented and the most significant findings were deduced.

5. Research Findings

A thematic analysis of each variable was carried out to measure the responses of the participants in the factors that affect CC adoption in SA. During the interviews, the researcher discover that there are many factors that affect the adoption of CC in HLIs in SA. The table below mentions few of them:

Table 1: Factors affecting the adoption of Cloud Computing in Matjhabeng TVET colleges

Data security
Poor internet access
Infrastructure
Insufficient skilled staff
Government support
Socio economic status
Poor Internet access
Confidentiality
Complexity
Affordability
Privacy

Based on the above discovered factors, 62.4 % of the respondence stated that data security, poor internet access and infrastructure are key factors affecting CC adoption because South Africa is one of the developing countries with limited computational resources. 26.5% of the respodence asserted that insufficient skilled staff, government support and socio economic status are another factors that affect CC adoption. Confidentiality, Complexity, Affordability and privacy were highlighted by 11.1 % of the respondents.

6. Research Limitations

There is a limited research articles in South African context on CC adoption in HLIs hence the researcher had to review other research papers on CC adoption in HLIs from other Countries like Kenya, Nigeria, Ethopia and Pakistan.

7. Conclusion and recommendations

In this paper, we identified influential factors in the adoption of cloud computing in HLIs in SAbased on existing literature and opinions of the expert in IT. The paper demonstrated the factors that are affecting the adoption of CC in SA, focusing on Matjhabeng TVET colleges. Subsequently, The authors have shown that the purpose of a university or college does not necessarily allow for any generalizations to be made; that adoption in CC can be viewed as either internal or external to the University; that stakeholders often make judgements about

whether cloud services can be trusted based on how it is evaluated and the negative views associated with data security, lack of infrastructure and limited internet access. The inductive nature of the work has specific benefits in terms of relevance. It shows an authentic account of locally contextualized events and a knowledge construction approach that can amplify existing knowledge on adoption issues in HLIs in SA.

Although this study is limited to a small number of participating TVET colleges as well as being averse to specic cloud technologies and vendors, it still provides future researchers with the concepts, and recommendations for further work. It is anticipated that further work would uncover even more detailed concepts which could either directly or indirectly aect cloud adoption. Further limitations include that this study only focused on IT professionals within two types of South African colleges and did not include any participants from academia. Views expressed in this paper should therefore be seen in an operational light, with few considerations on the challenges by academic departments themselves. The context-sensitive nature of this study also limits the generalizability of its results to other situations.

In future, the factors that are discovered in this paper can be utilised to pave a way for a conceptual frame work that can highlight factors to be considered when adopting CC in HLIs in SA. Further research can be undertaken to explore more factors and issues that influence the adoption of CC in HLIs. In addition, it would also be stimulating to explore data security enhancing factors from the cloud computing service provider's perspective.

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Enhancing students' preparation for the professional field: A quasi-experimental study on a new community service learning module for first year pedagogical sciences students

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Abstract

In this paper, we describe the implementation of a new teaching module in the first year of a Pedagogical Sciences programme based on Problem Based Learning, Community Service Learning and co-creation principles. In this module, first year students answered a real-life pedagogical question for a project partner from a professional organization. Students 'co-created' solutions for the pedagogical-themed question by working together with a university expert and a project partner from a professional organization. Results indicated that students involved in this new teaching module scored significantly higher on a range of self-reported outcomes: feelings of being challenged, being able to link science to practice, feeling prepared for the professional field in general, and intrinsic motivation. Significant positive results occurred specifically when levels of co-creation were relatively high. This study underscores the importance of involving societal partners and challenging students to work on real-life problems very early on in academic education, that is, already in their first year at university.

Keywords: *Problem Based Learning, Community Service Learning, Co-creation, Motivation, Science and Practice, Pedagogical Sciences.*

1. Introduction

1.1 Background

The academic study programme Pedagogical Sciences aims to optimally prepare students for their role as scientist-practictioners specialised in the relation between developing individuals and those (professionals and caregivers) involved in their upbringing and education. Academically trained pedagogues are expected to be able to develop and implement theoretical and scientifically based solutions for (new) educational issues, in close consultation with a wide network of societal partners. However, a nation-wide evaluation amongst all students in The Netherlands (i.e., the National Student Evaluation, NSE), indicated that students in Pedagogical Sciences programmes felt poorly prepared for their prospective professional field (NSE, 2017). A broad evaluation of the bachelor's study Pedagogical Sciences at Utrecht University in 2016-2017 also indicated that students missed the connection between their studies and their prospective professional field.

A focus group of Pedagogical Sciences students at our University pointed out that particularly the first year of the programme was very theoretical and did not allow students to practice one of the key skills required of scientist-practitioners: bridging the gap between science and practice (OC kamer, 2017). Also, more incidentaly, students mentioned that the lack of contact with their prospective professional field in the first year of their studies was a factor which negatively affected their study motivation.

To address these issues, we implemented a new teaching module in which first year pedagogical science students answered a (real-life) pedagogical question for a project partner from a professional organization. The aim of the current quasi-experimental study was to compare student self-reported outcomes between three versions of the new module that differed with respect to inclusion of a real-life versus a hypothetical problem, and the level of contact with the project partner from a professional organization. Self-reported outcomes measures included students' feelings of being able to bridge the gap between science and practice, their sense of preparedness for working as a professional in the field, their feelings of being challenged, and their intrinsic study motivatoin.

1.2 Educational principles underlying the new module

In order to address the issues indicated by the students, we combined elements of various educational principles and approaches in the design of the new teaching module: Problem Based Learning (PBL), Community Service Learning (CSL) and co-creation. PBL is a student-centered teaching method which students collaboratively work through facilitated problemsolving on open questions (Schmidt & Moust, 2000). Crucially, teachers have no fixed answers to these questions in mind; the students thus have "ownership" of the issues they are working on, and this is an effective ingredient in problem-based learning (Savery

& Duffy, 2001). CSL can be described as experiential education in which students, teachers and societal parties work together on social issues. It is a form of education that encourages students to apply and enrich academic knowledge and skills by working on real-life issues in a way that creates value for societal partners. Intended societal partners are organizations, social enterprises and other initiatives that work on specific public issues in local communities. Students are more satisfied with their university when they participate in CSL (Eyler et al., 2001). Co-creation, a term originally stemming from marketing theories, refers to processes in which value is co-created by consumers through playing a collaborative and active role (Prahalad & Ramaswamy, 2004). This concept is also applicable in higher eduction, in which students act as co-producers in the learning process (Mavondo et al., 2004). Students who consider themselves as co-producers 'take full responsibility for their learning and use teachers and other resources to support their effort and ensure more successful outcomes' (Mavondo et al.,2004, p. 46).

In the new module that we designed, principles of PBL, CSL, and co-creation were applied by letting students collaborate in groups of four to five on a (real-life) pedagogical question for a project partner from a professional organization. Students became members of so-called professional "focus networks", together with a project partner from a professional organization and multiple university teachers with relevant expertise on specific topics and skills (expertise in terms of content, expertise in terms of academic skill training), allowing for co-creation between all partners involved. The answer to the pedagocial question was unknown to both University teachers and project partners, and students were thus given full ownership. Students were enrolled in the module for a full academic year. They began with clarifying the problem after consulting the project partner from the professional organization, performed an analysis of the scientific literature, and finally wrote an advisory report for the project partner. The value for the project partner, then, was the advisory report in which their question was answered based on recent scientific literature.

In the current study, we aimed to test the impact of the CSL and co-creation elements of the module on student self-reported outcomes, by manipulating the type of problem (hypothesical vesus real life) and the level of co-creation (no versus low versus higher co-creation) to test the impact.

1.3 Hypothesis

We hypothesized that first year Pedagogical Science students that worked on a real-life problem would score higher on all outcome measures (i.e, enhanced motivation, feelings of being challenged and being able to link science to practice, and feeling more prepared for the professional field in general) (PBL + CSL group), than students working on a hypothetical problem (PBL only group).

In addition, we expected that more opportunity for co-creation would lead to higher scores on all outcome measures.

2. Methods

2.1 Sample and procedure

A total of 246 first-year-students from the Pedagogical Sciences track at Utrecht University took part in the study. Half of the sample enrolled in the academic year 2017-2018 (group 1, N = 121), and half the sample enrolled in the academic year 2018-2019 (group 2, N = 125). At the end of the academic year, in June 2018 and June 2019, respectively, students filled in a set of questionnaires. At that time, 10 (8%) and 12 (10%) students had quit the programme, respectively.

2.2 Design and module description

A quasi-experimental design with three groups was used. Students in group 1 either received the new module, but without any contact with professionals in the field (N = 70, 1a, PBL only, no co-creation), or were enrolled in a pilot group for the new module which did include limited contact with professionals in the field (N= 22, 1b, PBL + CSL, low level of co-creation). Students in group 2 were all enrolled in the new module with more extensive contact with professionals in the field (N = 91, 2, PBL + CSL, higher level of co-creation). The content of the module was as follows, for each of these three groups:

Group 1a: students were introduced to a current pedagogical theme at the beginning of the first year, and given a question relevant to this theme. The question was made up by teaching staff and novel in the sense that there was no pre-defined answer. An example theme was "*online integrity"* and a question within that theme was "*How can we support parents to help their teenagers become smart users of social media, in order to protect their online integrity*?". In the first course of the first year (running from September to October), students were requested to analyse the theme and question from multiple perspectives, such as those brought forward in traditional and new media, and the scientific literature. In the second course of the first year (November – January), students were requested to more deeply analyse the scientific literature about their respective theme and question. In the third course (February – April), students were requested to write an advisory report in which they specifically answered the question, based on scientific literature. In the fourth course (May – June), students practiced their presentation skills and gave a presentation at an end-of-year-symposium, in which they showcased their results to their fellow students.

Group 1b: students in the pilot group followed the same courses and made the same assignments as the students in group 1a, except that the theme and question that they were working on were real and came from a professional organization in the field. An example

theme from a youth care organization was "*teen pregnancy*", and the question within that theme was "*can we use real-care babies as an intervention for vulnerable teenage girls, to help reduce their risk for teen pregnancies*?". Students were introduced to the theme and question during a visit to the professional organization in September, and reported their results back to the organization during a second visit in May.

Group 2: students in group 2 followed the same courses and made the same assignments, and the theme and question that they were working on were real and came from a professional organization in the field, like in group 1b. However, students in group 2 had more intensive contact with the project partner from a professional organization in the field. Specifically, they had similar meetings with the professional organization in September and May, and an additional interim meeting in February. In the additional interim meeting, students were requested to pitch multiple answers and pieces of advice, based on the scientific literature. In the interim meeting, the project partner of the professional organization provided direct feedback to these ideas, and informed students of which pieces of advice might be feasible to implement in the organization, and which pieces of advice may not be feasible to implement and why. On this basis, students tailored their advisory reports to the specific needs of the organization. Members of the professional organization were thus actively involved in the process during the academic year, allowing for more co-creation than in the pilot group.

2.3. Measures

At the end of the academic year, students in all groups filled in a number of questionnaires.

General evaluation questionnaire: Students were given a number of statements and asked to rate to what extent they agreed with each statement. Statements concerned, amongst other issues, students' level of motivation to work on the module's assignments (1 item), the level of challenge they had experienced when working on the module's assignments (1 item), and the extent to which they had learned about bridging the gap between science and practice (1 item). Students were asked to answer on a five-point Likert scale, ranging from 1 (disagree) to 5 (agree). These items were filled out by 102 out of 111 students (92%) still enrolled in the programme at the end of academic year 2017-2018, and by 86 out of 113 students (76%) still enrolled in the programme at the end of academic year 2018-2019.

National Student Evaluation: Three selected questions from the Dutch national student evaluation (NSE) were used and adapted for use in this study. These items concerned students' sense of feeling prepared for working as a professional in the field. Cronbach's alpha was .76. This scale was filled out by 96 out of 111 students (86%) still enrolled at the end of academic year 2017-2018, and by 86 out of 113 students (76%) still enrolled at the end of academic year 2018-2019.

Academic Motivation Scale – College Version, intrinsic motivation scale (Vallerand, Pelletier, Blais, Briere, Senecal, & Vallieres, 1992; translated to Dutch by Stevens, 2016). An adapted version of the Academic Motivation Scale was used. Students answered 11 questions on intrinsic study motivation. Cronbach's alpha was .84. This scale was filled out by 104 out of 111 students (94%) still enrolled at the end of academic year 2017-2018, and by 79 out of 113 students (70%) still enrolled at the end of academic year 2018-2019.

3. Results

First, we compared student self-report scores between students who had had no contact with a professional in the field (1a, PBL only, no co-creation) and those who had had only limited contact with a professional in the field (the pilot group, 1b, PBL + CSL, low co-creation). A MANOVA was run with group as fixed factor and the three questions from the general evaluation questionnaire (motivation to work on the module's assignments, level of experienced challenge, and learning about bridging the gap between science and practice), and the average NSE score (students' sense of feeling prepared to work as a professional in the field) as outcome. There was no significant effect of group ($F(4, 80)= 1.475$; $p = .218$).

Second, we merged group 1a and 1b and compared student self-report scores between students who had had no or only limited contact with a professional in the field (group 1, no + low co-creation) and students who had had more intensive contact with a professional in the field (group 2, PBL + CSL, higher level of co-creation). Again, a MANOVA was run with group as fixed factor. There was a significant effect of group ($F(4, 171) = 12.582$; $p < .001$). Tests of between-subjects effects showed that group 2 scored significantly higher on all outcomes ($p's < = .001$), although the effect on motivation to work on the module's assignments was only marginally significant ($p = .055$).

Third, in a separate analysis, intrinsic motivation was compared between group 1 and 2 (note that these scores had been collected on a separate form, which contained no identifying information, and could thus not be merged to the data that was used for the MANOVA reported above). There was a significant effect of group ($F(1, 183) = 7.982$; $p = .005$), and group 2 scored higher than group 1.

Figure 1 shows that the effect sizes of the differences between group 1 and 2 ranged from small/moderate to large and were largest for students' experienced level of challenge and their sense of feeling prepared for working as a professional in the field. Cohen's d of .20 is typically considered a small effect size; .50 is considered a moderate effect size; .80 is considered a large effect size (Cohen, 1992).

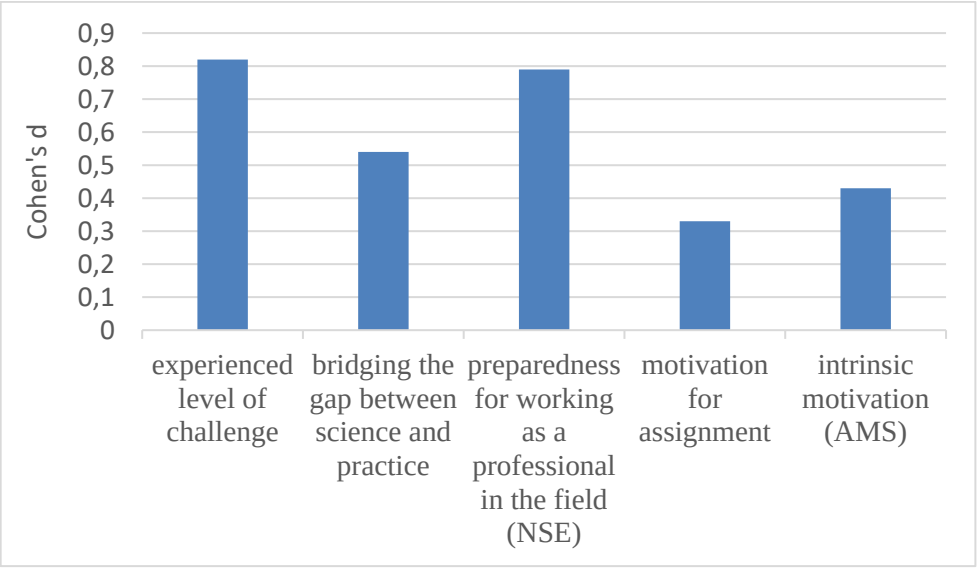

Figure 1. Effect sizes of the group differences between group 1 (N = 96 to 104 across scales) and group 2 (N = 79 to 86 across scales) on student self-report scores. Positive numbers refer to higher scores in group 2 compared to group 1.

4. Conclusion and discussion

This quasi-experimental study shows that enrolment in a new teaching module in which elements from PBL, CSL, and co-creation were adopted, significantly enhanced a range of self-reported outcomes in first-year Pedagocial Sciences students: students' feelings of being challenged, being able to link science to practice, feeling prepared for working in their prospective professional field, and intrinsic motivation.

Notabely, however, no significant positive effects of the new module were observed when we compared outcomes between subgroups of students who had received a hypothetical question (PBL only group) versus a real question from a societal partner (PBL+CSL group), when the level of co-creation was small in the latter group. Specifically, only the unique combination of a PBL+CSL approach with relatively high levels of co-creation led to enhanced student self-reported outcomes. As the positive effects of the module were observed in the second academic year that it was implemented (i.e., cohort 2018-2019 received PBL+CSL with relatively high co-creation), a further underlying cause of the observed positive effects could be that the team of teachers and coordinators had gained more experience than in the first year of implementation (i.e., cohort 2017-2018, no to low levels of co-creation).

A limitation of the current study is there was no random attribution of the students to the independent variables, so student cohorts might be confounding. Another limitation was the number of students who filled in the set of questionnaires at the end of the academic year. Although drop-out rates were very similar across the two cohorts (academic year 2017-2018 and 2018-2019), participation rate was much lower in the second cohort. This effect was most profound for the Academic Motivation Scale (intrinsic motivation scale), where 70% of students filled in the questionnaire in cohort 2 compared to 94% of students in cohort 1. Since no characteristics of the non-participating students are known, an attrition analyses could not be performed. Therefore, it is unclear whether attrition was selective and may have biased the results.

To conclude, the current study underscores the importance of involving elements of PBL, CSL and co-creation in higher ducation, and attests to the value of such an approach very early on in the academic curriculum, that is, in the first year. Moreover, the study shows that the specific combination of PBL and CSL with relatively high levels of co-creation led to positive student self-reported outcomes. Furthermore, findings highlight the importance of piloting educational developments and taking multiple years to fine-tune such developments in an increasingly experienced teaching team.

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How to support mobility students to gain soft-competences: Knowledge, Skills and Attitudes

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Abstract

Students participating in mobility experiences have a great learning opportunity, but in many cases they hardly realise about the soft-competences they developed during mobility. In this context, the supporting role of universities is key for students to make the most of their mobility and be able to communicate their learning outcomes. This study analyses the support services that students receive for the development and acknowledgement of mobility soft competencies (related with the three dimensions: knowledge, skills and attitudes or KSAs) in order to define the university strategy in this field. Results show two types of support for outgoing and incoming students: (i) passive initiatives based on delivering relevant information for the mobility period to students; and (ii) active initiatives based on training activities and activities for student integration in the host university/city/culture. No support initiatives on mobility related KSAs for returned students or academic staff have been identified.

Keywords: *Erasmus; student services; soft competences, knowledge, skills, attitudes.*

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1. Introduction

Students participating in mobility experiences need to constantly adapt to new circumstances. They change their life-styles, get acquainted with other cultures and some even change habits and attitudes to adapt to the host culture. The mobility experience is a learning opportunity but often students hardly realise about their learning process and are not able to communicate (e.g. to family, friends and most importantly to potential employers) the soft-competences acquired. In this context, the supporting role of universities could go beyond the administrative dimension of student's mobility: they could support students to acknowledge and maximize the learning process and the competences (understood as a combination of knowledge, skills and attitudes – Boyatzis, 1982; Council of Europe, 2018) gained during their adaptation to a new international context. In this way, universities could increase the impact of mobility experiences on students' professional and personal development.

This study analyses the support services that students receive for the development and acknowledgement of mobility related knowledge, skills and attitudes.

2. Theoretical framework and methodology

Boyatzis (1982) defines "competence" as the underlying characteristics of the individual causally related to an effective or superior performance in a professional activity; where the individual characteristics are commonly classified in the following three dimensions (Meng et al., 2017): (i) knowledge or the "cognitive" dimension of competence. It refers to all the topics and issues individuals know or need to know to perform a specific task; (ii) skills, the "practical" or applied dimension of competence, which refers to what individuals are able to do or what they need to be able to do to perform a specific task, and (iii) the attitudes (and values) that individuals must espouse in order to perform a specific task effectively. Table 1 shows the sub-dimensions of the mobility-related knowledge, skills and attitudes (KSAs) that we have identified through literature review.

Deardorff (2006) proposes a model for the development of competences in intercultural contexts in which knowledge and skills are individual characteristics that emerge from the mobility experience, but they need an attitudinal background to thrive. Since KSAs are the key ingredients of competences, we put our focus on the learning mobility outcomes understood as KSAs and how its development among mobility students can be supported[1]. In so doing, we perform a preliminary exploration of the institutional initiatives already

[1] To our understanding, the KSA approach facilitates students and universities to acknowledge the mobility benefits in detail, without losing the information that a competence approach (more general, complex and abstract) could entail.

implemented for the development and acknowledgement of mobility related KSAs among university students.

Table 1. Dimensions and sub-dimensions of mobility-related competences.

Dimension	Sub-dimension	Source
Knowledge	- Cultural self-awareness: knowledge on one's own culture in the global context; - Deep cultural knowledge: knowledge about the other culture in question; - Global knowledge: understanding of global issues, processes, trends, and systems; - Sociolinguistic awareness; - Specific higher education knowledge (higher education system, methods and field-related knowledge).	Deardorff (2006), Reimers (2009), Gonzáles & Wagenaar (2003)
Skills	- Ability to acquire, analyse, evaluate information, use cultural references to think critically and solve practical learning problems; - Skills to listen, observe, and relate, as well as communicate and connect with people from other cultural backgrounds; - Capacity to use acquired knowledge to extend one's access to learn the unknown.	Piacentini (2017)
Attitudes	- Openness, curiosity and discovery to intercultural opportunities; - Tolerance and respect to cultural differences and ambiguity.	Hunter (2004), Deardorff (2006)

The collection of initiatives was carried out through an online survey. This survey was designed to collect institutional information - name, type of institution and country - and descriptive information on the initiatives, activities or services - name of the initiative, description, related KSAs duration, target audience, assessment and implementation of the initiative, dissemination, etc.

The survey was sent to 749 addresses from European and non-European higher education institutions, companies, foundations and NGOs. The survey received 32 valid answers, being the size of the sample the main limitation of our study – we perform a preliminary descriptive study to provide university practitioners with useful tips for reflecting about the support they provide to students and staff on mobility related KSAs, but we cannot reach extrapolable conclusions, identify general trends or recognise patterns by type of institution or country.

3. Results

The analysed initiatives came mostly from universities (26) but also from NGOs (2), community colleges (1), institutes (1), companies (1), and foundations (1). Answers came

from institutions from 14 different countries, mostly from Europe: Belgium (8), Finland (1), France (2), Germany (2), Greece (4), Italy (4), Poland (1), Portugal (3), Romania, (1), Spain (1), Sweden (2) and The Netherlands (1); but also from the United States of America (1) and Canada (1).

The 32 initiatives collected can be classified into initiatives aimed at supporting students before mobility (53.12%) and during mobility (46.88%). We did not identify any initiative supporting students after mobility. As for initiatives assisting (academic or administrative) staff in supporting students, we only found some informative meetings regarding application processes and paper work, but not on KSAs development and student integration processes.

3.1. Initiatives aimed at supporting students before mobility

The initiatives supporting students before they participate in mobility experiences have two distinct purposes: (i) encouraging students to participate in international mobility programmes; and (ii) training students in those mobility related KSAs.

There are two types of initiatives that seek to encourage students to participate in international mobility programmes. First, seminars on the international job market (one initiative) in which experts from European companies are invited to share their view on the international industrial context. These seminars are aimed to all students, whether they will participate or not in a mobility programme. And second, international weeks/days to promote mobility (three initiatives) celebrated once a year (usually during the fall term) through workshops and meetings with partners (foreign universities) to inform students about mobility options.

As for those initiatives that offer training in mobility related KSAs, they may be classified as follows: (i) pre-mobility language courses for outgoing Erasmus students (one initiative): in most cases they focus on academic language, but also on general communication skills. (ii) Informative meetings prior to mobility (four initiatives): formal or informal meetings in which outgoing students receive basic information on their arrival to the host country/university (some initiatives include contents related to intercultural competences). They seek to offer information and clarify doubts before mobility. All initiatives facilitate experience exchange and advice between outgoing and returning (or incoming) students. And (iii) workshops/courses/tools on mobility-related KSAs (eight initiatives): face-to-face or online courses for outgoing Erasmus students – some also address other students (e.g. introductory courses to fist year students). Most trainings apply an overall perspective, covering a wide range of KSAs necessary during mobility, e.g. travel safety and health issues, intercultural awareness and cross cultural communication, culture shock, information about the target culture, student learning possibilities, etc. However, some

initiatives include/are focused on intercultural competences or international employability and job-seeking.

3.2. Initiatives aimed at supporting students during mobility

The initiatives supporting students during mobility have the following objectives: (i) the integration of the incoming students in the host city, university and/or culture and (ii) the support of KSAs development. As for those initiatives favouring the integration of the incoming students, we have identified three types. First, welcome meetings to deliver practical information to students (three initiatives) about the university and establish social relationships (e.g. university tour or presentations on administrative processes and services for students). Second, accompaniment initiatives (five initiatives) for incoming students upon their arrival or along their mobility experience in order to facilitate their integration in the city/university/culture. E.g. on-line psychological support, buddy programmes (native students support and advice incoming students), academic guidance by tutors, social and cultural activities and workshops (photography, folk dancing, city tours, etc.). And third, initiatives aiming at achieving active engagement of mobility students with the university context (two initiatives). They include: (i) invitations to international students to deliver presentations on their home countries to school children and (ii) on-campus job/volunteering opportunities were students are encouraged to reflect on their learning process.

The initiatives supporting KSAs development are the following: (i) language courses for incoming students on different languages, including the native language of the host country (two initiatives): these courses are offered in wider programmes together with other courses on non-linguistic KSAs such us conflict resolution or host culture. And (ii), KSA measurement and development (three initiatives): (i) a conceptual framework on international competences gained in volunteering activities during mobility; (ii) a survey on the skills developed by students volunteering on international contexts; and (iii) a digital learning toolkit for personal skills development together with training in communicating the experiences, insights and personal developments achieved during mobility.

3.3. Mobility related KSAs supported through the initiatives collected

If we analyse the type of KSAs supported by the 32 initiatives identified, we find that, in our sample, the types of knowledge most addressed before the mobility experience are cultural knowledge (82.4%) and self-awareness (76.5%), whilst during the mobility experience the most supported are sociolinguistic awareness (80%), followed by cultural knowledge and self-awareness again (both with 73.3%).

However, there are differences between the other types of knowledge to be acquired. One of them is the importance of cultural knowledge before the mobility experience (31.43%)

and how its interest decreases during the development of the experience (7.7%). On the contrary, regarding technical knowledge and knowledge on the educational context, they seem to be types of knowledge expected to be acquired mostly during the mobility experience and not beforehand in our sample (5.71% and 8.57% before mobility and 15.4% in both cases during mobility) – see Figure 1.

As for the skills, there are some differences between the initiatives supporting outgoing or incoming students. Most initiatives address adaptability and communication skills, especially those aimed at helping outgoing students (76.5%). Other skills most addressed are language skills followed by problem solving or team work. The main concern seems to be the students' adaptation to their host country. Additionally, it is worthy to highlight that very few initiatives support the development of creative thinking and analytical or negotiation skills. This may entail that these skills are usually addressed in our sample in university courses but not through institutional initiatives tailored to incoming students (Figure 2).

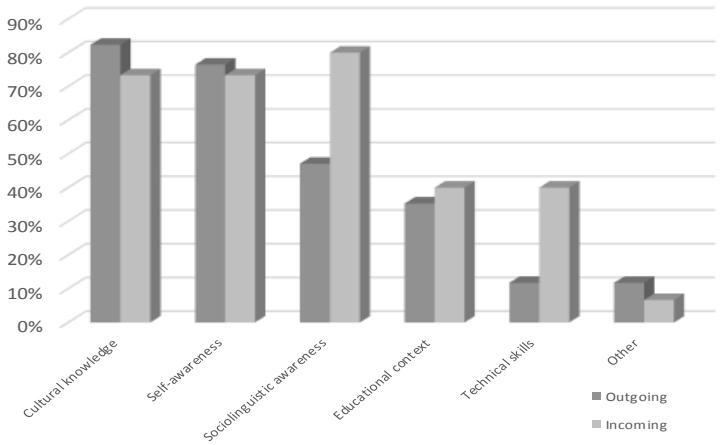

Figure 1. Types of knowledge addressed by the initiatives

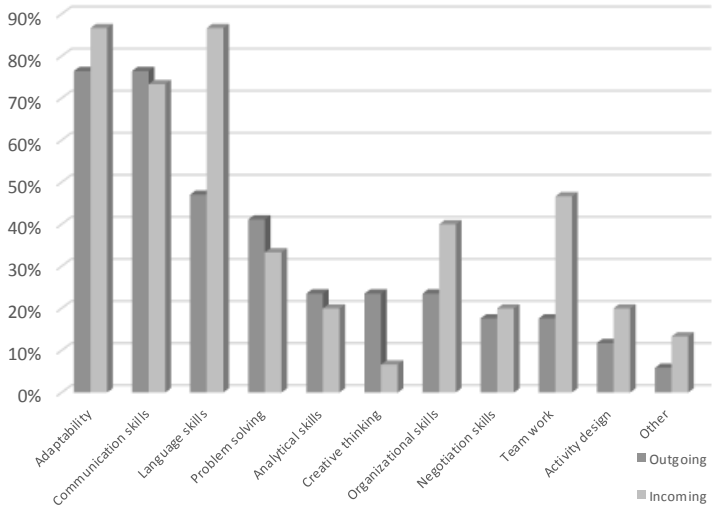

Figure 2. Types of skills addressed by the initiatives

The main attitudes addressed by those initiatives supporting outgoing and incoming students are open mindedness (88.2% and 60% respectively) and transcultural understanding (82.5% and 73.3%), but also confidence in the case of incoming students. Both types of initiatives aim mostly at improving empathic attitudes and mental appraisals that support tolerance and understanding towards foreign cultures

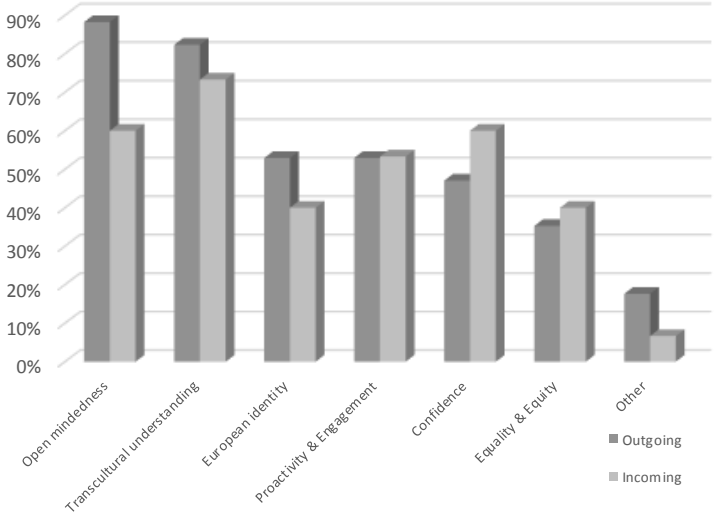

Figure 3. Types of attitudes addressed by the initiatives

4. Conclusions

We have analysed 32 institutional initiatives that provide support to mobility students in their development of KSAs. In future research we will focus on increasing our size sample to reinforce the robustness and extrapolability of our results.

Our sample shows two ways for supporting (outgoing and incoming) students' KSA development: (i) passive initiatives based on delivering relevant information for the mobility period to students; and (ii) active initiatives based on training activities and activities for student integration in the host university/city/culture.

So far, we have not identified any institutional initiative supporting returning students. The only initiatives that involve returned students are those in which they can share their experience with outgoing or incoming students; however, these initiatives do not aim at addressing their specific needs. This gap is aligned with the results of ESNsurvey (Josek et al., 2016), in which Erasmus students reported the lack of support services after mobility, even though coming back to their home country is often a difficult time for mobility students.

We have neither found initiatives aiming at assisting (academic and administrative) staff in supporting students to gain mobility-related KSAs. Indeed, the only initiatives reported that involve university staff consist in providing administrative information on mobility programmes.

Regarding the assessment of the initiatives implemented, the respondent institutions either do not gather any feedback from students or base the initiatives' evaluation on satisfaction questionnaires that do aim to collect information on KSAs development. Gathering KSAs feedback may help in making more explicit this objective, revising initiatives to render them more effective in this sense and reinforcing the students' understanding on the goals of the Erasmus experience.

Also, there are some KSAs that only a few of the identified initiatives support. For example, technical skills and creative thinking are addressed by very few initiatives, probably because in the institutions of our sample they are usually addressed in university courses but not through institutional initiatives tailored to mobility students. Additionally, surprisingly enough, few initiatives support the development of students' European identity or key European values such as equality and equity.

Summarising, we have identified interesting initiatives encouraging the participation in mobility programmes, facilitating incoming students' integration and supporting the development of mobility-related KSAs. Some of these initiatives are very interesting and could be easily extended to most universities. However, universities should define their strategy in this field, making explicit the characteristics of the mobility experience that they

want to offer and its expected learning outcomes (including KSAs). In this way, they could design a set of activities (and assessment and monitoring tools) that exploits their complementarities and work in a coordinated way as an effective plan to reach the university goals.

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"I really don't know what you mean by critical pedagogy." Reflections made by in-service teachers in the USA

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Abstract

This is a qualitative case study of the responses given by in-service teachers in an exit interview upon completing a grant program that prepared them to be English-as-a-second-language (ESL) teachers in the USA. There were 28 participants in this study and they were in-service K-12 teachers who would become ESL certified. Based on Freire's (2000) Pedagogy of the Oppressed and Gee's (2015) discourse analysis, the researcher analyzed their responses and found that the majority (96%) did not know about critical pedagogy or took the literal meaning and thought that the term meant critical thinking or evaluation of teaching. As critical pedagogy is an important construct for ESL teachers to take ownership and appropriate social justice, challenge the status quo of systemic oppression and marginalization of immigrants and refugees, the researcher advocates for academic programs to include critical pedagogy for strengthening the knowledge base of ESL teacher education programs.

Keywords: *social justice, emancipation, discourse analysis*

1. Introduction

Critical pedagogy in the field of Teaching English to Speakers of Other Languages (TESOL) is not a novice construct. It can be traced back to Paolo Freire's *Pedagogy of the Oppressed* written between 1967 and 1968 (Holst, 2006, p. 243). The term can be broadly construed as a sociopolitical framework for empowering learners by challenging the social realities and the status quo. According to Santana-Williamson (2000), the main tenets of critical pedagogy includes "understanding of education as political and never neutral, encompassing the notion of empowering, transforming, and emancipating learners, and advocating for critical consciousness" (p. 7-11).

According to Norton and Toohey (2004), "critical approaches to language education will require commitment to social transformation, justice, and equality." (p. 15) Therefore, citical pedagogy is a way of seeing social realities with critical lenses, with the intention to transform such realities and advocate for social justice and equity. As such, it goes beyond the literal meaning of critical thinking or critical analysis, which are often criticized as monolithic and skill-based.

This article focuses on the analysis of 28 recent Master of Arts in TESOL graduates' exit interview responses to a question, "Do you think that it is important to include critical pedagogy in the education of ESOL teachers? Would you elaborate on that?" The dataset was part of a large data corpus collected through a grant project which was funded by the U.S. Department of Education. The grant was to provide scholarship to 120 in-service teachers so that they could complete the courses required by the State and become ESL certified. Among them, 28 teachers from two sub-urban school districts participated in the end-of-project interview in 2019.

2. Theoretical Underpinning and Literature Review

The theoretical underpinning of this article was based on Gee's (2015) discourse in a big D and small d. Hanan (2018) problematized the critical attitude in critical pedagogy and proposed a "pedagogy of difference" (p. 903). Many studies corroborate the claim that ESL education requires an understanding of critical pedagogy and its application for enhancing the experiences of teachers and students (Wang, Many, & Krumenaker, 2008; Crookes & Lehner, 1998; Johnston, 1999)

3. Methodology

The grant project has a large data corpus with quasi-experimental data and multiple qualitative datasets. One of the sub-projects was to interview the grant completers and analyze their reflections. These reflections are instrumental in shaping the future courses in

the academic program. They are also invaluable for understanding how well the academic program had prepared the cohort members to become K-12 ESL teachers. As only a small dataset was selected for further analysis, this is a case study (Creswell, 2013) with the intention to offer suggestions for updating the existing curriculum.

There were 28 participants in the study. All of them were in-service K-12 teachers in public schools in a Midwestern State. The 28 participants had recently completed the seven courses required by the State's Teacher Certification Agency and they were on route to become ESL certified. They were phone interviewed by a trained research associate. The questions were semi-structured and they were designed for the grant completers to reflect upon the education that they received in the program. The author of this article was the co-director of the grant project and she analyzed the data using discourse analysis (Gee, 2015). James Paul Gee introduced the term "Discourse" with a capital "D", which foregrounds the social conventions which allow people to interact, and "discourse" with a small "d", which are the "stretch of language in use." (Gee, 2015)

4. Findings and Discussion

Among the 28 responses, only one participant gave a thoughtful definition of critical pedagogy. Participant A said,

> "I find that having context-driven ideas and coming up with cultural ideologies like social justice or something and relating it to the classroom is good at providing those personal experiences, but combine that with critical thinking, you know, you can really get things going in the classroom. I want to say. It's just as long as we get the kids participating whatever it takes to get the students participated based on their, based on what they know and what they like, and be able to get them to produce what is taught, that's what's important. I mean, I got some things out of the classes that's for sure that I haven't thought about before."

This participant understood that being critical goes beyond critical thinking, despite having critical thinking involved. It has a social consciousness perspective that intertwine with cultural ideologies, justice, and equity. The definition offered by the participant was thoughtful and relevant. It echoes with the definitions of critical pedagogy given in Santana-Williamson (2000) and Norton and Toohey (2004). More importantly, the participant went into the further explanation of how critical theory could be applied in the classroom, with the aim of increasing students' participation and engagement.

Two out of 28 participants took the literal meaning and guessed that critical pedagogy was equivalent to critical thinking. Participant B said, "Yes, I do. 'Coz what's critical, including critical pedagogy, increases critical thinking skills, which can help them in TESOL students

or TESOL teachers and many different aspects of their lives. So if you're including critical practices, you're encouraging them to be critical thinkers." Participant C said, "Oh, absolutely. I think that, you know, in order for our students to be critical thinker - we, as teachers, need to be also critical thinkers, and we need to make sure that we're taking our lessons." Both Participants B and C made a direct linkage to cirtical thinking and they thought critical pedagogy was to encourage critical thinking for the teachers and students. Though critical pedagogy requires critical thinking skills, it is not equivalent to critical thinking because it has an overarching goal of social justice. As such, both Participants B and C did not know about critical pedagogy.

Nine out of 28 participants conceptualized the term with the assumption that critical pedagogy was having a critical analysis or evaluation. Their responses are shown in Table 1 as follows.

Table 1. Participant responses.

	Do you think that it is important to include critical pedagogy in the education of ESOL teachers? Would you elaborate on that?
Participant D	"Critical. Yeah, yes. Anytime that you're doing any type of classwork or anything like that, you have to have critical analysis behind it. You're not an expert at everything, so having those different outside pedagogy type things is essential to be able to be critiquing there."
Participant E	"I'm not sure I understand that term, but certainly pedagogically you know the teachers will need to know what works in what subject. Um. As it has to, well, teacher, we work with every subject and so it helps for us to be able to understand you know pedagogy: what works and what doesn't work pedagogically in many subjects so when we look at it. I tend to look at it with a linguistic eye and academic language eye so connecting that and then having (inaudible) become to connect that as well is helpful."
Participant F	"With critical pedagogy, I'll take that as meaning that, it's evaluative and yeah, its feedback from things, and then it's evaluating itself and improving as it goes along and also yeah, 'coz that's what it means. And yes, I think that part of the, the feedback and looking at what's going on and then looking and improve is a good thing."
Participant G	"Um. Yeah, I think it's always important for teachers to look at how they're instructing as a whole like how does each lesson fit into a unit? How does each unit fit into a year? I think it's important that we have our students um develop more and more of their analytical skills within each lesson. I'm hoping that I understood critical pedagogy. I know I can't ask you to clarify."
Participant H	"Um. Yeah, I'm kind of (inaudible) what critical pedagogy was. I remember a little bit. You're not allowed to answer anything like if you can give me a refresher. If it is what I think it is, then it's just the idea that we kind of look

	at the practices that we already have and find out why they are this way and are there better ways that we could be doing better and more inclusive. And if I'm right about it, then definitely we should totally be more inclusive, and be critical about our process about how we go about teaching in educating students; so they can be as successful as we want them to be or as they want themselves to be."
Participant I	"Critical pedagogy. I would say that EL teachers are in somewhat unique place, I suppose. Because EL is somewhat of a new area in K-12 classroom, relatively speaking to other disciplines. That being said, there had been a number of different approaches to teaching EL K-12. Not all of them have been good. Not all of them have been bad, but it's going to be critical of the different pedagogies and be able to take the things that are valuable. That research shows actually work."
Participant J	"I do because you're going to have different types of ESOL students in the classroom, so being able to think critically about the way that you teach and provide the instruction on the curriculum is important."
Participant K	"I think, I mean yes. I don't think that's the most essential part for, essential for teachers is not as I don't think like as part of a second degree program. I don't think that it's essential. But if it's a first degree program that then absolutely essential. But I think most of us had some sort of understanding about to begin with. But the idea of reflecting and just putting that into practice, you know, doing reflective types of assignment, I think that's totally reasonable and sound and helps you see how you're from."
Participant L	"Well, if I if if you're talking about critical pedagogy in terms of like being critical of the pedagogy we're using right now - pedagogy from the past and then what we're moving towards, then yeah, absolutely. I would completely agree. You know, we were able to look at a few like educational-wise, and and things that were enacted in the past, and how so much has changed, and kind of talked about our current educational system today, and why we're critical of it now. And I think that it's just, it's really, really important to stay knowledgeable about that stuff and where you can operate within those spaces and how you can advocate for better education for your students."

As shown in Table 1, nine participants thought that critical pedagogy was to have a critical review or evaluation of teaching. Participant H mentioned the word, "inclusive", which is under the paradigm of social justice. However, he or she was unsure about the definition.

The overall findings of the study show that only 1 out of 28 participants (3.6%) had a thoughtful understanding of critical pedagogy and its application in the field of TESOL. Two participants (7.1%) thought that it was critical thinking. Nine participants (32%) thought that crticial pedagogy was having a critical analysis or evaluation of teaching. Sixteen participants said they didn't know the term or they chose not to respond to the question. Since the sixteen

responses were repetitive, they were not shown in this article. One of the responses was, "I really don't know what you mean by critical pedagogy." The majority of the participants (96%) did not comprehend the meaning of critical pedagogy and its application in TESOL.

Based on the findings, the researcher analyzed the responses with discourse with a big D and small d in mind, and proposed the following chart to explain why.

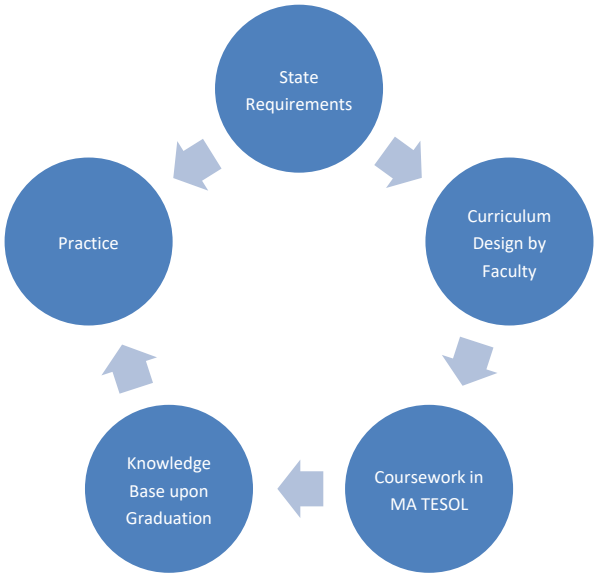

Figure 1. Contextual Realities Behind the Teacher Education Curriculum.

With "Discourse with a big D" (Gee, 2015) in mind, the author analyzed the contextual reality behind the responses. The State's department of education set forth the coursework requirement for ESL certification. In order to keep the State anonymous, the name of the State is not included in this discussion. As the State mendated these coursework requirements, universities designed curriculum and then teacher candidates took the courses in MA TESOL in order to complete the requirements. When analyzing the State's requirement, there was no mentioning of critical pedagogy in the required courses. The coursework in MA TESOL did not incorporate critical pedagogy and therefore, the knowledge base lacks the framework of social consciousness, as evidenced in the exit interview.

5. Conclusion

This study examined the responses given by MA TESOL graduates in a gradute program in the USA. Based on the responses, the researcher concludes that critical pedagogy was not

included in the curriculum, which was designed by the university and designated by the State Certification Agency. As critical pedagogy has become an important pedagogical and research paradigm in the field of TESOL, it is suggested that the TESOL curriculum incorporates it in the academic program.

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(Natural) Science and Technique in Medicine: Teaching Competences along with Research Activities

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Abstract

While factual knowledge is more and more present in digital format anywhere and anytime, (higher) education needs to extend its scope to supporting the development of personal skills and competences.

The teaching and learning project "(Natural) Science and Technique in Medicine – SciTecMed" is closely related to recent research in the intersectional field of natural science, technique and medicine. Local experts from the natural science and medical faculties engage in various teaching formats that are open for students of various majors. Together, students experience the idea of interdisciplinary collaboration, discuss from their individual perspectives and learn to learn from each other and to instruct each other. By the given context of the research activities, students earn insights into the scientific process and the usage of appropriate (digital) tools, enhance their corresponding skills and have the chance to take part into the scientific activities. We describe the concept of the project, potential obstacles, student's interests as well as the syndetic benefits for both sides – education AND research.

Keywords: *Interdisciplinarity, Scientific Competences, Learning Formats, Digitalisation, Medical Education, Research-Teaching*

1. Introduction

In times of ongoing technical developments, fake news, digital and steady availability of information higher education needs to shift from the delivery of pure knowledge to the development of competences and skills. It turns out, that in European countries like Germany, there are deficits in education of digital and technological skills and problem-solving competences (IMD, 2019, PIACC, 2013). Competences are currently being (re)defined, such as key competences like interactive usage of media, self-contained action as well as interaction in a heterogeneous environment (Rychen, 2003). As one important sector, the medical system is in need for much more digital offers and support systems (McKinsey, 2014), while the medical education itself is still in a transition process with no comprehensive and consistent approaches for digital education (Haag, 2018). The need of teaching scientific competences in medical education has been stated by the German Science Council (Wissenschaftsrat, 2014) and is politically manifested in the „Masterplan Medical Studies 2020“ by the federal ministry of education and research (BMBF, 2017) and recently registered in the draft of a new medical approbation regulation along with interprofessional and communication competences (BMG, 2019). The OECD Education Ministers comprehensively phrase: “Sustainable development and social cohesion depend critically on the competencies of all of our population – with competencies understood to cover knowledge, skills, attitudes and values.” (OECD, 2005).

2. The Teaching Project SciTecMed

The teaching and learning project “(Natural)Science and Technique in Medicine – SciTecMed” (in German: “(Natur)Wissenschaft und Technik in der Medizin – NWTmed”) is based on activities in the field of (natural) sciences and technical developments in medicine-related research. It has been launched to familiarise students with interdisciplinary and scientific working. Therefore, experts from across the disciplines engage in different teaching formats to reveal their research activities and underlying theories. The teaching offers are open for students from all fields of studies to share a common learning experience, stimulating the interdisciplinary exchange and fostering the mutual understanding and appreciation.

The project has been founded in 2018 at the Justus-Liebig-University in Giessen. There, one comes across quite advantageous conditions, since the Justus-Liebig-University, as a multi-discipline university, comprises a whole span of faculties and subjects. In our project SciTecMed we focus on the related faculties of “Mathematics and Computer Science, Physics, Geography” with approx. 3100 students and “Biology and Chemistry with approx. 2000 students, as well as the faculty of Medicine with approx. 3100 students. A close

spatial and organizational connection to the neighboring TH Mittelhessen University of Applied Sciences favorably provides a good link to the engineering sciences.

So far, the academic program provides elective modules and extra-curricular offerings and can account for compulsory optional subject achievements in the individual course of studies. The teaching courses feature different formats ranging from lectures, seminars, lab practices, hands-on workshops to excursions, which addresses as many as possible of daily scientific routines (Tremp, 2012) and thereby serve various of research-teaching designs, such as Research-tutored, Research-based, Research-led and Research-oriented (Huber, 2014, Healey, 2005). The broad range of teaching formats and the degree of individual motivations and engagement aims for a level of highly development competences (Wildt, 2011). The communicative approach in real life is complementary to digital available knowledge and teaching courses and contributes to a sustainable learning (Draeger, 2015). In general, the project tends to a trustable relation between the experts and students as well to positive motivation as surety for effective learning (Al-Sugri, 2018). It is considered, that potential hurdles of getting into touch should be kept as low as possible in order to make students benefit from special teaching and supporting offers (Wild, 2019).

3. Tentative Observations

The SciTecMed project is continously being developed in many respects and offers academic courses since the past four terms (Lang & Repp, 2018). Participating students stem from majors in e.g. biology, chemistry, law, economics, history, space technology, material science, mathematics, medicine, medical computing, physics and corresponding subjects. The number of engaged protagonists within the SciTecMed network (> 30 protagonists) is constantly rising, which guarantees for a broad range of topics and expertise. Along with that, the number of courses is increasing, comprising offers like SciTecMed – overview into the field of (natural) science and technique in medicine and scientific working, artificial intelligence methods for medicine, natural science and life science, mass spectrometry in medicine and life science, inactivation of microbes by plasma sterilization, methods of nuclear physics measurements in medicine and life science, viso-haptic teaching of rheumatic and osteological diseases by virtual reality, emergency medical aid and technical rescue by firefighters, Neurotronics – how electronics may learn from biology, as well as practical handling on clinical trial data (SciTecMed, 2020). One result of the intense discussions with students is that there is an urgent need for courses that do not only use digital methods for the sake of knowledge delivery, but do handle modern methods as tool for their future career. Consequently, SciTecMed makes use of virtual reality for teaching and to discuss applications such as medical elucidation on patients (aerzteblatt, 2019). Besides its application e.g. in life science and medicine, the methods of

artificial intelligence and much more its capacities, potentials and boundaries, as well as juristic and ethical aspects are being reconsidered (Lang & Repp 2019).

In addition to that, a common master module with the partner university in Kazan (Kazan Federal University, Tartastan) is going to be launched, extending the SciTecMed portfolio. This master module is based on common virtual seminars (video conferencing e.g.) hosted by each university including tandem practical (lab) projects with the aim to facilitate international and cultural exchange of the "young" scientists in teaching, learning and research by meeting virtually and in real.

In order to coordinate and guarantee for the acceptance as study achievements, the project is in close touch with the responsible offices of student affairs. It needs quite an amount of coordination efforts to create time wise arrangements that meet students' constraints of the different subjects and faculties. Content wise, there is always a heterogeneous level of prior knowledge and skills of the participants, especially considering their completely diverse curricula. This fact turns out as a good starting point and chance to engage skilled students themselves as teachers for their fellow students, which elevates their own level of comprehension. The rate of participation of the SciTecMed courses fluctuates within the terms and offers. It is observable that this strongly depends on the extent of attention created for the project and the single topics. This may be due to the fact, that SciTecMed offers are currently elective modules as well as due to a broad variety of more intuitive offers within the own main subject. Nevertheless, participants appreciate the offers because of the specific contents, the training of competences and the authentic contact to the experts in the field as well as the face-to insights into scientific carriers. They finally recommend these courses for their fellow students and do not want to miss it by themselves.

A random sample survey was done across the courses to get an idea of the wishes and expectations of students that are willing to participate into the SciTecMed program. The according sample size amounts to n = 39. It is notably, that only 4 out of 39 confidentially state, that they have any prior research experience. The average number of participants' years of the university enrolment is 3,5. Figure 1 illustrates some of the considered aspects, where the students' interests are weighted with a Likert scale (ranging from 1 with shallow to 5 with highest interest).

It is notably, that students are eager to learn about scientific working and scientific organization, what has explicitly stated in many individual students' declarations. This seems to be of special interest for the passing of their theses. The interest in the context of SciTecMed is obvious, since they are taking part into SciTecMed program. Students are willing to spend time into specialized topics and deal with theory and approaches in depth, while practical courses and internships are little less appreciated. Overall, students are interested in interdisciplinary working and willing to take part into the research projects.

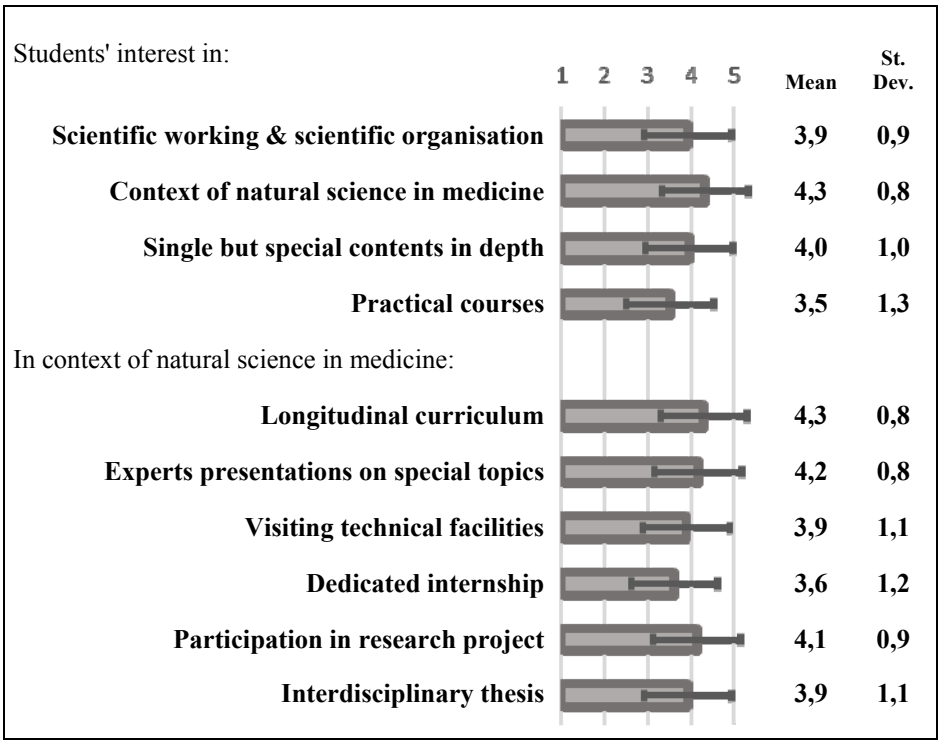

Figure 1. Participants' general interest and special interest on natural science in medicine (Likert scale).

The students' gain of skills and competences along with the teaching offerings in SciTecMed can be observed along the ongoing terms. Especially, their knowledge and sensitisation for required competences as well as their interest in and willingness to engage into research projects is increased. The exact amount of gain of the targeted competences and the tools to measure are part of further work in progress. In the supplemental material the practical benefit of interdisciplinary exchange and discussions compared to a "conservative" preaching of research is depicted. Besides the delvivery of pure knowledge, the students gain and train real competences as wel as lecturers and students both experience feedback of the whole teaching process. Further, there there are additional benefits for science, that can turn out eventually. According to Humboldt's fiction of universities (Wulf, 2016), there are regular beneficial side effects of the teaching activities, namely driving innovations in research itself. As we see in SciTecMEd, there are ideas for scientific theses drawn and pursued as well as clinical studies initiated such as the application of atmospheric plasma for orphan dermatological diseases – derived by the interdisciplinary interaction of lecturers and students among the SciTecMed courses (Lang, 2019, JLU, 2020).

4. Conclusion and Outlook

A lively teaching and learning project based on research activities has been established with the aim to enhance scientific, interdisciplinary, international and digital competences. Structures for teaching and the acceptance of study achievements have been developed. While the gain and measurement of competences is still subject of recent investigation, the observations from the runtime of the project show a high acceptance and joy of the participating students. While there may be still an initial barrier for students to familiarise with these academic offers of this genre, the necessity of the corresponding competences and the benefits by joining such programs need to be clearly communicated to the students and more curricular modules should be established. Benefits regularly exist on both sides – for students and lecturers, namely the enhancement of individual competences as well as creative ideas for research.

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Exploring the use of Plickers for conducting assessments in higher education

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Abstract

The emergence of new technologies has necessitated the need to explore new and innovative tools to conduct assessments in Higher education. One of these newest technologies is plickers which represent a student centered and student engagement during the delivery of course content. The focus of this paper is to explore the use of plickers for conducting assessments in higher education. Issues to be examined are, usability of plickers, tools that create student-centred and student engagement environment. The issues to be explored include the following, first, the selection of appropriate technological assessment tool that does not hinder student learning. Second, the technology that provides immediate feedback to students and to guarantee effective teaching. Third, the cost effectiveness of the tool and its availability to facilitators. The paper is theoretical in nature and use and is mainly interpretive (qualitative inquiry). It is argued that plickers is one of the innovative and yet unexplored tools that can be embraced to conduct assessments in the current technological changes. Furthermore, the paper argues that plickers enhances student engagement during class and provide immediate feedback to the formative assessment.

Keywords: *Plickers; formative assessment; assessment tool; student engagement.*

1. Introduction

The use of Information Communication Technologies (ICT) has been thriving worldwide in the last few decades. Its use has also impacted the instructional delivery in higher education (HE), and has shown potential to support learning and teaching in a number of ways (Wrenn & Wrenn, 2009). Therefore, there is a need for a technology that can be intergrated seamlessly into teaching and learning. In today's teaching and learning, lecturers are keen in measuring the outcomes of their lessons (Chng & Gurvitch, 2018). The traditional way of assessing students is burdensome. As a result, Higher Education Institutions are seeking approaches and alternatives to assess students and seek ways to give them timely feedback. The technology that can support lecturers with the challenges of collecting real-time formative assessment data quickly from students is the use of plickers. Plickers is a software that is conveniently and freely available for use. There is no need for the students to use any hardware device when participating in formative assessments during class. Currently, there are two choices to conduct formative assessments during class by using Learning Management system (LMS) or Clickers at one University of Technology. LMS requires each student to use a computer. Additionally, clickers require each student to have clicker device that they will use to answer the questions.

2. What is plickers

Plickers are a student response that uses online software system which can be characterized as a low-technology tool (Chng & Gurvitch, 2018; McClure & McAndrews, 2016). It is a tool for collecting real time assessment data that saves time for marking. According to Kent (2019a), it can also stimulate active learning and focus the attention of the student. Additionally, it promotes active learning as it allows students to participate during class. Subsequently, it promotes learning and does not obstruct learning. It simply requires the facilitator to login into plickers website (www.plickers.com), use the camera enabled smartphone to access the plickers application, and each student to have the printed plickers card. It facilitates the asking of questions and provides feedback during the lecture (McClure & McAndrews, 2016; Wood, Brown, & Grayson, 2017). It can also be utilized for monitoring daily progress and attendance (Krause, O'Neil, & Dauenhauer, 2017). The results are stored in the database for a lecturer to view them later if they need to (Lowe, Macy, & Stone, 2019).

3. Literature review

Lecturers have the responsibility of selecting tools that create a student-centred and student engaging learning situation while delivering course content. It is important to select the accurate and most appropriate technology to guarantee effective teaching, while avoiding technologies that seems to obstruct learning (Freeman & Tashner, 2015). As technology

changes, so are the learning needs of the students (McClure & McAndrews, 2016) that needs to be met. One of the students' needs is receiving immediate feedback to know how they performed in an assessment. The need for immediate feedback requires the intergration of technology into teaching and learning.

Research indicates that student learning development can be supported by enhancing assessment and feedback which might be in a form of formative or summative assessment (Dixson & Worrell, 2016). One of the importance of assessing students learning is to award the university degrees (Deeley, 2018). Furthermore, it specified that students who participated in quizzes performed better in their examination compared to their counterparts who never participated (Price & Kirkwood, 2011). Therefore, plickers offers a fun and useful way to involve students in the learning process (Frey, 2020).

4. Current situation

Currently, there are two choices to conduct formative assessments during class by using LMS or Clickers at one University of Technology. LMS requires each student to use a computer and not all lecture rooms are equipped with computers for each student to use during class time. Problem with LMS is that it requires the student to login with their password. Password expires every 30 days for security purposes, as a result, it requires to be reset with a new password before it expires. Most students don't bother resetting the password until it is required, which might take time to go and reset it with the administrator when it has expired.

To solve the problem of using LMS, clickers was introduced. Clickers are an interactive PowerPoint presentation that allows users to interact actively in class. However, clickers need each student to have the device they will use to respond to questions and a receiver attached to the computer that the lecturer will use to obtain the answers. Answers are sent to the receiver, and the system collects the results and aggregates results in a graph form for the students to see (Berry, 2009).

The probable challenge with clickers is that you need to wait for all the students to respond, which might be a challenge to know who has not responded. The students also need to be familiar with the device to be able to answer the questions. Moreover, if the other lecturer has requested the devices from the administrator, the other lecturers must wait for the devices to be available. As a result, lecturers become discouraged to use the devices and opt for traditional methods of assessing student, which consumes time.

Plickers is a new audience response system (Wood et al., 2017) that is seen as a solution to address these problems which is simple and inexpensive to implement. It does not require students' prior knowledge to use the software. All they need to do is to hold the plickers card

so that it can be scanned. Furthermore, lecturers can save time of attending the training to use the clickers software and LMS in order to conduct assessments.

5. The role of formative assessment in class

Students are different in terms of their learning need in class. What the lecturer does in classroom plays a significant role in student learning process. According to Wiliam and Leahy (2016) education is concerned with increasing the student engagement and to make classroom process more responsive to students' needs. One way to do engage students in class is to involve them in lesson by asking them questions during the lesson. Feedback can be discussed immediately to clarify misunderstandings in the lesson. When formative assessment is used effectively, students develop the ability to identify gaps in their learning and develop skills and content needed to improve on their learning (Wiliam & Leahy, 2016). Students are able to gain insights into their level of understanding and competence. This also assist students to play an an active role in their learning instead of only acquiring the information during classes . The active role provides the students with the opportunity to speak up, listen to other students, and reflect back on their learning (Mshayisa, 2020). In other words, students can put to practice what they have learned and measure their success. The students can also examine if they have achieved lessons' outcomes. The use of formative assessment to monitor students progress assist in identifying students that are at risk earlier so that their needs can be attended to. Tools such as plickers are beneficial for formative assessment to improve student learning and to assist in indicating where improvement is needed.

6. Benefits of plickers

Despite the fact that everything is done online, which requires that there should be internet connection throughout the session; the benefits outweighs the challenges. The first benefit is that it is a free online tool for gathering real-time assessment data. As a result, the lecturer can ask questions and receive immediate feedback from students in class (Wood et al., 2017), which increases student engagement and participation in class. Active engagement of students in class is recognized by Kent (2019b) to lead to a better recall and utilization of information. Student performance in assessments improve when students are able to recall what they have learned.

To collect the answers to the questions, the teacher raises the smartphone and students tend the cards with their respective answers and smartphone picks up information in a database. This benefit makes it an inexpensive tool because students need not to have or use any technological equipment during the assessment. Most lecture rooms are equipped with the

projector that is used to present the lessons, which makes it possible for the facilitator to project the questions for the students. It is simple, usable and time saving.

Furthermore, the Plickers program generates the response straightaway (Chng & Gurvitch, 2018; McClure & McAndrews, 2016). In the light of this, the lecturer can determine if the lesson was understood by the students (Chng & Gurvitch, 2018). When a gap is discovered in the learning needs of the students, the lecturer can develop the question for students to answer. The lecturer can determine if the lesson goals were achieved or not immediately. It supports constructive feedback in that the results are relevant for that particular lesson and are immediate (Ovando, 1992). Moreover, there is no need to wait for the lecturer to mark the assessment and keep the students in suspense on how they did in their assessments.

Plickers offers an option to archive the reports or discard them; print reports for the individual students and to export the reports in a CSV format. Another benefit of plickers is that there's no need to wait for the students to login. They can participate in assessment as long as they have the QR code cards. All that is needed is to implement the use of plickers is mainly dependant on the facilitator and not on the participants.

7. Implementation of plickers

To use plickers in a lecture room, firstly, both a computer that will be used to display questions on a projector for the respondents and a mobile device should have internet connection. Secondly, plickers card for each respondent are required to be able to conduct formative assessment. The respondents do not need to have any device with them to participate in the assessment. The process to use plickers includes the creation of the account, adding the class and the respondents to the class. Respondents can be added anonymously depending on the objective of the assessment. The assessment is a combination of true or false and multiple choice questions. The participants uses the assigned plickers card as per their registration to answer the questions that are projected from the computer, and the facilitator captures their answers by using the plickers application. Each card has the respondent details embedded within and has four possible answers, i.e., A, B, C, and D displayed on four sides accordingly to form the unique QR code. The cards are displayed in a PDF format which is also available to download for free or can be printed directly from the website. It is recommended that the cards be printed on a white paper or cardstock so that the plickers application reads them speedily and effortlessly. Furthermore, the cards can be made durable by pasting them on the hard cover of notebook or card box, especially if they are going to be handled by many respondents. Alternatively, cards can be purchased from online commercial stores that offers quality material. However, laminating the cards yourself is not recommended because it might hinder the process of scanning the results. The laminated cards has a glossy look that makes it difficult for the camera to read the respondent's answer,

especially when there lights are on in the room. Another disadvantage is that they require special care so that they don't have fingerprints that can hide the answer.

To answer the question, the respondents hold up their cards to show the preferred answer for the facilitator to scan the answer by holding up their cards with the preferred answer facing up. To ensure reliability of the assessment, the letters on the cards for the answer are too small for the respondents to copy each other or disclose to each other their answer. The cards should be visible to the mobile device of the facilitator to pick up the information.

The respondents reveal the cards with their respective answers and the facilitator raises the camera enabled mobile device to record the respondents' answers. The mobile device with the application picks up information in a database . The device shows the respondent information when scanning the responses to indicate the responses were received. It picks up the information about the respondent assigned to the card and captures the response. Connection should be established if the device does not pick up the details of the respondents. The responses of the respondents will be matched with the one in the database, and correct and incorrect responses will be recorded.

The reports section displays the results instantly for all the respondents to see who has answered the question correctly. The results are displayed as spreadsheet, each corresponding to the respondents' results. Furthermore, they can reveal the respondents' understanding of the lesson. The lecturer can choose to print reports for individuals, archive or clear the reports. Furthermore, the results can be filtered by class if there is more than one class. The reports can later be used for summative assessment to formally record them and for the respondents to view them.

8. Discussions and conclusion

Plickers is an emerging approach for assisting in delivery of content and for conducting assessments which has the potential to assist lecturers with the challenges of collecting real-time formative assessment data quickly from students. The assessments are done in real time and the results are available immediately. Students are eager in knowing how they performed in assessments in time. Timely feedback helps students and lecturers to take action earlier if needed.

Plickers create an enabling environment for the student to participate in class. This type of participation creates an engagement about the lesson at hand without the need of hardware for the students. This enables all students to participate during class activities and assessments. It also enables the students who are shy to participate in class to do so without feeling ashamed.

Paper based cards can be used to print the cards that will be used to scan the responses. Additionally, lecturer can determine students' knowledge and understanding about the lesson while still on the same subject. Questions can be prepared and loaded beforehand or can be done on the fly as the need arises. The application does support lecturers who realize that there is a question that needs to be asked at a particular time during class.

This paper demonstrates how facilitators can take an advantage of this inexpensive tool for conducting formative assessments. Plickers is a suggested tool that can be incorporated seamlessly during class time. There is no need for students to learn how to operate new technology to successfully use it.

The paper argued that plickers is one of the innovative and yet unexplored tools that can be embraced to conduct assessments in the current technological changes. Moreover, the paper argued that plickers enhances student engagement during class and provide immediate feedback to the formative assessment. The main aim of the paper was to highlight and suggest the use of plickers as an assessment tool when conducting formative assessments in higher education.

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Using Real Data in a quantitative methods course to enhance teachers' and school leaders' statistical literacy

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Abstract

Engaging part-time Master of Education students in the study of quantitative research methods is challenging. The majority of them lead busy lives as teachers and/or education leaders, attend their MEd classes in the evenings and plan to engage in small-scale qualitative research for their theses. In this context, it has been hard to motivate students to engage critically and deeply with quantitative research methods. A widespread deficit view of their own competency in mathematics and computing, which are often considered essential, further compounds the problem. This paper describes the redesign of a quantitative methods module and the resulting changed experiences of students. Findings from this practitioner research study point to the positive impact of using a real national data set – the Growing Up in Ireland Dataset – on students' engagement and appreciation of the value of quantitative research in education.

Keywords: *Quantitative methods, pedagogy, teacher professional learning, statistics, real data, leadership, literacy, engagement.*

1. Introduction

Engaging educators in the study of quantitative research methods is challenging (Smith & Martinez Moyani, 2012). The majority of our Master of Education students lead busy lives as teachers and/or education leaders, attend their MEd classes in the evenings and plan to engage in small-scale qualitative research for their theses. In this context, I have struggled with the design and delivery of a quantitative research methods module. Our students consistently reported that they considered the module to be difficult and irrelevant to their studies, frequently making reference to their plans of using qualitative methodologies for their thesis research. My repeated explanations regarding the broad aims of our M.Ed. course in relation to training in research skills and the centrality of quantitative research in education never had much of an impact. While students seemed to reluctantly acknowledge that the module formed a core component of the programme and while they (thankfully) also attested to my efforts, enthusiasm and supportive approach, there were only rare moments when I felt that they were captivated and deeply engaged in their learning. More often than not they appeared tired, insecure and, in some cases, resigned to the fact that quantitative methods were too hard and that they were not "great with numbers" – The question of "how relevant is this when I will not be using this methodology?" haunted me the most. How could I *make it more relevant*?

Reflecting on my own experience with, and on the moments I enjoyed the most when, conducting quantitative research planted the seed for my reconceptualization of the module. Not being a statistician, but rather an education researcher with an interest in using quantitative methods and mixed methods to explore sociological questions related to teaching, learning and schooling; what I enjoyed most was formulating research questions, designing research instruments to collect data and analysing the data. Looking at a new (clean) dataset, running the first statistical tests, experiencing flow, creativity, curiosity and surprise – those were clearly some of my *wow* moments as a quantitative researcher. Was there a way in which I could transfer this experience into a short introductory quantitative research methods module? Staring with this goal in mind I redesigned the module.

At the core of the redesign was my central effort to use relevant examples from important quantitative education studies throughout – real instruments, real data and real problems and research findings. I wanted to bring about change that is locally appropriate (Somekh & Zeichner, 2009, cited in Eberhardt & Heinz, 2016).

2. Literature review

Despite a significant increase in the use of data in education at school and national policy levels in Ireland and internationally, and the resulting need for educational leaders to be statistically literate in this 'world awash with numbers' (Sobal, 1981), research focusing on

how to best prepare educators to engage with quantitative data remains underdeveloped (Salloum, Young, & Brown, 2016). The most conclusive findings relate closely with my experience; education students, similar to their peers in other disciplines, find quantitative research courses difficult, unpleasant and often unrelated to their own experiences and/or research work (Smith & Martinez Moyani, 2012; Benson & Blackman, 2003).

Statistics education is a relatively new area of research (Garfield & Ben-Zivi, 2007). A number of studies have concentrated on the impact of various pedagogical approaches; for example, Magel (1998) found that cooperative learning approaches used in large lecture contexts led to improved student outcomes. Salloum, Young & Brown (2016) explored the use of real secondary data in quantitative methods courses designed for doctoral students undertaking research in the field of educational leadership. Their findings are promising, reflecting students' 'favourable support of the use of real data in statistics courses despite challenges to learning statistical software and time constraints inhibiting full engagement in the analyses' (p. 203).

The American Statistical Association's Guidelines for Assessment and Instruction in Statistics Education (GAISE) for teaching introductory college statistics emphasise that the use of real data 'enlivens the class' and furthermore that:

It is important to use real data in teaching statistics to be authentic, to consider issues related to how and why the data were produced or collected, and to relate the analysis to the problem context. Using real data sets of interest to students is also a good way to engage them in thinking about the data and relevant statistical concepts (p. 16).

This paper focuses on the use of secondary data in an introductory quantitative methods module. In preparation for the redesign of the module, permission was sought and granted to use the extensive dataset compiled by the national longitudinal *Growing Up in Ireland* study, which focuses on the development and education of children in Ireland.

3. Module Description

Inspired by my own engagement with national and international student data sets and, in particular, the *Growing Up in Ireland Study*[1] I decided to re-design the module and assessment so as to move students to the exciting centre of quantitative research. I was convinced that teachers (many of whom are also parents) had to be interested in the Growing Up in Ireland study, which focuses on the development and education of children in Ireland. I designed a module that allowed me to explore quantitative research methods and results that were of high relevance for teachers in tandem. I wanted students to

[1] http://www.esri.ie/growing-up-in-ireland/

scrutinise research findings, raise methodological issues, understand the complexities of quantitative research in the social sciences (including survey design, scale development, reliability and validity issues) and, ultimately, ask and explore their own questions using SPSS and a real national dataset (see extract from worksheet for data analysis workshops in Appendix 1 and samples of slides for this module in Appendix 2).

The core learning outcomes of the redesigned quantitative research module were for students to be able (upon completion of the module) to: critically read quantitative research papers/reports; refine research question/s and select appropriate quantitative methods; design, plan and carry out small-scale quantitative research; conduct basic descriptive and inferential analyses using SPSS; and report findings from basic descriptive and inferential analyses using appropriate terminology and visual representations of data.

Sessions were seminar-based, generally including an input from the lecturer and incorporating small group and whole class discussion.

Growing Up in Ireland is a Government-funded panel study of children carried out jointly by the Economic and Social Research Institute (ESRI) and Trinity College Dublin (TCD). The main aim of the study is to paint a full picture of children in Ireland and how they are developing in the current social, economic and cultural environment. The sample of 8,500 nine-year-old children was randomly selected from 900 schools. In addition, over 2,300 teachers and principals (connected to the study children) cooperated with the study. Children, parents, teachers and principals were surveyed and data sets containing all (coded) data as well as detailed code books, manuals and conceptual frameworks are available for researchers and lecturers on request.

The assessment for this module consisted of: 1) Conducting and reporting on quantitative data analyses (in class collaborative activity using SPSS to analyse Growing Up in Ireland Data) (20 per cent), 2) Review and discussion of a quantitative or mixed methods academic paper (preparation of worksheet and in class activity) (10 per cent), 3) Quantitative methodology paper (70%).

4. Research Methodology

This practitioner research study set out to explore the impact of using 'real data' in an introductory quantitative research methods module which was part of an MEd programme enrolling mostly teachers, special education teachers and a small number of principals and deputy principals. The overarching research question was: How can I use the Growing Up in Ireland data set to enhance engagement and learning outcomes for my students? Engagement was conceptualized as three-dimensional incorporating behavioural, cognitive and emotional engagement (Fredericks et al., 2004, Keane & Heinz, 2019).

Data was collected from MEd students through the use of an end-of-module online questionnaire. Furthermore, students' class work, the questions they posed during class discussions and data analysis workshops as well as their assessments were analysed, and the lecturer recorded notes and reflections after every class.

There were 25 students in the MEd class. Nine of them completed the online questionnaire. All students included a brief reflection on their learning from the quantitative research methods module in their final assessment. Data analysis included frequency statistics and thematic analysis of recurrent themes in the qualitative data.

5. Findings

The analysis of the lecturer notes and reflections indicated that student behavioural and emotional engagement was significantly enhanced throughout the module compared to its earlier version which had focused more on the teaching of procedures. The new approach was problem led and the introductory sessions explored different carefully selected education studies employing quantitative research. The problem focused pedagogical approach placed emphasis on understanding the complexities of theoretical constructs like attitudes, motivation, self-concept (see sample slides in Appendix 2) and the challenges associated with measurement. Students engaged critically in discussions about validity of indicators for a wide range of variables (for example social class) and constructs (for example self-concept) and many commented that their 'eyes were opened' and that 'they hadn't thought as deeply about how to measure some of these things' before. Similarly, when introducing simple inferential statistics, the focus on specific and contextually relevant education questions (and questions for which participants typically had hypotheses) resulted in lively discussions (behavioural engagement) and critical questions (cognitive engagement). For example, the question 'whether school type – single sex or mixed – had an impact on girls' maths performance' sparked immediate interest in the study group which contained maths teachers teaching in both, single sex as well as mixed schools. Another, more personal, dimension that I had hoped would further contribute to creating authentic engagement related to the parental perspectives, interests and concerns of many of the mature students'. The use of real-life studies followed by real life data collected and conducted to better understand children's lives and development clearly struck a chord with all participants.

Students' heightened levels of interest were particularly noticeable when they engaged in data analysis. After a review of the GUI child questionnaires which helped to familiarize students with the content of that study and data, and after an introductory workshop to SPSS using common examples, students posed their own questions and conducted simple frequency tests, t-tests and ANOVAS. The topics they chose were wide ranging including

healthy diet, ways in which parents punish their children for misbehaviour, bullying, children's and parents' perceived body image and breastfeeding. While the late hours and long duration of the workshops scheduled after a full day of work (mostly in the busy school environment) caused a certain level of tiredness for some students they were mostly focused, curious and clearly excited about the tables and graphs they produced with the help of SPSS which gave them the 'real' answer to important questions.

Module evaluations confirmed my own observations and reflections with 100 per cent of respondents (N=9) confirming that 'the module encouraged critical thinking', that 'the practical workshops provided a good insight into quantitative data analysis', that 'the Growing Up in Ireland data was interesting' and that 'their learning from this module had been meaningful', and eight of nine respondents indicating that 'the practical workshops were enjoyable'.

Table 1.Results.

MEd Quantitative Methodologies Student Feedback Feedback Survey Item	**Agree**	**Unsure/not applicable**	**Dis-agree**
The expected outcomes of the module were clear to me.	8	1	0
The module was well organized.	9	0	0
The module encouraged critical thinking	9	0	0
The practical workshops were enjoyable	8	1	0
The practical workshops provided a good insight into quantitative data analysis	9	0	0
Working with Growing Up in Ireland data was interesting	9	0	0
Overall I feel that my learning from this module has been meaningful	9	0	0

6. Conclusion

The findings from this study indicate that the use of real data in conjunction with active and problem-based learning methodologies can positively impact the engagement of part-time Master of Education students who are also education professionals. As illustrated by the student quote below, the practical approach and relevance of chosen problems and materials helped many students to overcome deficit views regarding their numerical and computing abilities which have been identified as common and serious barriers to learning on quantitative research modules (Acton and McCreight, 2014, 9).

> *As I reflect on the quantitative research module I realise how much I have learned, despite my struggles with the content. Looking back […], I realise that initially my*

> *attitudes […] were very much influenced by my own self-perception as a learner, as being inadequate in my numerical and computing abilities.*
>
> *Nonetheless, the module enabled me to gain a deeper insight into a range of quantitative methodologies […]. I learned about research design, sampling, data collection and data analysis involved in quantitative research. I was introduced to statistics, particularly as they are used in educational research. I learned about SPSS, and how it is widely used for quantitative data analysis in education and the social sciences. But the most significant change for me was that I became more confident in my understanding and ability to critically read quantitative research papers and reports, especially through completing the assignments.*
>
> *So what are the implications of this to my own professional practice? I have seen that sometimes it is useful to make certain areas of study obligatory. I have also seen the positive impact of these [active and hands on] learning strategies when used in areas of weakness. I will therefore try to incorporate these lessons into my own professional practice [as a teacher].*

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Appendix 1. Extract from Practical Workshop - *Interrogating Growing up In Ireland data*

Below are sample research questions that were explored through analysis of GUI data. The relevant Variable Labels are indicated in brackets behind the research questions.

A) We want to study the phenomenon of bullying.

1) **Descriptive statistics** - describing the data – occurrence and perceived reasons for bullying, feelings of children who were bullied and rates of reporting of bullying

a. What percentage of children report that they have been bullied? (Q42.)
b. How often do children report the bullying took place? (Q43.)
c. What form did the bullying take? (percentage of children reporting bullying incidents falling into different categories) (Q44A.-I.)
d. What do children perceive to be the reasons for being bullied? (Q45A.-K.)
e. How did children who were bullied feel? (Q46. (a)-(g)
f. Did children tell anyone that they were bullied? Who did they tell? (Q47. & Q48a.-d.)

2) **Inferential statistics** – exploring/testing relationships

a. Do children's reports of being bullied correlate with primary caregiver's reports of their child being bullied (do PCG know about their children's difficulties)?
(Q42. & E11.) – *cross-tabulation / chi-square test*
b. Is there a correlation between being bullied (yes/no) and children's self-concept (Piers Harris Scores)?
(Q42. & Piers Harris_Totalscore etc.) – *independent sample t-test*

B) We want to study the phenomenon of parenting

1) **Descriptive statistics** – describing the data

a. When children misbehave, what methods do parents use to discipline them? (Q59. (a) – (i))
b. How well do children get on with their mum? (1. How well…)
c. How well do children get on with their dad? (2. How well…)
d. How well do children get on with mum's partner? (3. How well…)

2) **Inferential Statistics** – exploring/testing relationships

a. Is there a statistically significant gender difference? Is there a statistically significant difference with regard to the disciplining methods used by parents with girls and boys? (Person 2 gender & Q59. (a) – (i)– cross-tabulations / chi-square tests
b. Is there a statistically significant difference by social class? Do children from different social class backgrounds experience different parental disciplining methods? (Family's social class & Q59. (a) – (i)– cross-tabulations / chi-square tests

c. Is there a statistically significant relationship between parental disciplining methods and children's self-concept (Q59. (a) – (i) & Piers Harris_Total Score)? - ANOVAs
d. Is there a statistically significant relationship between the level of parental involvement in school and children's school performance/ability as measured by Drumcondra Tests?(P38b & Drumcondra Total Score test) – ANOVAs

C) We want to study predictors of self-image

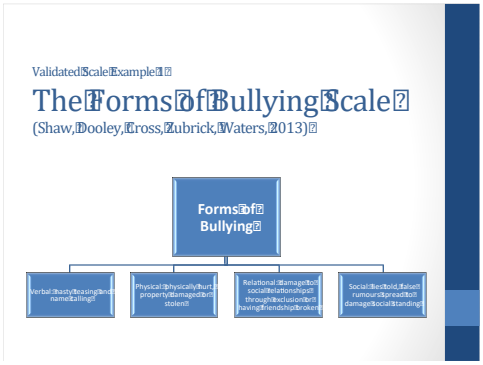
1) Descriptive statistics – describing the data

a. Check means and distribution for the Piers Harris Self-Image Scores – are they normally distributed? (Piers Harris_Totalscore, etc.)

2) Inferential Statistics – exploring/testing relationships

a. Is there a statistically significant gender difference? Is there a significant difference between the mean scores of boys and girls? (Person 2 gender & Piers Harris) independent sample t-test
b. Is there a statistically significant social class difference? Is there a statistically significant difference between the self-image scores of children from different social class backgrounds? (Family's social class & Piers Harris) ANOVA
c. Do children who like school have a more positive self-image? (Q5x & Piers Harris) *ANOVA*

Appendix 2: Sample Slides from Quant Methods Module



Validated Scale – Practice Example

Student-teacher relationship scale

What dimensions?

- Conflict
- Closeness
- Dependency

Develop items – statements that can be rated according to agreement

Example: *I share an affectionate, warm relationship with this child.*

See scale in "Measuring theoretical constructs – scales" folder on Bb
See more info and links to scales and relevant articles at:
http://curry.virginia.edu/about/directory/robert-c.-pianta/measures

Example of research problem 1:

Academic Performance and Single-Sex Schooling

- *Does school type – single sex or co-ed – have an impact on the maths performance of girls?*
- *Does school type – single sex or co-ed – have an impact on the language performance of girls?*

What are the *independent* and *dependent* variables? What other variables might be *intervening or moderating* the relationship? Should we control for any variables?

(see study by Eisenkopf et al., 2015)

This is were theory comes into quant research: Researcher uses previous findings to develop Theory – a scientific prediction or explanation for what s/he expects to find OR a "set of interrelated constructs (variables), definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining natural phenomena.
(see Creswell, 2014, 53f, 60f., Kerlinger, 1979, Thomas, 1997)

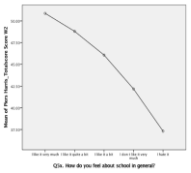
Topics explored in GUI

- Child's Birth
- Household Composition
- Child's Health/Healthcare
- Child's Cognitive Development
- Child's Nutrition
- Child's Relationships
- Child's Lifestyle (Habits, Play, Activities)
- Child's Physical Activity Levels / Exercise
- Childcare Arrangements
- Child's Education / Home Learning Environment
- Child's Physical Development
- Child's Socio-emotional Development (Wellbeing)

Some examples from your analyses

Perceptions of school and self-concept

Perception of school experience: ANOVA test indicated a significant linear relationship between children's perception of school and their positive self-image as measured by Piers Harris (total score). With regard to the children's total self-image PIERS Harris scores, mean scores were lowest for children who hated school (M= 37.31 SD=10.21) and highest for children who liked school very much (M=50.87 SD=6.48). (F (4, 7320) = 279.084 p = .0000).



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Development of an Academic Risk Model to support Higher Education Quality Assurance

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Abstract

This paper presents a model of risk management in higher education, to support the quality assurance framework and the activities, more generally, of a Higher Education Institute. Its purpose is to define the Institute's approach to academic risk and its management and to inform decision-making. Academic risk is defined and contextualized in terms of published literature. Decision-making and judgement is at the centre of all academic activities and accordingly inherent risk will always exist, through the exercise of judgement, the operation of academic policies and procedures and through compliance. A normative model of academic risk assessment is proposed, based on three levels: isolated academic risk, repeated academic risk and systemic academic risk. This is followed by a proposed model for action according to the level of risk. Finally the operation of the model in our higher education institute is presented.

Keywords: *acdemic risk; risk assessment; risk response.*

1. Introduction

This paper presents a model of risk management, to support the quality assurance framework and the activities, more generally, of a Higher Education Institute (HEI). Its purpose is to define the Institute's approach to academic risk, its management and to inform decision-making.

2. Academic Risk

Risk management is key to the effective strategic management of any organization (Carmichael, 2016). Most often risk management relates to managing risk exposure and encompasses all facets of the organisation's strategy and operation. HEIs are exposed to a wide variety of risks including financial austerity, increased accountability, changing government policy, cybersecurity, reputation and quality assurance ((PWC) Coopers, 2018), so risk management is essential to their success (Kageyama, 2014), (Mukherjee, 2019). This has led to country-wide adoption of risk management for HEIs (Lucchese, Sannino, & Tartagli, 2020), (Edwards, 2012), (HEFCE, 2001).

Risk classification in a HEI has been collated excellently by (Teferra, 2019) and can depend on responsibility or functionality (Huber, 2009), ten responsibility areas defined by (Lundquist, 2015) or eight principle areas plus multiple minor areas of risk identified in ((PWC) Coopers, 2018).

In the context of this paper, risk means the academic risks associated with the core activities of the HEI across teaching and learning, research, engagement and the broader activities of the HEI that relate to knowledge creation, dissemination and usage. In identifying these risks, it is recognised that risk is an integral part of the activities of any HEI and that by providing a policy framework in this paper for understanding, identifying and responding to risk, the HEI actively seeks to understand and manage its activities in a coherent and consistent manner. Risk management in this paper focusses on how it may be of benefit in supporting the HEI's quality assurance framework and related activities. This work brings the focus to the benefits that could accrue in supporting the academic quality assurance framework.

2.1. Academic Decision-making

Decision-making and judgement is at the centre of all academic activities and accordingly inherent risk will always exist. This paper's aim is not to eliminate these risks, but rather to provide a framework for understanding the nature of the risks and for guiding activities to ensure the risks are addressed at both individual and organisational levels.

Broadly, academic decision-making will fall into the following categories:

1. Through the **exercise of judgement** in academic matters. Such judgement, by its nature, will require the specialist knowledge of the decision-maker (or makers) to be applied, often in a variable or unstructured set of circumstances. This judgement is particularly acute in circumstances such as the assessment of learners and the determination of award classifications bands. Ordinarily, the risks associated with the exercise of judgement is mitigated through extending the number of decision-makers (i.e. external examiners, examination boards) and by formulation of and transparency in the decision-making criteria (i.e. marking schemes).
2. Through the operation of **academic policies and procedures**. Any HEI has a well-developed and published set of regulations covering the academic activities of the institute. Notwithstanding this policy framework, decision-makers may encounter circumstances where the policy framework:
    a. encounters exceptions or unaccounted for situations;
    b. is considered ineffectual for the circumstance encountered;
    c. is not understood or applied properly.

    It would be expected that issues arising from an effective policy framework should be minimal in nature. The HEI's Academic Council and its committee structures provide oversight to the operation of academic policy and procedures and are normally in a position to determine changes to or amendments necessary to adjust the policy framework as required, where legislative or operational changes occur, or where gaps in the policies are identified. It would be expected that in circumstances where the academic regulations are contested then the matter would ordinarily be referred to the normative policy making body before decision-making occurs.
3. Through **compliance** with academic standards. The HEI would normally have defined in many cases distinct standards that must be applied universally (for instance in entry requirements, degree awarding titles or structure of award classifications). Given the universality of the standard, the expectation is that such standards are applied consistently and without exception.

2.2. Normative Model of Risk Assessment

While significant complexity exists in any HEI's operating environment, there is nonetheless a set of expectations or norms around the outcomes expected with the activities of the Institute. These norms may vary from activity to activity and from discipline to discipline. Clear direction is required on the identification and reporting of deviations from these norms. This paper is not designed to establish these norms, but to recommend academic management structures to consider their own operations in the context of the norms expected of their activities and to appropriately act upon and report upon exceptions.

Exceptions might be noted in terms of:

1. Academics making an error of judgement or going too far in the exercise of their judgement;
2. Situations not accounted for in the HEI's policies, where a response occurs which is out of kilter with the ethos, spirit or Quality Assurance culture of the HEI;
3. Misunderstanding of the HEI's policies leading to mistaken measures being taken.

Academic risks can be considered at three levels, which are defined as follows:

1. Isolated academic risk: This represents a single or isolated incidence (whether deliberate or accidental) that occurs in a manner whereby the expectation of this being repeated by the same or other individuals would normally be considered to be limited. In this respect, isolated academic risks are somewhat akin to quasi-random events or variations that will effectively rectify themselves and are unlikely to require further actions.
2. Repeated academic risk: This represents a repeated incidence, either by the same individual or other individuals (whether deliberate or accidental), which signifies that the expectation of continued occurrence cannot be considered as limited, but neither can it be considered as systemic. In this respect, an actionable academic risk represents an event(s) or variation(s) that requires some action to ensure that it does not become a systemic risk.
3. Systemic academic risk: This represents a repeated incidence, either by the same individual or other individuals (whether deliberate or accidental), which indicates a continuing or recurring cycle of occurrences that are at a systemic level within the organisation or parts of the organisation. In this respect, a systemic academic risk represents an event(s) or variation(s) that requires immediate action at a suitably senior level or levels to rectify.

Table 1 Level of Risk

	Isolated	**Repeated**	**Systemic**
Exercise of judgement	Green	Orange	Red
Academic policies & procedures	Orange	Orange	Red
Compliance	Orange	Red	Red

Table 1 sets out a model of impacts of these types of risks, with their occurrence, to categorise the level of risks associated with each type codified by colour, from low risk (green) to high risk (red).

3. Action required for relevant level of risk

The type and extent of intervention for any risk level should be proportionate to the impacts the incident might have on the operations of the HEI and particularly for good governance and reporting. Actions should therefore represent an escalating onerousness of action and reporting, as the risks move from low to high, in an appropriate manner. Table 2 sets out the proposed requirements and responsibilities of academic decision-making areas for the HEI as a whole.

Table 2 Required action for each level of risk

Risk Level	Colour	Local Decision-making Area	Institute
Low	Green	Record the incident and the steps taken to avoid its recurrence.	Notify the decision-making area and request that they put in place measures to avoid re-occurrence.
Medium	Orange	Risk incident should be reported to Academic Council (via the Registrar) with details of any actions taken.	Academic Council should approve intervention (with relevant area, if appropriate) to avoid re-occurrence and provide for its implementation.
High	Red	Risk incident should be reported to Academic Council (via the Registrar) with details of any actions taken.	Academic Council should approve intervention (with relevant area, if appropriate) to avoid re-occurrence and provide for its implementation. Council shall report the incident to Governing Body.

3.1 Academic Risk Structures

The Academic Council's Quality Committee should be the owner of the policy and provide for its implementation. To achieve this, the Quality Committee could establish a sub-committee, an Academic Risk and Compliance Committee, to manage the operation and implementation of the policy.

The Academic Risk and Compliance Committee should monitor and report on the risks that emerge under this policy and should:

1. Consider incidents and classify them in accordance with this policy;
2. Refer incidents to appropriate bodies within the institute for action as the committee deems appropriate;
3. Monitor and report on incidents.

The committee should meet at least once a semester, but may be required to meet more often to deal with specific items referred to it from time to time.

3.2 Referring items to the Academic Risk and Compliance Committee

Items may be referred to the committee for consideration for a number of reasons and through a number of channels, commensurate with the complexity of managing risk in an academic environment and with the normative model of risk assessment. Possible referral routes are as follows:

1. Where areas making academic decisions become aware of reporting obligations under the policy they should communicate those concerns to the risk and compliance committee through the Office of the Registrar;
2. Academic Council committees or sub-committees may refer matters directly to the Academic Risk and Compliance Committee;
3. Individuals may make the Academic Risk and Compliance Committee aware of particular circumstances or incidences by communication in writing to the Committee through the Office of the Registrar;
4. If there is any doubt whether a matter should be referred to the Academic Risk and Compliance Committee, then guidance should be sought, in the first instance, from the Office of the Registrar.

3.3 Reporting

The Academic Risk and Compliance Committee should report annually to the Academic Quality Committee and Academic Council on the activities of the Committee over the past year in summary form.

School or Faculty Boards and Academic supports, including the Offices of the Registrar, the International Office, and the Research Office should report annually that they have complied with the Academic Risk Policy.

4. Conclusion

A model of academic risk management in higher education has been presented in this work. The model requires a HEI to consider its approach to academic risk and its management and how this can inform decision-making. The importance of academic independence and the inherent associated risks in decision-making and judgement is recognised and

preserved, by acknowledging that there will always therefore be an inherent risk, through the exercise of judgement, in the operation of academic policies and procedures and in compliance. The paper also presented a normative model of academic risk assessment, based on three levels: isolated academic risk, repeated academic risk and systemic academic risk, with a proposed model for action according to the level of risk.

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Dropout and Engineering undergraduate programs at the Universidad Nacional de Colombia between 2012-2019

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Abstract

Dropout is a topic of significant concern to Higher Education Institutions, especially in Colombia it is considered one of the most important indicators to define higher education quality. Nevertheless, in Colombia, and particularly at the Universidad Nacional de Colombia, it has been generally assessed only academic dropout. This decision has prevented understanding other types of dropouts that also occur in the university. The research group performed Multiple Correspondence Analysis to assess the relationship between dropout types (academic, dropout on request, and expiry of time limits) and variables such as sex, socioeconomic stratum, type of admission, and semester of dropout. In the results, we found a disparity between types of dropout concerning the type of university admission, sex, socio-economic stratum, and the semester in which dropout occurs. Women are related to the dropout request while men are associated with the academic dropout. Additionally, the academic dropout occurs in the first 4 semesters, and the expiry of time limits occurs in the last ones.

Keywords: *Dropout types; engineering undergraduate programs; socio-economic stratum; sex; semester, type of admission.*

1. Introduction

In higher education and developing countries, dropout has been a topic of significant concern. For instance, Colombia has the second highest dropout index in Latin America (Ferreyra et al., 2017). This phenomenon has been also considered by the National Accreditation Council of Colombia; thus, dropout is one of the most important indicators to determine the quality of a higher education institution.

For the Colombian Ministry of National Education (2009) dropout occurs when the student stops their curricular program and does not register for two continuous periods. On the other hand, at the Universidad Nacional de Colombia (UNAL from now) (2008), a student can be considered as a dropout if after three consecutive years they do not re-entry the academic program. In both cases, to define desertion it is necessary to consider the determinant factors of this phenomenon, among which are individual socioeconomic conditions, academic skills, institution resources and individual variables (motivation, health, among others). Additionally, the academic abandonment can be classified according to the reasons for which it occurs: Voluntary or involuntary; related to the moment in the program in which it is presented: premature, early or late; or depending on whether it is temporary or permanent (Castaño et al., 2004; Ramirez et al., 2016).

1.1. Dropout at Engineering undergraduate programs at Universidad Nacional de Colombia

Notwithstanding the Engineering school's good results at national (Revista Dinero, 2018) and international rankings (QS Quacquarelli Symonds Limited, 2019), it has not been immune from academic abandonment. Whereas the academic dropout rate of engineering school has decreased and is lower than other schools at UNAL (Oficina de Planeación y Estadística Sede Bogotá UNAL, 2019), numbers are still high (range from 32.4% to 65.4%). Those rates are problematic considering that dropout can have serious social, economic and academic consequences for both dropouts, educational institutions, the country and society (Patiño & Cardona, 2013; Torres, Acevedo, & Gallo, 2015).

1.2. Research goal

The analysis presented in the present paper aims to characterize the dropout in the Engineering School at Universidad Nacional de Colombia, between 2012 and 2019.

2. Methodology

To characterize the dropout in the School of Engineering at UNAL from 2012 to 2019, we consulted the institutional databases and obtained variables such as Type of admission[1], Semester of dropout, Sex and Socioeconomic stratum[2]. Besides, we had to construct the variable **Status**, which refers to the differents ways of blocking an academic record. For example, in the first place, there is **Academic dropout** which occurs in two cases: having a GPA average of less than 3.0 on a scale from 0.0 to 5.0 or lacking the necessary number of credits to complete the program. In the second place, there is **Expiry of time limits**, where the student stops attending or paying for the tuition at the University without giving notice. In the third place, some students apply for readmission, change or withdraw from the program, and transfers to another campus, which is called **Dropout on request**.

To achieve a detailed description of dropouts, Matlab ® computer system was used for performing various multiple correspondence analyses (MCA) between all variables and types of dropout (Status). Besides we used a k means analysis to determine the number of clusters in each MCA graphics.

3. Results

3.1. Demographic characteristics and dropout

In the window of time studied, on the one hand, women admitted to the School of Engineering only represented 17%. They were characterized by being mostly from stratum 3 (41%). On the other hand, men represent 83% of the population of the School of Engineering and they mostly belong to stratum 1 and 2 (37% in both cases).

3.2. MCA results

In Figure 1, each MCA graphic has a variance explanation above 80%, which means great power in the relations drawn. Besides, dimension 1 explains more variance in all graphics.

As shown in Figure 1, the Academic dropout is more related to males who were between the semester 0 to 4, especially to those who live in socioeconomic strata 1 to 3 or in non-

[1] The regular admission implies a minimum score in the university exam. The Special Admission Program (now PAES because of its Spanish initials) privileges vulnerable groups (indigenous communities, Afro-Colombian, victims of the non-International Armed Conflict in Colombia, among others). The Special Admission and Academic Mobility Program (from now on PEAMA because of its Spanish initials) is a strategy of the institution to link more high school graduates from all over the country to higher education.

[2] Each city in Colombia is divided into 6 socio-economic strata, which respond to a classification of residential properties. This differentiation is made especially for the collection of public services, allocating subsidies to the lower strata (1-3) and collecting contributions from the high strata (4-6) (Marcos, 2018). Non-stratified houses correspond to indigenous reserves.

Figure 1. Multiple Correspondence Analyses

stratified houses, and to those who were admitted by PEAMA and PAES type of admission. Only women who live in strata 1 are strongly related to academic dropout. Furthermore, the dropout on request is related to women at semesters 0 to 8, who live in stratum 2 to 5. Moreover, females with regular admission were associated with this type of dropout, but only men who live in stratum 5 were strongly associated with dropout on request. Finally, the expiry of time limits is mostly related to women in semesters 8 to 15, and with PEAMA and PAES admission. Additionally, this type of dropout is associated with males who reported to live in stratum 5, are between semester 4 to 15, and had a regular type of admission.

4. Conclusion

One of the most evident results is that each status is related to a specific group of semesters. For example, we can state that the academic dropout generally occurs in the first four semesters of the programs. Furthermore, expiry of time mostly occurs in the last semesters, between semesters 8 and 15. Additionally, dropout on request occurs between semesters 0 and 8 only for women. The first case could be explained by the high academic demands during the first semesters: in all engineering programs, the basic or foundation courses in mathematics and physics must be taken, therefore, there is a greater probability of losing the course and deserting due to low academic average. Other studies in the UNAL have shown that students at first semester have a higher risk of dropping out than those at other semesters (Gallego, 2014). Notwithstanding, a contribution of this study is that other types of dropouts were evaluated and, with these preliminary results, the differences in their behavior can be observed. This opens the possibility to deepen the explanations to these differences in the following phases of the study.

People's chances of entering higher education are directly related to their social origin, depending on many factors, such as the sex, socio-economic level, among others (Bourdieu and Passeron, 2009). Results also showed that women who enter at the School of Engineering have better socio-economic conditions compared to men, since they come from higher strata. Arango (2006) calls this situation as the relative social and academic over-selection of women in Engineering. Therefore, as we corroborated with this result, permanence in high education is also strongly affected by the social conditions of the people.

We found that the dynamics of the dropout is relative to this over-selection. Voluntary abandonment is produced when the student renounce, without notice, to the University, while involuntary abandonment occurs when the student has not good academic performance and withdraw from the university because he/she does not meet the demands (Himmel, 2012). In this sense, it seems women can abandon the program in a volunteer

way (dropout on request) and men, due to his infra-selection, present involuntary abandonment of the program (Academic dropout).

These are preliminary results and it is necessary to determine factors of dropout and to dialogue with people who dropout and with those who are at risk, in order to explore their experiences with this problem. With those tools, the Faculty Board could make decisions, identify the probability of dropout of those at risk, and control some of the factors related to this phenomenon that are under its governance.

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Chart for Flexible Curriculum in terms of Time and Similarity

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Abstract

Within the framework of the evaluation of curricular reforms made in the programs of the Faculty of Engineering of the Universidad Nacional de Colombia, this proposal is designed as an evaluation tool for a flexible curriculum, to characterize the enrollment behavior of students and their possible relationships with demographics and academic success. The principle consists of plotting the median time and similarity coefficients of each student in the program on the axes of a two-dimensional Cartesian plane. On the X-axis, the time coefficient was plotted, consisting in the relationship between the time proposed by the program curriculum for each course, and the time when the student takes it. On the Y-axis, the similarity coefficient was plotted, consisting in the number of courses that were taken at the time indicated in the curriculum grid. The conclusions suggest that, for the program analyzed, there are no demographic biases. However, the findings of this study suggest that even though students seek to take the proposed curriculum with the highest possible similarity, they spend more time than the estimated to achieve academic success

Keywords: *Curriculum; Assessment; Time; Similarity*

1. Introduction

Internationalization of higher education is forcing engineering programs to look with special care the way of doing self-assessment and obtaining accreditations. One of the critical factors for effectively assessing programs with a flexible curriculum and academic freedom is to measure the time and relationship among the proposed curriculum established by the program, the actual curriculum that each student decides to take, and demographic variables.

The Universidad Nacional de Colombia is the most recognized public University with a presence in the entire country. The main campus is located in Bogotá, where students from all Colombian regions access programs that are far from their hometowns. Since middle education in Colombia has different levels that are highly related to demographic classification (Barón-Rivera & Bonilla-Mejía, 2014), the University established different admission programs searching equity for all applicants. In this sense, the PEAMA and PAES programs consist of the student taking courses at the nearest location to his or her hometown or reducing the score needed to be admitted, respectively.

However, a significant problem resides in the belief that the current program curriculums have bias related to demographic variables and that these variables are related to the number of semesters to complete the curriculum. For these reasons, it becomes necessary to develop a tool that allows studying the proposed curriculum in terms of similarity and time. This article presents a proposal that allows representing each student's curriculum as a point in a bi-dimensional plot through a classification made with a Matlab® algorithm. This paper takes a look at students of Agricultural Engineering and the pattern in which they take their subjects over time.

2. Methodology

In order to assess the flexible curriculum, it was necessary to establish all the information needed for the classification of data for each student. Table 1 summarizes an overview of the information sources, which are, in their entirety, University dependencies that store the databases containing all the data needed for the analysis. It was also needed to define the target population that was stablished as the students that entered the Agricultural Engineering program from 2010 to 2012. Considering the mean number of students admitted per semester, an estimated of three hundred people that take almost fifty courses represent nearly fifteen thousand registries. The process of Extract, Transform, and Load (ETL) is divided into two stages that consist in the depuration of the obtained data and the codification of the different curricula in order to easily compare them with the ones taken by each student.

Table 1. Records used and their source within the University.

Source	Variable
National Academic Information Office (DNINFOA)	Student IDs and sex
	Courses taken by each student sort by typology and semester
	Admission period
	Last academic status
National Admissions Office (DNA)	Place of birth
	Students sex
Program	Academic pensum for each reform

2.1. Depurate of registries

After filtering the information given by DNINFOA, it was necessary to define the adequate number of academic periods for each year. This consideration is specific to the University due to the possibility of taking courses between semesters in a short inter-semester period that allows the students to take one course during one month of dedicated work. These courses are an opportunity to take courses of upper semesters or to repeat the failed ones. Therefore, all the courses taken in the inter-semester period were assigned to the previous one in order to make a reasonable comparison.

Colombian cities are sorted in thirty-two departments that can be grouped into five regions. Due to the way the DNA registers the birthplace and the different changes in that codification through the years, a region standardization was needed for analyzing this information accurately.

2.2. Codification of the curriculum

Three curricula were examined due to the different changes that occur during the periods of analysis. The first curriculum was stablished in 2010 (Dirección de Área Curricular de Ingeniería Civil y Agrícola, 2010). In the second one, created in 2013, it was necessary to move the electrotechnology course to the eighth semester (Dirección de Área Curricular de Ingeniería Civil y Agrícola, 2013). The last one was implemented in 2016 (Equipo Directivo de la Facultad de Ingeniería, 2015). Each course was defined as an object that has the following attributes: code, name, and a defined semester to be taken for the students of each curriculum.

2.2. Defining the coding algorithm to analyze the information

Two tables were defined: (1) Students that contains the ID, admission period, sex and last academic status and (2) Courses that has the student ID, the semester in which the student took the course, a course code and name, a typology, and the Total number of courses taken by the student. For each student, the flow of actions is represented in the following pseudo code:

```
for number of students
 Xvalue = 0;
 Yvalue = 0;
    identify the courses and in which semester was taken
    for number of courses
        if the course is a Disciplinary or Basic
           Xvalue = Xvalue + semester taken – recommended semester;
           if the course has taken in the recommended semester
               Yvalue = Yvalue + 1;
           end
        end
    end
    Xvalue = Xvalue/Total number of courses;
    Yvalue = Yvalue/Total number of courses;
 Results = [Xvalue, Yvalue, Sex, Type of admission, Latest
          academic status, Birth place]
end

Results(Yvalue) = Yvalue – Median Yvalue
```

The scope of the study was limited to disciplinary (core) and basic courses, considering that changes in the order of the elective courses represent no significant differences in the figures. If the student decided to take more elective courses in one semester, this will be reflected in an increase of the Xvalue caused by the delay.

Figure 1 and Figure 2 show the way to interpret the results obtained in the bi-dimensional plot. The Y values increase in terms of the similarity the relationship of similarity between the courses took by the student, and the distribution of courses recommended by the program. The Xvalues represent the evaluated mean of how early or late the students take the courses in their academic career. For example, a student that accomplishes the courses in the same way as proposed in the curriculum and without any delays would be located at the top of the plot (Xvalue = 0 and Yvalue = 1).

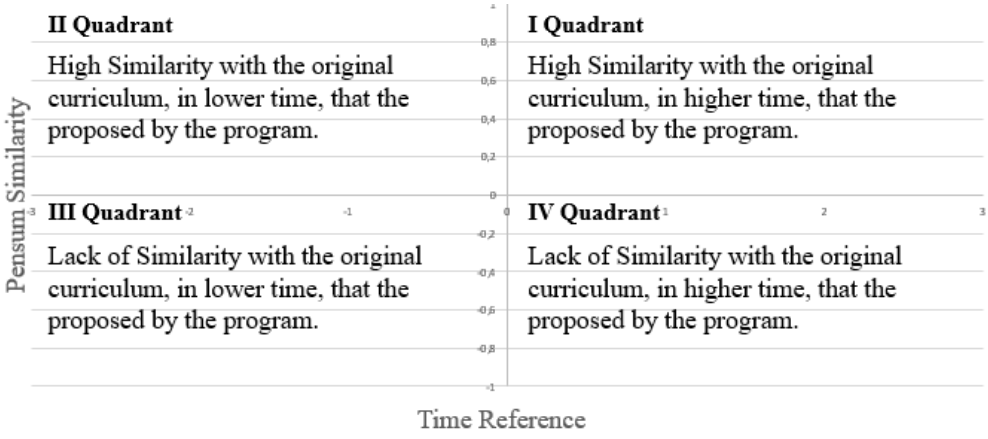

Figure 1. How to interpret the results.

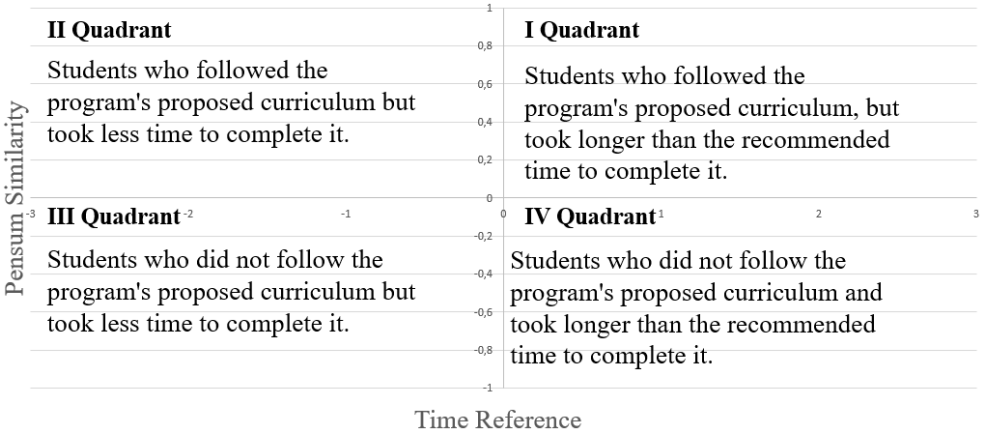

Figure 2 Practical Examples

3. Results

The first set of analyses examined the impact of sex and region as is shown in

Figure 3 and Figure 4, respectively. Results obtained indicates that there are no strong relations among the data. However, the entire population reported significantly more courses taken late in comparison with the proposed program curricula.

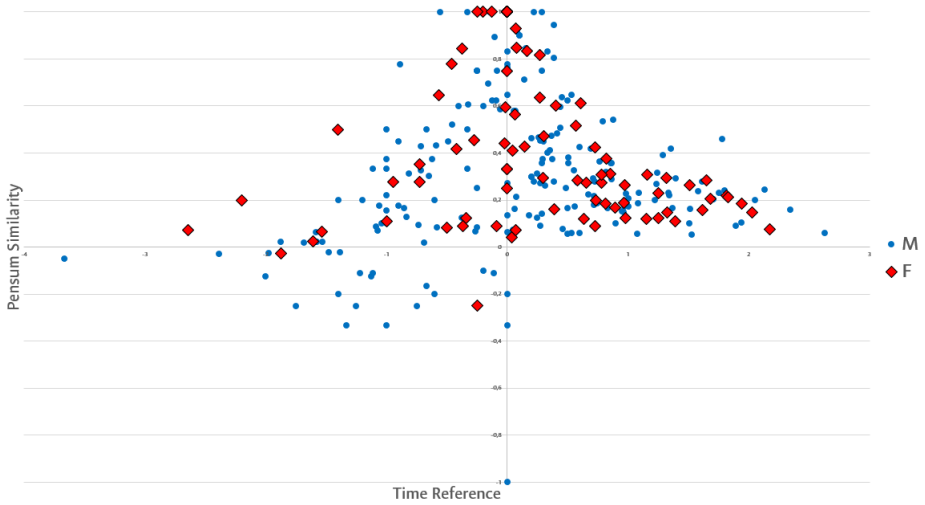

Figure 3. Sex distribution.

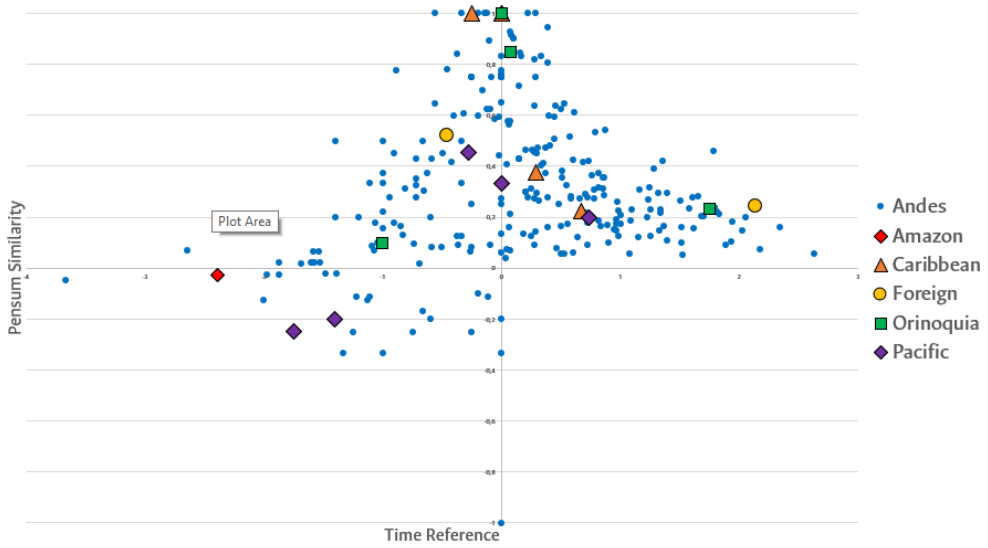

Figure 4. Region of the student hometown

The third plot shown in Figure 5 represents a more specific analysis of the behavior obtained in the previous analysis with demographic data. Academic status indicates that even when the entire population of the study has completed at least the maximum amount of time to finish all the courses, there is still a significant amount of people that is active as undergraduate student and a big part of this group is located in the first quadrant of the cartesian plane.

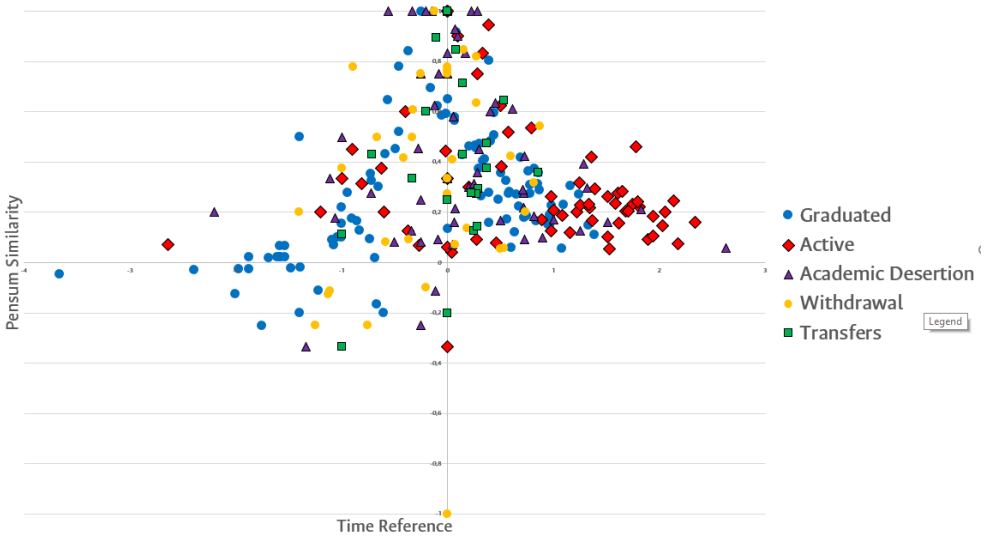

Figure 5. Latest academic status distribution

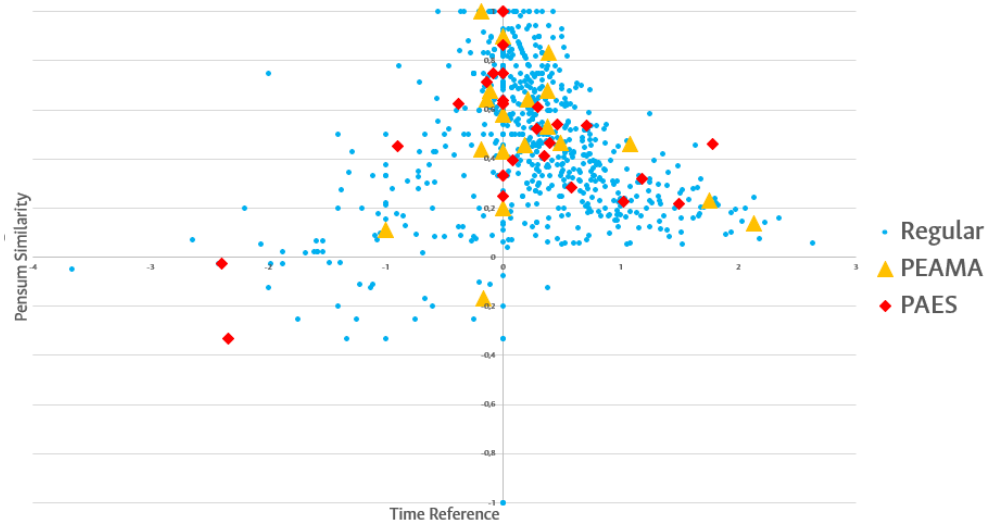

Figure 6. Types of admissions

Due to the low number of students who had a special admission (PAES or PEAMA), it was necessary to make the sample more prominent, as shown in Figure 6. With the new set of data, the tendency to be in the first quadrant is more significant. However, in order to explain the behavior of the students located in the left zone of the plot, this data analysis evidenced that some courses programed for the end of the curriculum, like economy and management, are taken early by the students.

4. Conclusions

The present study was designed to determine possible implications of the way students take their courses in a flexible curriculum. Results have shown that the Agricultural Engineering program has no bias generated by sex, city of origin, or type of admission, this apparent lack of correlation can be attributed to sampling size and sampling bias generated by previous relationships between variables, such as the current ratio of men to women (4:1) and the relation between regular and special admissions (9:1). Nevertheless, the findings of the designed tool still state significant discoveries.

Given the trend to quadrant 1 shown in the results, it became noticeable that students seek to follow the proposed curriculum. However, there is a trend toward zero on the Y axis, which indicates that there is a slight variation in a small group of subjects. The analysis of the database showed that there is a considerable number of students who decide to take economy courses early despite the recommended time suggested in the curriculum (at the end of their program). However, there are possible explanations and questions that still require further research.

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A transversal methodology for the implementation of virtual reality in Architecture learning

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Abstract

Virtual reality (VR) has achieved an adequate level of development in education and research in higher education The training in Architecture requires a reflection on the incorporation of new design technologies at the Degree and Master's level, due, in part, to the dissatisfaction of the students with the poor implementation of these technologies. The pedagogical possibilities of VR are very high. The aim of this paper is to propose a transversal methodology for several subjects in the same semester. It consists of the virtual recreation of a work of relevant architecture in the history of contemporary Architecture. The possibilities of implementing VR in the architectonic subjects are analyzed. This methodology takes advantage of the potential of this technology to create a transversal educational activity, for different subjects and areas of knowledge in the same academic year. Subsequently, the different phases for its implementation are described in terms of activities and scenarios. The paper concludes that transversal methodology offers the opportunity to analyze the same building from different disciplines, checking the interrelation between them, and saves time for the student in completing teaching assignments.

Keywords: *Virtual Reality; architecture; transversal learnin; educational technology.*

1. Introduction

The pedagogical use of the virtual reality (VR) can be a great motivation for the student. Vera Ocete (2003) stresses that the learning curve with VR is faster, and greater and better content assimilation can be achieved with VR than with traditional teaching tools, mainly because students use almost all of their senses in the VR learning experience. Thus, in 2015 UNESCO recognized the work of the Institute of Technical Education of Singapore in the development of a virtual and augmented reality program, capable not only of enhancing practical learning, but also of improving the assimilation and evaluation of skills.

The use of VR for the representation of three-dimensional space and architectural projects has been used in Architecture teaching with 3D-models of buildings or architectural elements (Navarro Delgado & Fonseca Escudero, 2017). However, these are activities that are carried out in a single subject. Therefore, this paper tries to present a methodology that takes advantage of the potential of this technology to create a transversal educational activity, for different subjects and areas of knowledge in the same academic year.

2. Background

VR is defined as a "*highly interactive, computer-generated environment. It can be graphics-based or text-based. Some types of VR, such as a collaborative virtual environment (CVE), combine graphics and text*" (Pantelidis & Vinciguerra, 2010:151). Many authors have analyzed the applications of VR in higher education. Bowman, Hodges, Allison, & Wineman (1999:170) described its application in social studies as follows: *"Villages, town, and city areas, home interiors, habitats, and maps are constructed to provide a feeling of being there*". Abulrub, Attridge, & Williams (2011) discussed the benefits of using a 3D photorealistic interactive and immersive virtual environment for engineering undergraduates and postgraduate teaching, learning and training. Häkkilä, Colley, Väyrynen, & Yliharju (2018) highlighted the implementation of VR in smart buildings, Lisichenko (2015) in Geography education, and Navarro Delgado & Fonseca Escudero (2017) in urban design. There is a great potential for future applications of VR in Architecture and Urbanism because both of them involve visual simulation, spatial thinking, and learning-by-doing activities (Passig & Sharbat, 2000:176). The use of VR in these subjects is a natural evolution of computer-assisted instruction (CAI) or computer-based training (CBT) (Pantelidis & Vinciguerra, 2010:161). There are two VR modes: desktop and immersive. Desktop VR is popular in CVEs used in education and training where participants interacts with others via avatars (e.g., the 2D virtual world of Whyville or the River City Project). Immersive VR has important benefits in Architecture and Urbanism (see Table 1): it reduces the cognitive effort required for interpretation, enables the creation of a dynamic interaction and introduces a novel persepective (Wickens, 1992).

Table 1. Some benefits and values of VR in the Architecture learning process.

VR values	Author
Motivation	Wickens (1992), Winn (1993)
Different perspective	Wickens (1992)
Immersion, interaction and promoting to learn from non-symbolic first-person experience	Winn (1993)
Stimulate learning and comprehension	Bowman et al., (1999)

3. Methodology

We applied the Constructivist Learning Environments (CLE) model (Jonassen, 2000), through the Project-Based Learning (PBL) technique where the common project consists of the virtual recreation of a work of relevant architecture in the history of contemporary Architecture. We use three scenarios: classroom (C), laboratory (L) and virtual learning environment (VLE). All the subjects involved shared the following aspects:

• Coordination of teachers: the coordinators of the subjects involved met at the beginning, middle and end of the course.

• Work groups: the students were organized in teaching units of 25 students and in work groups of 5.

• The Virtual Moodle Platform of the Virtual Campus provided teaching resources and was used for evaluating and social interaction.

• Collaborative evaluation.

To establish the transversality of the subject, it is necessary to previously determine (a) which subjects can use 3D simulations and (b) if they allow the development of a shared work. In Architecture, VR can be used in many of subjects since, traditionally, students have worked with models and rendered images so the immersive visualization seems an immediate step. Pantelidis (1997) justifies the incorporation of the model when the realization of an attractive class requires travel, money and/or logistics, and shared experiences are desired in a group. Adapting the methodology of Pantelidis (1997), we classified subjects as transversal if they met the following objectives:

General Objectives (subject) → Related to 3D simulations (subject) → Related to 3D simulations of a building and its environment (transversal).

From the expected cross-sectional results, the following were determined: (a) level of realism of the building, (b) type of interaction, (c) type of sensory input and output required, (d) RV software. Finally, we designed and built the virtual environment.

4. Results

4.1. Teaching transversality

The first course in Architecture (first semester) was used as an example of transversal model of VR implementation. Representing a building in immersive VR enables the objectives of the three selected subjects to be achieved (Table 2).

Table 2. Transversal contributions of knowledge areas.

Id	Subject	Transversal objective
WSI	Workshop IA	Master drawing techniques, including digital techniques applied to architecture and urban planning
IAC	Introduction to architectonic construction	Ability to graphically describe how construction systems are organized and solve practical cases on the application of organization materials for structures, facades, roofs, interior elements and installations of buildings of small complexity. How it works, how it is built, what they are called.
IAH	Introduction to architectonic history	Analysis of an example of modern architecture to be placed in its historical context.

The goal was the development of 15 representative houses of contemporary architecture in VR. Given the time constraints, the dwellings must be simple in the use of geometric shapes (e.g. La ville Savoye by Le Corbusier). The level of realism must differentiate the construction materials and the environmental conditions (day and night). The sensory output is through HMD (head-mounted display) of the HTC Vive type (https://www.vive.com/us/). In the generation of 3D modeling (CAD technologies) free internet programs and educational licenses for students are used. Free tools like Google Blocks™ (https://arvr.google.com/blocks/), Paint Lab VR™ allow the drawing and sculpting of 3D models (http://paintlabvr.com/). The modeling used were the Rhinoceros™ 3D and Autodesk™ educational edition.

4.2. Design and construction of the virtual environment

The methodological development follows the scheme in Table 3, which describes the sequence of phases, activities and learning scenarios.

Table 3. Methodological development for the subjects involved, in relation to the activities and learning scenarios (LS).

Phase	Activity	LS
0. Seminar	Formation of the content creation team (teaching staff and students) and election of building	C/VLE
1. Research on the building	IAH: acquiring planimetry data, photographs	C
	IAC: material and construction system data	C
	WSI: theoretical bases on the computer program	C/VLE
2. Modeling	3D modeling of design and construction elements	C
3. Immersion in VR	Importing rendering to visualization program, adding materials and lighting	L
4. Evaluation	Immersion and assessment by students	L
5. Presentation	Presentation of results in each subject	C

For each of the phases, the activities to be carried out were developed as follows:

0. Seminar. The 75 students were organized into 15 groups of 5 students. In the seminar a presentation of the work was made and the houses were distributed among the groups.

1. Research on the building. Students researched on the architectural work selected for the 3D survey. The proposed software was required include to immersive VR. In addition, the VLE provided conceptual information on 3D modeling techniques, associated technology, and usability standards.

2. Modeling. Modeling was carried out using the Autocad 3D educational version program. The 3D model contains the data necessary to visualize or render a three-dimensional object, and can contain two types of information (Moreno, Aguilar, & Hidrobo, 2018): (a) the geometry and construction systems, and (b) the attributes of the surface in terms of color, texture and lighting that confer realism to the representation.

3. The VR immersion was carried out in the Fab-Lab laboratory, where the HMD is located. Using a second software, the 3D model was opened to prepare the VR environment (lighting, textures, animations, effects, etc.), and it was connected to the HMD sending the

information for immersive viewing. Autodesk Live - that enables interactive viewing for Revit (BIM model viewing) - , Autodesk VRED Professional, and Rhinoceros™ were used. The laboratory has a computer that uses a GTX 970 video card to use Professional VRED with HTC Vive.

4. Evaluator experience. This was carried out in two phases:

• In the first part, a meeting was held. The students in a group distributed among themselves the virtual vision of 3 buildings of the other groups. Wickens (1992) suggests the concept of visual momentum to address the issues of cognitive loss. Students have to assess: (a) use of consistent representations, (b) use of graceful transititons.

• Evaluation through a test. The evaluation was conducted through test surveys and BLA (Bipolar Laddering) questionnaires (Pifarré & Tomico, 2007). Navarro Delgado & Fonseca Escudero (2017) proposed the use of tests (from 0 to 5) to evaluate the implementation of these technologies as well as for selecting the sample model and the type of analysis.

5. Specific presentations for each transversal subject (IAH, IAC, WSI) using the 3D model: (a) in IAH, the students can use images of VR to explain the story of the building; (b) in IAC, the students can use 3D model images in the descriptions of its constructive elements. Even the VR architectonic model can be used later by other subjects (e.g. Architectonic Projects).

5. Discussion and conclusion

Although in general, game-based learning environments are more effective than virtual worlds or simulations (Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014), in the case of Architecture, the development of buildings in VR becomes complete when the sensitive dimension is incorporated into the 2D and 3D dimensions of work. According to Bowman, Hodges, Allison, & Wineman (1999:169): "*The experience of creating a simulated environment or model is important to the learning objective*", especially in the following advantages of the model.

Transversal methodology enhances the student's research role and it offers students the chance to become real scientists (Dede, Ketelhut, & Ruess, 2003). It offers the opportunity to analyze the same building from different disciplines, checking the interrelation between them, and saves time for the student in completing teaching assignments.

It fosters the constructivist dimension of knowledge, by actually building a model in which sensations produced by the Architecture can be experienced and analyzed. VR allows the incorporation of the sensitive dimension of the Architecture, an aspect that currently can only be visualized by means of 2D rendered images. The methodology allows students to

relate the sensation in the perception of Architecture with all the related subjects in the construction of the VR model.

On the other hand, this model allows to build an open repository of buildings that can be used in other subjects. In this way, the elements built virtually can be used for all the subjects in the curriculum.

Among the drawbacks, it should be noted that the proposal involves an important coordination effort between tutors in different subjects and areas of knowledge. In terms of the software and hardware necessary for the application of the method, the existence of virtual reality laboratories clearly facilitates its implementation, so this method can be difficult in schools that lack it. It is desirable that each student has an HMD, which allows the work to be done to be divided. In this sense, the implementation of cardboards that turn smartphones into VR devices solves this problem. For this reason, the rapid advances in technology clearly support the implementation of VR as an essential tool in advanced Architectural teaching.

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Perceptions of organizational injustice in French business schools

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Abstract

Whereas the institutional drivers of the accountability discourse and the apparatus of performance evaluation accompanying such a discourse in the neoliberal university are well documented, their implications at the individual level have received lesser interest. Our paper suggests that more attention be paid to the voices and the experiences of the "governed". It accounts of the unfairness of the accountability regime in higher education, and more specifically in business schools, as it is perceived by scholars in France. Using insights from the institutional complexity (IC) and organizational justice (OJ) literatures, as well as an empirical analysis of the French business scholars'take on their changing work context and the metrics against which their performance is assessed, our study extends the understanding of the implications of organizations' rewards, incentives, performance control and evaluation practices for OJ. Moreover, it deconstructs the narrative of the accountability regime by reminding that institutional complexity leaves very little room for many scholars to be star researchers, excellent program managers, innovative and inclusive pedagogues as well as impactful public servants at the same time without hindering other academic missions they value (disinterested collegiality, care, social inclusion), their quality of life, family, and or health.

Keywords: *business schools, accountability, organizational justice, scholars, evaluation, neoliberal university*

1. Introduction

The narrowly defined stereotype of the excellent scholar as both a star researcher and a successful manager of a flagship graduate program has compelling implications for academic culture, scholars' legitimacy and self-representation, the labour of academia, professoral career trajectory, and well-being in the academic workplace. The excellent scholar is praised for her or his impacts. In the business discipline, which is the focus of this paper, the stardom in research and outreach is proxied by the number of publications in highly-ranked reviews (most of which publish exclusively in English), number of citations, research grants received, international mobility, and research contracts with public and industrial partners. The excellence as a program manager is assessed against performance indicators such as the number of accreditations obtained by the program and or the school, a favourable position on the ranking system (for example, the famous Financial Times' MBA ranking), successful implementation of the program at international campuses, which are all variables for lucrativity. Whereas the institutional factors (for example, the globalization of education, the decrease in higher education organizations' public funding, the growing competition between universities, and the "dictatorship" of the ranking systems) that drive those expectations have been well documented, their implications at the organizational level (the university, the faculty or school) and the individual one (the scholar) have received lesser interest. We suggest that more attention be paid to the voices and the experiences of the "governed", the scholars who have to cope with the above-described appraisal logics and processes. There are grounds for caution about the rapid and invasive diffusion of this dominant narrative about how the scholar's road map to excellence should look like. Results of a recent study by Wellcome Foundation and the research consultance firm Shift Learning (2020: 3) revealed that : "Researchers say that their working culture is best when it is collaborative, inclusive, supportive and creative, when researchers are given time to focus on their research priorities, when leadership is transparent and open, and when individuals have a sense of safety and security. (…) While most researchers feel that their sector is producing high-quality outputs, they also report deep concerns about how sustainable the culture is in the long term. They say that conditions are being worsened by a complex network of incentives from government, funders and institutions that seem to focus on quantity of outputs, and narrow concepts of 'impact', rather than on real quality. The upshot is that they feel intense pressure to publish, with too little value placed on how results are achieved and the human costs." . While the sample used was UK-based, the study's findings echo earlier concerns about the terrorizing impact of the globalized university's performance evaluation and the discourse of accountability on scholars in other European and international higher education settings. Our paper discusses the unfairness of the accountability regime in higher education, and more specifically in business schools and faculties, as it is perceived by scholars in France.

First we review the main attributes of the accountability regime. Thereafter, we briefly describe the conceptual framework, then the methodology of our study. This is followed by the presentation of the main findings. We conclude by outlining their implications.

2. The accountability regime

The accountability regime is characterized by an attitude that "prizes results", normative apparatus and a broader range of devices associated with the "new public management", which have come to define "true accountability" (Rouillard and Giroux, 2005). The latter have stimulated the pursuit of action understood as the cornerstone of efficient practice and the imperative for periodic assessment and highly visible justification. How it has influenced teaching and research in the whole university is explained by Sulkowski (2016: 10) as follows : "What dominates is the view of university transformation into a business market organization, executing the concept of 'new public management' (…), universities become 'producers' of educational services in a competitive market. This applies as well, and more fiercely, to teaching students, but equally to research performed by academics." It coincides with (or is considered by many observers as the consequence of the decrease in governments' financial commitment to higher education. Universities' performances are mainly defined by their economic relevance, as the so-called "knowledge-economy" objective has become part of the competitiveness agenda of many governments. Universities have hence been pushed to become "entrepreneurial" (Ramboarisata, 2016). As Mautner (2005: 96) puts it: "The social, political, and educational context in which they have moved centre-stage is a complex mesh of trends including the reduction of government funding, the consequent necessity to raise money from external, frequently corporate, sources, deregulation, increased competition and internationalisation, and the replacement of collegial by managerial (or, as critics would have it, managerialist) governance structures."

3. Conceptual framework

Two concepts are central to our analysis: institutional complexity (IC) and organizational justice (OJ).

As academic capitalism has gained ground, sustained by the diffusion of the accountability discourse in more and more regions and scientific disciplines, the logics pertaining the academic and social missions of universities (such as higher education as a public good, academic freedom, disinterested collegiality) have to co-exist with the market logics. This encounter entails a competition rather than a natural fit. Higher education organizations and scholars feel pressured to cope with these multiple and very often contradictory logics. Adaptation (and even resistance) efforts have become uneasy and paramount. This situation epitomizes what is known in Organizational Studies as institutional complexity (IC). IC

researchers (Greenwood et al., 2010; Pache and Santos, 2010 ; Greenwood et al., 2011) argued that organizations and their members acquiesce to these logics in order to gain legitimacy and to obtain or maintain resources.

Recently published autoethnographies, collective autoethnographies and other qualitative accounts of scholars' evaluation conditions and experiences within the marketized university - also known as the corporatized or the neoliberal university - (see for example the special issue of the review Ephemera in 2017 untitled "The labour of academia") as well as calls to reflect on and write about the academic responses to the corporate culture in higher education (see for example the call for papers, launched in 2019, for a special issue of the review Management and Learning untitled "The performative university - Targets and terror in academia: Implications for learning in business and management context") suggest that there is an issue of organizational injustice within the higher education context. Organizational justice (OJ) is a concept used to refer to the perception by individuals that they are fairly treated at work (Colquitt et al., 2001 ; Skarlicki et Folger, 1997 ; Adams, 1967). Injustice issue arises when the conditions for OJ are absent or violated. In the context of higher education transformations and the imperialism of the accountability regime, injustice has been signaled as more and more scholars are critical of the "narrow way in which their work is judged and valued, and what might be seen as an encroachment on academic freedom and the Weberian notions of vocation" (Robinson et al., 2017: 483).

Our study extends the understanding of the implications of organizations' rewards, incentives, performance control and evaluation practices for OJ. It does so by exploring an overlooked[1] sector, higher education. Moreover, it deconstructs the narrative of the accountability regime by reminding that institutional complexity leaves very little room for many scholars to be star researchers, excellent program managers, innovative and inclusive pedagogues and well as impactful public servants.

4. Methodology

We chose to focus on the case of French business scholars for a certain number of reasons. First, it was a convenient choice, as both authors use French as work language and one is based in France. Both belong also to the business discipline. Beyond convenience though, our choice was motivated by our own observations (and those of others) that the corporatization of French universities and business schools represent a much more radical change when compared to what occurred in other settings. With its tradition of coordinated

[1] The links between workers' performance evaluation and justice in commercial businesses enjoyed much discussion and empirical studies (see Aissi and Neveu, 2015, for a review of the literature).

economy (versus the liberal-market economy of UK and US), characterized by collectivist governance and solidarity, France used to favor public funding for its higher education sector. Accountability-and-market-driven reforms such as *La loi relative aux libertés et responsabilités des universities* adopted in 2007 and the very controversial *Loi de programmation pluriannuelle de la recherche*, the adoption of which is imminent, force a break-up with the traditional ideals. From the point of view of IC, the French case is thus a very interesting one since the degree of contradiction between logics is high. Our particular interest for the business discipline can also be explained by the fact that it (and its schools) have been much more favourable than any other in internalizing those imperatives of accountability and the audit culture as well as the logics of the market; although academic capitalism has affected the management of the whole university. Globalization has accelerated business schools' path toward meeting their market-focused objectives via an intensification of offshore and online programs' offerings (Parker and Guthrie, 2010). Hence, in major business schools' setting, the new accountability ethos has promoted practices the main legitimacy challenge of which is to create new revenue streams and to improve cost-efficiency, the bottom line, and image (Starkey and Tiratsoo, 2007). On the research side, as Butler et al. put it (2017: 468) "These trends suggest that the Humboldtian idea of the university – which measures the value of scientific-philosophical knowledge (Wissenschaft) according to the degree of cultivation (Bildung) it produces – has been superseded by a regime based on journal rankings, citation rates, impact factors and other quantitative metrics used to assess and reward research 'output' (Lucas, 2006)."

Using text analysis and the protocol of grounded theory applied in the study of organizationa, we conducted a two-level-exploration which respectively aims at:

- Assessing institutional complexity, which characterizes the setting of French business schools. More precisely, the study identifies the main institutional actors, the main interests at play and the contradictory expectations they impose one scholars.
- Examining traces of organizational injustice as perceived by the scholars.

Our documentary sources include governmental policies, publications by accreditation agencies presenting their assessment methods, study reports and position papers published by the French business schools and faculties' institutional stakeholders (the CGE which is the association of business schools, the CPU which is the association of universities' chancellors, and the FNEGE which is the largest and most influential foundation in the French business scholarship). That first set of documents enabled us to explore the dominant discourses at the institutional level. A second set of documents from which we gathered information includes a total of 263 articles and video-interviews retrieved from the websites of *The Conversation France* and *XERFI Canal* . These two outlets are used by French-speanking scholars for scientific vulgarization and (more and more) for activist communications. During the period of our study (2017-2019), there was a hiking number of

articles and interviews about the transformations of French higher education and their impacts on research productions and producers as well as on teaching activities. Those data allowed us to inquire about the French scholars'take on their changing work context and the metrics against which their performance is assessed.

5. Findings

Symbolic and cultural institutions in academia, which are often from internal and socio-historic sources (for example, regional and linguistic aspirations, the scientific community, individual scholars) and the logics they value (such as autonomy of thought, plurality of perspectives, ethics, disinterested collegiality, social inclusion, emancipation, and public service) have been strongly destabilized, even alienated, by the market logics carried from the external environment by regulative and normative institutions. The latter, as shown in table 1 below, are framing the definition and traits of what should be an excellent school and an excellent scholar. Their interests and expectations (especially, those of the regulators and normative actors such as the accreditation bodies) seem attractive to universtities' and schools' managers in the current context of resource scarcity and national competitive strategy-building. Nevertheless, as these expectations tend to overvalue the income-bearing dimension and outcome-focus of academic activities, regardless of the implications of such a choice on the scholars' work organization and on the symbolic and cultural institutions mentioned above, they end up creating tensions at the organizational and individual levels. The French business scholars and their organization are thus facing a significant institutional complexity.

Given such a complexity, the scholars are obliged to make a choice. Some acquiesce to the dominant external pressures, at the cost of abandoning traditional academic values. Some other, beholding to the principles of public service (teaching at the undergraduate level versus serving the "customers", which is often the status of the students of flagship programs in campuses located overseas) and socially-relevant research (which often demand conducting complex projects versus multiplying publications at high frequency) let go of the stardom and may suffer from marginalization and anxiety. A few try to abide by the contradicting pressures at the cost of their quality of life, family, and health. This situation creates (or enhance pre-existing) organizational injustice. Table 2 provides a portrait of the practices which French business scholars consider unfair by violating distributive, procedural, and interactional justices.

Table 1. Institutional context of the French business schools

First-order codes	Second-order codes	Aggregate dimensions
European and French regulators	Actors	Multiple and competing logics
Public and private funders		
Business media and their ranking systems		
Student media (eg., SMBG, l'Étudiant)		
University affairs media		
Foundations and associations		
Accreditation bodies		
Research bodies (eg., CNRS)		
Professional students (eg.,MBA, DBA)		
Foreign students (in France and in overseas' campuses)		
Undergraduate students		
Graduate students		
Industrial partners		
Scientific networks/associations and their reviews		
Regional actors (*territoires, collectivités, chambres de commerce*)		
Financial autonomy	Interests and main discourses	
Strategic position in Europe and internationally (branding, reputation, quality)		
Teaching volume		
Research production (publications)		
Impactful outreach		
Development of lucrative curricula	Expectations as regards the role of scholars	
Pedagogical fashion		
International status		
Scientific impact		
Business impact		

Table 2. Perception of organizational injustice by French business scholars

First-order codes	Second-order codes	Aggregate dimensions
Activities are not valued fairly (eg., publishing frequently vs. conducting a complex research project; managing a research center vs. managing a department; teaching at the undergraduate level vs. teaching at the graduate level; teaching in MBA vs. teaching in Msc.; supervising students' research vs. partnering with industrial actors)	Distributive	Perception of injustice
Unequal repartition of tasks between colleagues		
Processes and criteria of hiring, tenure, and promotion	Procedural	
Lack of respect for academic freedom		
Lack of support when confronted with workplace-related illness (stress, anxiety, burn-out, etc.)		
Performative discourse of excellence	Interactional	
Linguistic issues		
Pressures for interested collaborations		

Among the frequently-mentioned drawbacks of those practices are the following. They promote only one model of professorship and only a certain type of research production and diffusion. They put scholars into fierce competition with each other. They are enforced with a paternalistic approach, and are gender-biased. They do not respect the professional nature of the status of professor.

6. Concluding remarks

The commodification of higher education and the unfair nature of the accountability regime and the evaluation system it imposes on scholars have been much criticized. Beyond shaming, outrage, suspicion, and lamentation though– which we think are necessary parts of a collective soul-searching -, it has become imperative to support this whistleblowing endeavour with evidence from empirical research exposing the negative externalities of the

corporatization of universities and business schools from different parts of the world[2]. By conceptualizing business schools as a field of tensions and accountability university as a discourse, our paper raises awarness about the relevance and legitimacy of other existing but overlooked meanings (yet pre-existing) responsibility of higher education organizations.

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Impact of GUI personalization of a word processor on a learning activity course

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Abstract

This research investigates the impact of an activity of personalization of a graphical user interface by the learners, on their behavior of using the ILE. The analysis conducted is based on an exploitation of the interaction traces between the learner and the interface of a word processor software with advanced personalization and auto-writing features including training of spelling and a learning analytics management module. The results show that, several variables related to the facilitation conditions recognized by the ILE partly explain the writing activity. Navigation variable can be correlated with the knowledge of customization possibilities. If the automatic sentence generator has no significant effect on the number of misspellings found in the documents submitted, the intention to personalize the interface seems to have a greater effect than the act of personalization itself. But the impact of the personalization process on learning outcomes is still to be established.

Keywords: *UTAUT model, ILE, adaptation, word processor, learning analytics, user interface, activity, flexibility*

1. Introduction

The question of personalization of learning is a central topic in the field of research on interactive learning environment (ILE). If the digital environments are today, from the point of view of the system (Dillenbourg & Chounikine, 2007) more and more functional, the question of their adoption by the learners remains posed despite the efforts and means of educational engineering made. In the absence of ease and speed of their handling, the increase in functionality generally implemented makes it possible to adapt usage trajectories that are often thwarted by the emergence of instrumental conflicts (Marquet, 2011). The development of adaptive systems and intelligent tutors (Aleven et al., 2015) does not allow learners to escape the process of instrumental genesis (Rabardel, 1995) (Peraya 2018), a process in which we believe that the interface of the ILE is decisive.

In this paper, we are interested in the question of the role and effect of graphical interfaces in the learning activity course and the impact it has in spelling that we observe through learning analytics. Our work is based on the idea that on the ILE, the appearance and the behavior of metaphorical objects triggering actions and dependent on the graphical interface of the operating system, can be factors of acceptance of the digital environment but can modify the the very purpose of the activity. This research is the second stage of our research that we have started in 2018 with a first stage focusing on the adoption intent with the personalization of a graphical user interface with 50 users (Zeller & Mohib, 2019). We now expand it to the learning outcomes aspect, considering the first significant results we obtained.

2. Literature review

2.1. UTAUT and user

Many studies have been conducted on the adoption of a product or technology, particularly in the HMI (Human Machine Interface) community. However, most studies remain focused on the evaluation of functional specifications of a product leaving aside the evaluation of cognitive and psychological aspects. In this respect, the notions of acceptability and intention of use complete the purely functional evaluation.

Barcenilla and Bastien (2009) define the term of acceptability as the degree of integration and appropriation of an object in a context of use. The adoption intent that influences and predicts individual behavior (Venkatesh et al., 2008) is a prerequisite for use behavior in reference to Venkatesh's Unified Technology Acceptance Theory (UTAUT). According to this model, seven constructs were defined as significant determinants of adoption intent and grouped into four factors: 1) the expectations in terms of effort associated with the degree of facility associated with the use of the system; (2) the performance expectations

associated with the degree to which an individual believes that use of the system will help him achieve a goal; 3) the social influence associated with the degree to which an individual perceives that people who are important to him believe that he or she should use the new system; and 4) the enabling conditions associated with the degree to which an individual perceives that an organization and a support, a help, exist to help him in the use of the system. Four moderating variables were added: age, sex, experience and voluntarism. We use the UTAUT model because of the high number of constructed allowing a high explanatory power of the intention to use a technology.

2.2. Graphical user interface and learning analytics

An interface is intended to allow humans to communicate with the machine to perform one or more tasks on a computer that implements processes to achieve it. First represented in the form of an online order, the interfaces have become graphical, relying still today on the metaphor of the office with windows, icons, menus and pointing actions (WAMP).

Our review of literature leads us to consider the process of appropriating a graphical interface of an ILE as a factor contributing to adoption intentions. This process can be revealed by the analysis of differentiated traces according to four types of activity carried out on the software which are the personalization of the interface, the navigation in the software, the formatting and text editing. It aims to characterize the effect of one of the variables of the UTAUT model, namely the enabling conditions of an environment, by establishing its intersection with two of the other three explanatory variables of this model, namely performance expectations and expectations effort. Venkatesh (2008) defines facilitation conditions as "the degree to which an individual believes that a technical and organizational infrastructure exists in support of the use of the system". We call the graphical interface of technical infrastructure linking the educational part and the system part of the ILE. Our study relies on Learning Analytics that is on the collection of digital traces left by the learners on the ILE, which once exploited, make it possible to improve them and facilitate the (Tempelaar et al., 2012), using predictive modeling (Aguilar et al., 2015) or explanatory modeling (Lan et al., 2014).

3. Methodology

3.1. Writing and spelling

According to Amadieu and Tricot (2006) textual learning involves activities of comprehension, memorization and inference production. We have developed a word processer, Docyrus, with advanced customization functions, justified by the central place occupied by this type of software in the office suites and whose purposes and the interfaces

on which they are based are plural and multi-forms. We have enhanced the ability of the learner to highly personalize Docyrus interface at any time of the activity.

Word processors can be facilitating instruments for writing invention for purposes of creation, revision or even memorization. It places the student in a continuous interaction with the machine (Bruillard, 2016) with the purpose of modifying students writing skills (Delbrassine, 2018). But learning can take a long time (Nivat, 1985) depending on the level of mastery targeted. Writing stories and tales, even with automated processes, reports requires high writing skills that can to some extent dampen as "the productions that result from it are rarely entirely new" (Ward, 1995). We have implemented in Docyrus an auto-writing module which can generate sentences from key words to help the learner write phrases of its story. Some of those sentences have words that need to be granted in gender and number to advance learners in their spelling. Docyrus detects and saves errors relying on its learning analytics module (Leijten, M., Van Horenbeeck, E., & Van Waes, L., 2015) and offers the student to correct them.

4. The research

4.1 Facilitation conditions of ILE and learning outcomes in reports writing

In our research, we consider the possibility of customizing an interface from the point of view of its flexibility as one of the facilitation conditions contributing to the adoption intention and otherwise the learning outcomes. We try to answer the following research question : which variables from the ILE ownership process explain the course of a learning activity? Our general assumption is that there is a correlation between the learner's knowledge of possible interface customization actions and the course of the learning activity on the ILE due to the impact of the navigation in the ILE from the interface.

We also hypothesize that the knowledge by the learner, at a certain time of the activity, of the possibilities of personalizing the interface, act as a dissonant element with the prescribed task, thus producing a disturbing effect on the expected actions. In this sense, we consider that text formatting actions differ from writing.

4.2 Sample and procedure

The research actually took place during the French Fête de la Science at Strasbourg University in September 2019. 177 participants were asked during thirty minutes to using a new word processor – Docyrus - instead of their familiar word processor to write a short story. On clicking on the start button, and without any information on the steps of the training sequence being given to the users, they quickly navigated step by step to implement the functional blocks necessary for the use of word processor and the writing of their story along with having to deal with spelling suggestions. The challenge was get zero

spelling errors as some of those sentences that Docyrus auto-generated needed sometimes to be corrected in gender and number. The actions necessary for carrying out the activity required the learner to navigate between the different tabs of the interface ribbon. At the end of the workshop, participants submitted one archive file that contained two files. The first one was the text file that could be analysed to identify spelling mistakes. The second one was a spreadsheet file wich contained learning analytics. Each event generated by the student's use of the keyboard or mouse was captured in real time in Docyrus and time stamped in thousandths of a second. We retained a final sample of 65 measurements due to incomplete activities that stopped suddenly and lasted less than 10 minutes. We measured 6 variables : V1 Show_GUI_Form – sum of opening the interface customization screen actions, V2 Navigation_actions - sum of navigation actions, V3 Text_formating – sum of text formatting actions, V4 sum of insertion images actions in support of story writing, V5 sum of auto-writing actions, V6 sum of spelling errors. We present below the significant results we have obtained.

5. Results

2719 actions were recorded, each one consisting of multiple logs. We used Spearman's Rho since some variables do not follow a normal distribution. The results (table 1) analysed in SPSS show a correlation between the learner's knowledge of possible interface customization actions and the realization of the learning activity on the ILE.

Table 1. Correlation between knowledge of possible personalization and navigation actions M-F

		V1_Show_GUI_Form	V2_Navigation_actions
Spearman's rho	Correlation Coefficient	1.000	**.447****
	Sig. (2-tailed)	.	.000
	N	65	65

Correlation is significant at the 0.01 level (2-tailed).

Table 2. Correlation between knowledge of possible personalization and navigation actions - M

		V1_Show_GUI_Form	V2_Navigation_actions
Spearman's rho	Correlation Coefficient	1.000	**.494****
	Sig. (2-tailed)	.	.003
	N	34	34

Correlation is significant at the 0.01 level (2-tailed).

Table 3. Correlation between knowledge of possible personalization and navigation actions – F

		V1_Show_GUI_Form	V2_Navigation_actions
Spearman's rho	Correlation Coefficient	1.000	**.437****
	Sig. (2-tailed)	.	.014
	N	31	31

Correlation is significant at the 0.05 level (2-tailed).

In addition, a differentiation of the results by gender (table 2 and table 3) can be established as many studies based on the UTAUT model had previously established. Indeed, the significance of the correlation is greater in the male ($p < 0.01$) gender than the female gender ($p < 0.05$).

Table 4. Correlation between knowledge of possible personalization and text formating – M-F

		V1_Show_GUI_Form	V3_Text_formating
Spearman's rho	Correlation Coefficient	1,000	**,353****
	Sig. (2-tailed)	.	,004
	N	65	65

Correlation is significant at the 0.01 level (2-tailed).

Also, text formatting actions (V3_Text_formating) can be correlated with knowledge of the possibilities (V1_Show_GUI_Form) for customizing the interface (table 4) ($p < 0.01$) unlike other actions such as inserting an image (variable 4). We find no correlations between the auto-writing generator (V5) and the sum of spelling errors (V6) found in the documents.

6. Discussion

The results correlate the visualization of possible interface customization options with navigation in the software. The gender variable is a moderating variable as in the UTAUT model. But we did not find any correlation with the age variable. Likewise, a correlation could not be established between the interface customization actions and the navigation. Similarly, the passage to the act of personalizing the interface after consulting the options proposed in the personalization screen, is not established. With reference to Sperandio's (2008) work on systems ergonomics, we understand this refusal to personalize as the learner's fear of "losing control of his actions" on the ILE. The correlation between the text formatting actions and the consultation of the interface personalization screen which both divert the learner from his main editorial activity can be compared to the Hélices model

(Linard, 2001). This model of activity connects the double hierarchical and sequential management of the course of action. It poses the central role of the anticipated image of the goal and of the evaluation tests which play the role of compass in the self-control of the action. In our result we understand the interface as a possible revealer of some of the multiple criteria of intentional control: cognitive (perceptions, goals, strategies and plans), psycho-socio-affective (dispositions, attitudes, norms, values and conflicts) and temporal.

7. Conclusion

In this study, we evaluate the impact of learner personalization of a word-processing interface on their behavior of using the ILE. The results show that the knowledge of customization possibilities can be correlated with the navigation and the text formatting variables. These correlations are gendered with greater significance for males. But the knowledge of those possibilities can also divert the learner from his main activity, such as implementing formating text actions instead of writing. The interface as a link between the learner and the environment in order to facilitate interactions can also hinder the progress of the activity. In that sense, the impact of the personalization process on learning outcomes remains to be established.

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How to Motivate Students in Large-enrollment Courses for Active-learning

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Abstract
Large-enrollment courses are often necessary platforms for teaching in universities all over the world. This article will begin with a theoretical approach in which we introduce proofs from cognitive psychology that demonstrate the effectiveness of active learning methods over the more traditional structured, lecture based, lessons. Second part consists of analysis of our lectures and described 5 possibilities how to motivate students to be active learners. The qualitative analysis of students'feedback is in the end of article. Students appreciated most using ICT tools for instant feedback during lectures and the fact that they had an option to be active.

Keywords: *university teaching; large lectures; active learning.*

1. Introduction

Active learning urges students to be participants in the learning process, requiring them to think about the course material rather than to passively sit and listen. It consists of short content related individual or small-group activities that all students in a class are called upon to do, alternating with instructor-led intervals in which student responses are processed and new information is presented (Felder, Brent). It activates all students rather than just the few who choose to ask questions, volunteer answers or pursue a dialogue with the instructor.

Empirical evidence for active learning

There has been rising empirical evidence suggesting that active learning is beneficial for students. Most data come from experimental designs of teaching. Hake (1998 in Prince, 2004), in his study of more than 6,000 students, examined pre- and post-test data and found significantly improved performance for students in classes where interactive-engagement methods were used. Active learning also improves acquisition of expert attitudes toward the discipline (Deslauriers, Schelew, Wieman, 2011) and knowledge retention (Graffam, 2007). Baepler, et al., (2016) conducted a study with 41 students who were given a lecture with active learning techniques. These students gained exceeded grade expectations and learned more than their peers in the same course that were taught by classical methods. Brooks (2011 in Baepler et all., 2016) found the same results.

Ruhl, Hughes and Schloss (1987) conducted an experiment with two classes where an experimental group was taught with the so called “two minutes brake” and the controlled group was taught using a straight lecture. Two minutes brakes were used as an active learning technique periods of discussion or note taking at least three times during lecture. According to Rowe (1983 in Ruhl, Hughes and Schloss, 1987) this helps students to assimilate new information. Students in experimental group scored significantly higher in free recall of facts and performance on objective tests. One of the reasons why active learning methods are effective is that they break lectures into smaller parts. As we know, attention spans drop after 15-20 minutes.

Although we have vast evidence of effectiveness in active learning, traditional passive methods of teaching are still widely used, especially in big classes. Some teachers report resistance from students toward active learning techniques (Henderson, Dancy and Niewiadomska-Bugaj, 2012 in Deslauriersa, McCartya, Miller, Callaghana, Kestina, 2019). Richard M. Felder (2013), a great promoter of active learning explained that he lectured around 60% of the lesson, then made use of activities based on active learning. Active learning methods are not self generating. These activities need be connected with learning objectives that require additional planning by often trial and error techniques.

Safe environment

For learning, and especially active learning, it is necessary to establish a safe climate in the classroom. A safe climate can be understood as a place where students feel welcomed, can demonstrate their attitudes and ideas and can make mistakes. Graham and Gisi (2000) claim that classroom climate predicts students´ satisfaction. Wilson and Ryan (2013) claim that rapport between students and teachers leads to numerous positive student outcomes, including better attitudes toward the teacher and course, higher student motivation, and perceived learning. Supportive teachers and supportive classmates increase academic efficacy and academic engagement no matter the size of the class (Rosenfeld, Richman, & Bowman, 2000 in Barr, 2016). According to Barr (2016) students believe that their learning is enhanced through personal interaction both with teachers and other students. Richmond, Berglund, Epelbaum and Kelin (2015) found that instructor rapport accounted for 54% of the variance in end-of semester student ratings of instruction.

We can establish a safe climate by taking two different approaches into account: 1. building teacher-student rapport: teachers should reduce anonymity by introducing their professional interests and passions. In addition, it is important to provide information about courses and lectures. 2. building student-student rapport: using icebreakers set the tone for future lessons. Students should have the opportunity to also express their interests in the subject matter.

Tandem teaching

We see tandem teaching (or co-teaching) as one method to enrich teaching. Students (N=372) positively rated having two different knowledge bases on a current topic (Heck, 2011). Villa, et al., (2008 in...) found that tandem teaching is beneficial for students because it enables academic improvement and develops a greater sense of community. Tandem teaching helps to deliver more creative lessons with model dialogues where both experts can acknowledge their point of view on one theme. Teachers serve as a good model of cooperation and expert dialogue. Different opinions of both teachers that are based on different expertise engages a diversity of ideas.

2. Experience analysis

The authors of this article have a dual role at university. The first is the education of prospective teachers in the pedagogical-psychological component of teacher training. Their second is to educate academics from different disciplines and faculties of the University in a relatively new program for the development of pedagogical competences. This role of curriculum creators and lecturers in academic teaching then in turn influences their own concept of teaching at university. A detailed examination of our own practice then becomes

both a suitable resource for teaching academic staff and an impetus for our own teaching innovation. We focus on lectures in large groups, which are traditionally most influenced by rigid approaches in understanding the activities of teachers and students. In the following section we introduce five areas of innovation in our own teaching that are in line with the five basic principles of effective teaching at university.

2.1. Learning goals

It is essential to plan a course syllabus with learning goals and outcomes. We agree with Biggs & Tang (2011) that all innovation of instruction should begin and start with identifying the learning goals and outcomes. For example: the goal of this course is for students, in pedagogical context, to be able to characterize basic didactic terms. Students should be able analyze model learning situations. Furthermore, students should be able to explain the procedure of planning, implementation and evaluation of instruction with professional arguments.

We also set learning goals for every lecture. These goals are set to be achievable, measurable and realistic. Here is an example of one lecture: at the end of today's lecture you should be able to: one, recognize properly formulated learning objectives; two, explain and demonstrate the importance of cognitive, affective and sensorimotor goals in education; and three, compare the difficulty of three cognitive learning objectives. These goals are presented at the beginning of every lecture. Students are asked if they already understand these goals. They should then read the goals and show by hand how who understands them. The procedure is easy - palm on the desk means that they do not know anything about the theme (goal), palm highest as possible means that they already understand this goal.

At the end of the lecture students are asked again. We have two reasons for doing so: one, students can think about the lecture and learning goals (it helps fit it into memory); two, we have feedback about students´ understanding of the lecture.

2.2. Assignment

We agree that the final exam should be well planned from the beginning of the course and in close compliance with its goals, content and learning instruction; however, the "perfect" test is still in the creative process. Nowadays test consist open ended and close ended and questions (wit 0-3 right answers). Test consists of questions with lower and higher order thinking skills where own analysis of learning situation and argumentation of right choice is necessary. As an example, we can show one open ended question: "Write two learning goals of your future class according to your studied field." This question control the capability of setting learning goals and ability to apply this information to the students' field.

2.3. Co-teaching

Authors of this article have had 3 years experience with co-teaching in the course for academics. These courses were positively rated by academics. We also felt the courses were quite successful; therefore, we wanted to try this teaching method in a bigger group of students. It is important to note that both of us have a different professional background. One of us holds a Ph.D. in pedagogy with a masters in chemistry and the other one is holds a Ph.D. in educational psychology. This enables us to explain teaching and learning in a more profound way.

The course were divided into 12 weeks which means we had 12 lectures (1 lecture = 1,5 hour). Eight of the lectures were lead by the pedagogue, two were lead by the psychologist and one lecture was lead of the deputy director of a basic school. One special lecture was taught in tandem by the authors. The theme of the tandem lecture was "How to motivate students during a school lesson?". We divided the themes of each lecture and, when we felt it necessary, the other one added important (or missing) information from their specialisation.

2.4. Activating students during lectures

Introduction

We feel that the most important lessons are the first two. The first lecture in particular should serve as a model of communication and style of work with students. In big lecture halls students are especially not used to working actively during the lecture; therefore, it is important to gradually prepare them for this style of teaching (and learning). We start with introducing ourselves and our course. We feel the introduction should start in a friendly way: we not only say who we are and what we teach but also why. We try to promote our interest and therefore spread our passion for teaching to our students. Students get the information about the course, test and voluntary tasks in e-learning. the first activity is the measurement of the learning goals of forthcoming lecture (see part 3).

Short assignments during lecture

Students are asked to do a mini assignments during the lecture. These assignments have more purposes than only activation: 1. assignments that induces prior knowledge: for example, in the beginning of the lecture about motivation we ask students "Why do pupils learn?" Students discuss this question in pairs and come up with reasons for learning. 2. checking of understanding: instead of asking students questions "Do you understand? Is there anything you don´t understand? etc." we have mini assignments. For example, we ask students to apply theory to real life situations, e.g., how does one best motivate another to learn a new language? We then give them four possible answers to choose from.

Using practical examples

We always have our target group in mind: teachers or future teachers. When we try to apply theory to everyday situations, we choose situations with a higher probability of future occurrences. We are aware of examples that are not connected to real life situations and try to avoid them. For example, when we teach about classical conditioning in learning, we talk about pupils in classes, not drooling, Pavlovian dogs.

Using different types of motivation

Often in academia, motivation is spoken of loosely and applied generally. We say teachers should promote motivation in their students, students should be motivated for learning, etc. Our question is more focused: how does one promote motivation in large-enrollment courses through activation methods? However, it's quite well understood that not all students can be motivated by one method. Therefore, lectures should look to multiple sources of motivation. We tried to involve three types of motivation: achievement, social and cognitive. 1. Social motivation is actualised with co-operation activities. We often use the "write-pair-share" method or a discussion in pairs (mini group work). In addition, one should assume that there are some students who will be reluctant to cooperate. 2. Cognitive motivation can be actualised by solving problem based activities, or by discussing tasks with ambiguous solutions. The main goal need not be to find one right solution, but rather, more importantly, to discuss the process of finding a solution and to formulate expert argumentation. 3. Achievement - we use assignments with only one right answer. Students who want to be good (or best in the classroom) want to know if they are right, not just partially right.

2.5. E-learning and activities outside of a classroom

For those who want to learn more, be creative, or get extra points for an assignment, we prepare three activities with an option to get 7 additional points out of 100 maximum achievable in the exam. These three activities are: one, Mind Map of an interesting theme from didactics or educational psychology; two, analysis of taught class; three, turn in notes that are taken during the class. We also provide presentations for students. These presentations are in e-learning but students can obtain them only after lessons. Presentations are considered as help for students, not as a study material. There are also additional materials: articles, videos, etc. Motivated students can have more information, students who don't understand the material have multiple avenues to study more.

3. Students' feedback.

The following section consists of students' feedback that was collected by survey and direct written feedback from the last two semesters.

First semester's quantitative feedback:

Our first attempt in making the course more active for students was voluntarily rated by 24 out of 178 students. This feedback is official feedback that Charles University uses for rating all courses. Firstly, students have to rate the course on a scale where 0% means "very bad" and 100% is "completely unique". Our average course rating was 90.19%. Secondly, students had to rate the following statement: "Forms and methods of teaching were chosen purposefully with regard to the nature of the subject." Students rated on a scale from 1 to 4 where 1=totally agreed and 4=totally disagreed. Our average rating was 1.22.

Second semester's quantitative feedback:

Official feedback has not been collected yet for this semester. As we know from our previous semester, this official feedback is not completed by a lot of students. From our experience, only extremely satisfied and extremely dissatisfied students rate courses. Because of this, we decided to collect our own feedback at one of the last lectures. Students were asked to anonymously write down on one side of paper positives (what they appreciate) and on the other side negatives (what should have been better) of the course. We got a total of 52 student responses.

Qualitative feedback

In the following we devote to the feedback as analyzed by the MAXQDA program. We rewrote these statements, gave them code and categorized these codes in research categories. In the following we explain these categories and cite some students´statements, written in italics. Most statements (32) were in the category "using ICT tools for instant feedback". Students appreciated new methods in teaching, fourteen statements explicitly wrote about using "Kahoot", twelve wrote that they liked "Plickers" and one statement was about liking "Sketchnoting". Five of the statements were general (using ICT, showing us how to work with ICT). It was said that these techniques "varied within the lecture". The second most used category, with 28 student responses, was "activization of students". The typical statement was (paraphrasing): *"Students had the opportunity to engage in interesting ways."* Six times students wrote about the dialogic lecture". Seventeen statements were thematically connected with co-teaching. Six statements thematized the diversity: *"not only thematic but also taught from a variety of diverse points of view." T*wo people wrote that they liked co-teaching because of *"more varied teaching*", one student saw a positive in *"more specialized teachers".*

Eleven statements were about the instructors. Students wrote that we were *"nice", "had a positive attitude*", had *"nice behavior"* and it was a *"positive climate thanks to the teachers".* Eleven people wrote that our course was useful. For 9 people, presentations were important, especially when they were *"brief", "available"* and *"good".* Six

statements were put into the category "course in general": *"interesting lectures"* (5x). We were glad to read this feedback: *"please teach like this - whoever attended the class always looked forward to it".* Four people liked examples that *"were connected to practise", "ilustrative"* and *"practical".* Four people liked that we were using a microphone. Three people appreciate that we put materials in e-learning. Three students said that the content of the course was great (especially formative feedback). Two students noted that they liked the idea of voluntarily activities because it helped them *"not to be so stressed for the final exam".*

We especially appreciated the feedback from one student in particular: *"This course is suitable also for teachers who have had many years of experience. I was very interested in the goals of learning that can be very helpful to the teacher in focusing on their pupils' work. Knowledge of effective strategies is also beneficial to practice. Personally, I gradually included the information I learned in the class into my own teaching. Pupils are more involved in the lessons. They are motivated, well informed about the subject matter and are willing to cooperate and feel comfortable in the lessons. The disadvantage, however, is the slow progress. On the other hand, it is balanced by a deeper understanding and real practical use of the information."*

4. Conclusion

Our jobs as college professors can be exciting and beautiful. At the same time, it is an activity that requires great knowledge and skill in the areas of cognitive and social psychology, pedagogy, didactics as well as current knowledge from the latest research applied to effective teaching strategies. We see the necessity of changing traditionally taught large-enrollment courses into courses with more active learning environment for students.

We understand that these methods and techniques may not be the expertise of all academics. However, since it is our area of expertise and experience, we feel an added obligation to not only make it a further focus of our research to teach to others but also to implement these methods and techniques into our own classes unrelated to this focus. It is important to have the courage to try new ways of approaching students, overcome fear or failing and spending more time of creating effective lectures. After reap the rewards of your hard work, students get more active and come with their own ideas. Not only students learn new information but also we as a teachers get more from lectures.

Our findings have shown that active teaching methods are appreciated by students in the large lecture hall setting and seem to be congruent with the previosly cited Hake, et al., (1998 in Prince, 2004) study claiming that "active learning is beneficial for students". Verification research design with an experimental and control group seems the best way

how to add an important value to our further research. We also hope to further solidify our findings with continued applications to our courses.

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Public Health Observatories: a learning community model to foster knowledge transfer for sustainable cities

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Abstract

A Public Health Observatory (PHO) is a platform to provide "health intelligence" as a service for a specific population. The World Health Organization (WHO) identifies the primary purposes of PHOs as "monitoring health situations and trends, including assessing progress toward agreed-upon health-related targets; producing and sharing evidence; and, supporting the use of such evidence for policy and decision making" For the purposes of the PULSE project, create an observatory to function as a unique point of access to the PULSE technology for people both inside and outside the project consortium.Specifically, we create a platform for e-learning and knowledge sharing that it can be easily navigated by lay persons that are interested in learning about or participating in the PULSE project. We targeted specifically policymakers, clinicians, as well as leaders and citizens in other cities. As a concept, it reflects the principles participation, sustainability, and collaboration across sectors and levels of government The Observatory leverages on the Health in All Policies (HiAP) framework. HiAP is a cross-sectoral approach to public policy that systematically takes into account the health implications of decisions, seeks synergies, and avoids harmful health impacts in order to improve population health and health equity.

Keywords: *Knowledge Sharing; Public Health; Sustainable Cities*

1. Introduction

A Public Health Observatory can be thought of as a platform for providing "health intelligence" for a specific population. The World Health Organization identifies the primary purposes of the Observatories as "monitoring health situations and trends, including assessing progress toward agreed-upon health-related targets; producing and sharing evidence; and, supporting the use of such evidence for policy and decision making"(Leppo et al., 2015).

For the purposes of the PULSE project an Observatory to function as a unique point of access to the PULSE technology for people inside and outside of the project consortium has been created.

The platform that is a user friendly, simple, and straightforward tool so that it can be easily navigated by lay persons that are interested in learning about and/or participating in the PULSE project.

PULSE is a participative project focused on well-being in communities. The final goal is to build extensible models and technologies to predict, mitigate and manage public health problems, and promote population health, in cities-

The project developed a set of tools to disseminate examples of Health in all policies in the seven-participant cities.

PULSE leverages on diverse data sources and big data analytics to transform public health from a reactive to a predictive system, and from a system focused on surveillance to an inclusive and collaborative system supporting health equity.

The types of data are: demographic data across cities, air quality data, health and wellbeing data from questionnaires, data from the PULSE questionnaire/google document survey,air Quality Index (AQI) data from pilot cities,data from PulsAir app and Fitbit, open data; simulation modelling data,dashboards showing real time data, simulation and visualization tools. The public space of the observatory has been designed with the intent of collecting the interests of other stakeholders and cities around the world.

The Observatory manages information gathered through the PULSE technology (risk models and data from air quality sensors and mobile app) and from other external sources available in the test beds

1.1. The HiAP framework

Basically, the Observatory is a tool to foster the Health in All Policies (HiAP) framework. HiAP is a cross-sectoral approach to public policy that systematically takes into account the health implications of decisions, seeks synergies, and avoids harmful health impacts in

order to improve population health and health equity. As a concept, it reflects the principles of legitimacy, accountability, transparency and access to information, participation, sustainability, and collaboration across sectors and levels of government. As such, a broader goal is for the Observatory to be used to help decision makers consider health when implementing policy of any kind.

As defined by the World Health Organization, Health in All Policies (HiAP) is an approach to public policy across sectors that systematically takes into account the health and health systems implications of decisions, seeks synergies, and avoids harmful health impacts, in order to improve population health and health equity. A HiAP approach is founded on health-related rights and obligations. It emphasizes the consequences of public policies on health determinants and aims to improve the accountability of policy-makers for health impacts at all levels of policy-making (Solar et al. 2019).

Solar et al (2009) have proposed a conceptual framework for HiAP implementation, which includes several dimensions and elements involved in the implementation and sustainability of this approach . Firstly, they proposed an explanatory conceptual model of the initiation and implementation of "Health in All Policies" (Figure 1), based on a synthesis of existing literature describing intersectorial and whole-of-government approaches to policymaking in general, and health equity specifically.

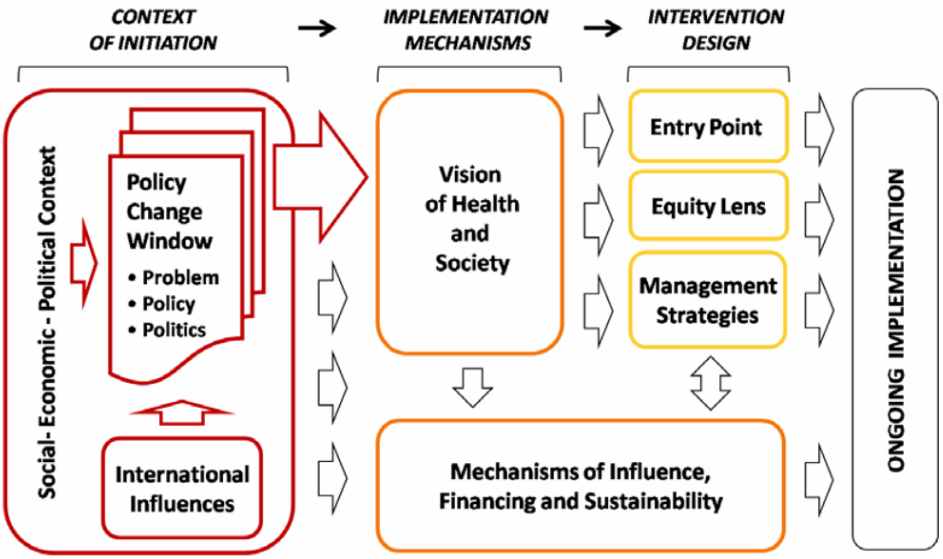

Figure 1.Getting Started with "Health in All Policies": A Conceptual Framework (Solar et al. 2009).

The framework includes three core conceptual domains, leading to ongoing interventions and policy-making that are mapped into three phases: context of initiation, implementation mechanism and intervention design.

2. The PULSE Public Health Observatory

The mission of the PULSE Observatory can be summarized as follows:

- Generating usable knowledge: our goal will be to use the observatory to help to generate knowledge relevant to issues faced by various stakeholders who design, decide, implement or benefit from interventions or policies that aim to improve health
- Facilitating the use of this knowledge: our goal is for stakeholders to use the data from the PULSE study (WebGIS, PulsAir mobile app, Fitbit, and air quality sensors) for the development, monitoring, and evaluation of policies on public health
- Encouraging communication and action based on this knowledge: there is the potential for tremendous benefits from our PULSE Observatory through encouraging dialogue between researchers, public health workers, citizens, and policy-makers about improving the health system.

According to WHO "the link between research and policy is not obvious and the 'transfer' of evidence in public policy requires a good understanding of the political process, taking into account the context in which action takes place." (WHO 2015).

Thus, PHOs plays an active role in brokering knowledge to bridge the gap between knowledge and action between researchers, public health workers, citizens, and policy-makers. The study on the structure of PHO in particular addressed the opportunities of the PULSE technology and how the project approach and techniques could be an ideal resource to at least provide a technological substrate to foster HiAP.

2.1. The Structure of PHO

The Consortium of PULSE worked to define a structure of the PULSE Public Health Observatory. Figure 2 depicts the most up to date version of the proposed structure for the Observatory.

The work has been carried out with the purpose of creating one unique web-based tool that is able to make visible and integrate all the activities of PULSE (Community of Practice, Learning Platforms, Health in All Policies, etc.), make visible and potentially exploitable the technological components of the project and finally be an official results page for the project.

2.2. Target groups

Five types of stakeholders to engage and also the possible technological tools and content available in the project to be shared has been identified for PHO in the following ways.

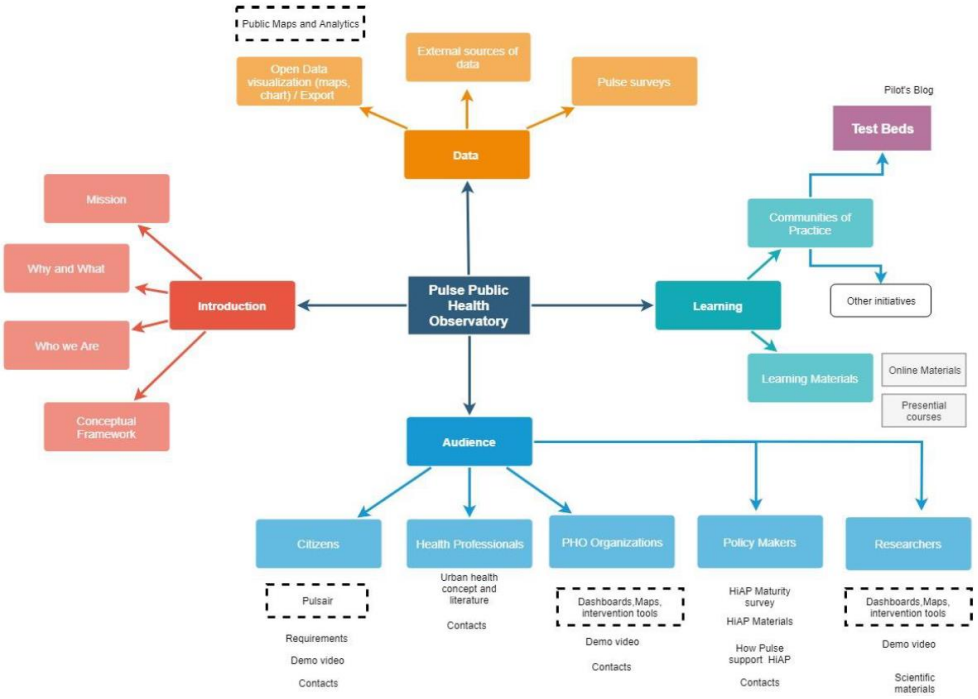

Figure 2. Structure of the PULSE Public Health Observatory.

The citizens are engaged through the mobile app, The Observatory provides general information about the app and its functionalities. All the citizens involved in the project use PulsAir, through which they actively take part in the system and they become both the starting point and the finish line of the data flow. PulsAIR is a novel participatory citizen science-based mobile application used to empower the citizens in their perceiving of urban environmental and health status, to foster a healthy lifestyle and to make people more aware about the air pollution in the city. Participants that consistently use the app and follow its advice are rewarded through a scoring mechanism that also works as an incentive to maintain interest. Through the app, Observatory is able to communicate directly with the population of the city. The web page also contains information about smartphone requirements (minimum operating system and hardware specs of the mobile phone), a demo video, and a contact form to gauge participant usage of PulsAir.

Health professionals are able to access project information and concept as well as literature about urban health.

The *Public Health Organizations* have access to the PULSE Dashboards and their functionalities (analytics, maps, risk models, simulation. A demonstration video will show

the full functionality of the tools. Members of the consortium have access to the actual developed Dashboards specific to the city in which they belong.

Policy makers engage with Health in All Policies through published material about the concept and through recommendations from the WHO. There is also be a Maturity Model Scale to assess uptake of an HiAP approach in cities

Furthermore, through the community of Practice, each test bed can share their experiences on how HiAP policies are applied in the city and how PULSE could technically foster the HiAP processes. As with public health organizations, *researchers* may be interested in dashboard-type tools that can be used to explore epidemiologic data and find correlations with health risks and pollution data.

Access to the Dashboards will allows for the comparison of data between cities (this feature is not accessible by PHO organizations). Furthermore, it will be possible to access the scientific material produced in the context of PULSE and from this initiative.

3. Learning Tools of PHO

The users of the Observatory can learn about the implementation strategies used by each pilot during the project. This includes a menu for each pilot city on the website where users can get information about the city as well findings from the study.

Although the final aim of PULSE is to create a versatile and adaptive platform that can potentially be applied to any urban environment, seven big cities across the globe were selected to test the PULSE system. These cities are Barcelona, Birmingham, New York City, Paris, Singapore, Pavia and Keelung. In each city, the app and the Fitbits are deployed to gather health and mobility data, in a unified format, from the population. However, each city has a differing access to public health and open data. Available data is integrated in the WebGIS and are being used to create specific dashboards and risk models for each pilot site. Moreover, air quality is measured differently in each city, through an integration of pre-existing monitoring stations and new air quality sensors purchased ad hoc during the project.

The Public Health Observatory proposes two approaches of learning:

- The Community of Practice (CoP) which can be used by each test bed (seven in total) to share information about deployment, focus of the pilot, and lessons learned. This section also contains experiences from other cities that are not a part of the project.
- Learning Materials: the Public Health Observatory also hosts a course on Big Data to Policy (BD2P) to train users to inform and shape urban policy across the health sector. Environment and transport content will be further developed in task 8.4 (PULSE Digital Training and Education Modules: Big Data to Policy). This material

will be digital, and it will also be possible to assist specific seminars (this is still under discussion among the PULSE partners).

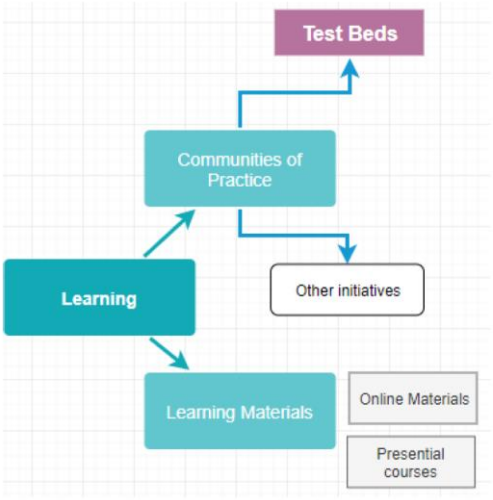

Figure 4. Schema of the learning services provided by the Public Health Observatory

3.1. Community of practice

The community of practice is intended as a web page shares all the information and news related to the test bed activities.

The contents are information about recruitment in each city, publications and conferences, content related to PULSE, video testimonials, interviews, preliminary pilot results (dynamic number of enrolled citizens, Air Quality (AQ) average in the cities, etc.), relevant content and initiatives from other online resources, links to training materials that are available on the WHO website.

3.2. Learning material: the new course Big Data to Policy (BD2P) course

The new course Big Data to Policy (BD2P) was defined and developed during WP8 of the PULSE project and has been subjected to an external review by market consultants (education) retained by Ohio University. These consultants have provided interim feedback indicating that the BD2P course is unique within offerings on the open market, especially given that the course is tailored to students who are not trained in data science.

It has a specific relevance to policy makers, and city officials, whose portfolios address a wide range of issues, including but not limited to sustainability, the climate neutral city, new mobility services and models, and population health and wellbeink. It fills a niche in urban design and planning and will be of interest to current students in further education, as well as practitioners in the field.

The course is subject to rigorous review and evaluation of user experience and satisfaction, and that the course be extended, over time, into adjacent areas of interest to potential students. The metrics to assess the BD2P course includes perceived usefulness, clarity, easiness of the educational material, feedback on the workload of the course, missing or expected contents, suggestions on how to improve the course.

4. Conclusions

The work reported the activities related to the definition, specification of the PULSE Public Health Observatory. These tools have been conceived as a comprehensive instrument available for different types of audiences (citizens, health care providers, PHOs, researchers, and policy makers) to learn and use data to take decision for public health. The paper describes the public accessible structure of the observatory that represent the framework of the project, how the project can foster the HiAP frameworks with the digital tools (Dashboards, CoP). The PULSE project also considers relevant to work on a final validation plan and present all the studies that will be performed in the remaining months.

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Critical Thinking on Technology Use: Higher Education Course Design to Promote Personal, Professional and Societal Change

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Abstract

Higher education is a venue for developing critical thinking skills, dispositions and actions (Davies, 2015). With the exponential growth of information and communications technologies (ICT) in the last thirty years, dynamic changes and societal impacts, and evolving research findings, intentional use for personal and professional well-being depends on emerging adults' critical thinking abilities. This paper describes the design of an undergraduate course and elements of critical thinking deployed through content, learning activities and assessments. Thematic analysis of student qualitative responses at the end of the course indicate specific areas of growth that represent gains in cognitive skills, dispositions and action orientations. These validate the selected methods of instruction and underscore the course design, content and pedagogical framework as applicable to a wide range of content areas and field domains in higher education.

Keywords: *critical thinking; dispositions; technology use; preprofessional standards.*

1. Introduction

A hallmark value of higher education is the acquisition of critical thinking skills that transfer to learners' future personal and professional lives and apply to their roles as global citizens (Casigrahi, 2017; Niu, Behar-Horentstein, & Garvan, 2013). Davies' (2015) model of critical thinking in higher education asserts that instructors and instructional designers integrate opportunities for critical thinking skills, expression of dispositions and determination of social action into the curriculum. Frameworks such as Bloom's taxonomy (1956) have long guided higher education instructional designers and educators on providing learning experiences that challenge existing cognitions and develop competencies for decision-making. Rather than teaching critical thinking as a separate skill or implying the acquisition of critical thinking, courses that infuse critical thinking within domain content are more successful in building these skills in meaningful and sustained ways (Abrami, et al, 2008). Critical thinking and action is goal directed (Ryan & Deci, 2000). Students in higher education experience a range of motivations for their learning, from personal (e.g., better understanding of oneself and direction in life); to practical (e.g., completing a degree), professional (e.g., gaining necessary competencies for a vocation), to global and societal (e.g, identifying steps toward wider change).

The use and presence of technology in our 21st century society is an aspect demanding attention to critical thinking experiences in higher education. Technology takes many forms and meanings, but concretely this means information and communications technologies (ICT) which include personal computing, social media, access to the Internet and digital devices, and learning technologies deployed in higher education. The topic is relevant for critical thinking competency-foci in higher education given that it touches on personal, professional and societal motivations of learners. The use of ICT is ubiquitous in emerging adults' lives, in their relationships and family connectivity, across fields of practice, and impacts society (Bialek & Fry, 2019). It is essential that higher education learners possess the skills to assess use and ramifications on their development and well-being . Yet the dynamic nature and relative recency of the phenomenon of ICT use and research on its effects bring particular importance for students' skills as critical thinkers. The advent of social media, 'smart' phones and homes, and cloud computing is within the lifetimes of most students in higher education (i.e., since 1990). The research on developmental impact is in early stages (e.g., yet the continual change in device and application availability challenge the interpretation and application of the results). Because of this, the technology consumer (in this case student in higher education poised to an adulthood of professional practice and family life) is often faced with competing information about the benefits or challenges to technology use; a situation that can leave the individual stymied in determining best practice for oneself and others. Critical thinking and action skills are required to make intentional decisions about the use of devices amidst a sea of incomplete

and changing data, and contexts that are inconsistent in their technology practices and supports (author).

This paper describes the creation and implementation of an undergraduate course on technology use with an emphasis on building learner critical thinking skills, dispositions and social actions. Although the course is embedded within the curriculum of a field (family studies) and adheres to domain principles, ethics and competencies specific to that field (e.g., National Council on Family Relations, 2014) its design presents a conceptual framework for the delivery of critical thinking skill instruction and activities that is widely applicable in higher education disciplines.

2. Course Design

2.1 Course description

Family Social Science 3105 Families and Technology is a 3 credit undergraduate course delivered at a midwestern public institution in the United States. It was developed in 2017 as a required course in the major. The classroom course is offered fall and spring semesters (15 weeks each) and heavily integrates technology for communication, content, collaboration and assessment during and between classes. On average 45 students are enrolled, representing learners across all undergraduate years. The course is listed as a "Technology and Society" elective by the university so approximately one fourth of the students represent non-family majors.

2.2 Course development

Design principles adhered to technology enhanced learning (ISTE, 2019; Wang & Hannifin, 2015). Content resulted from the designer's thorough review of the research and practice literature on implementation of technology by families and by family practitioners (e.g., parenting educators, marriage and family therapists, family financial planners, author, 2015). The course designer is an experienced family education scholar with more than 30 years of teaching and research in the area, and with specialized research on family and professional technology use since 2005 (author). The literature review identified topics that represent family structure and process interests (e.g., from couple formation and the use of dating apps, through parent-child relationships and family connectivity, work-family balance), and theoretical foundations framing the study of family and technology use and impacts. The second content dimension considered higher education's role in building pre-professional competencies and experiences. Field standards (e.g., American Association of Family and Consumer Sciences, 2013, American Association of Marriage and Family Therapists, 2015) indicate digital skills and practice ethics inclusive of technology. The final dimension framing content is the wider ecology that influences technology use.

Systems theory is a central tenet of family studies (Olson, DeFrain & Skogrand, 2014) with the shared perspective that individuals act on and are influenced by their proximal (e.g., family) and distal (e.g., community, society) relationships and networks. Therefore, an integrative view on technology use considered research on the individual, family and society, technology as a practice and content focus for professionals, the needs for professional preparation, and wider systems of influence (author).

2.3. Opportunities for building critical thinking skills, dispositions and actions

Davies' (2015) model of critical thinking in higher education incorporates cognitive skills and arguments as the traditional and central feature. Competencies represent Bloom's taxonomy (knowledge, comprehension, application, analysis, synthesis, evaluation) and those represented in problem-solving and decision making models (Halpern, 1998). Critical 'propensities' further represent the 'critical thinking movement:' affective, dispositions, emotions, attitudes and states of readiness. These relate to the self (e.g, tolerance of ambiguity, perseverance, desire to be well-informed) to others (e.g., respect for alternative viewpoints, understanding of individual differences) and in relation to the world (e.g., interest, inquisitiveness) (p. 58) Critical consideration of social conditions and actions represent what Davies' describes as the 'criticality' movement and the more familiar critical pedagogy movement. These activities focus the learners' interest in the inequalities and conditions affecting technology use and identification of action for social change and justice.

Weekly presentation of content in class and in reading, weekly short quizzes and in class discussion of topics promote comprehension, analysis, application of content. Objectve items on three exams test for comprehension, analysis and application. Open ended questions enable the demonstration of independent decision making, affective perspectives on technologies choices (e.g., recommendations for parent action given ambiguous conditions), and asserting actions for social change (e.g., recommendations for reducing digital divides experienced by global families).

Students prepare five blog posts (about 1 every 3 weeks) addressing critical thought prompts representing course content. The posts appear on the student's personal blog (made public or private depending on the students' preference). Each post is approximately 1000 words and includes 2 artifacts from the course (e.g., readings, video). A sample prompt: "*Listen to the podcast on the social media scandal at Harvard. What is your reaction to the ultimate decision related to a student's admission decision? Was it fair, given our current social media climate? Consider our class discussion about our individual use of technology and its additional impacts on others, and how our use is heavily influenced by others' expectations of us*." Prompts encourage students to write from multiple perspectives on an issue, apply content, identify wider influences on technology use and encourage avenues

for social change. A grading rubric assesses the quality of the post for clarity and incorporation of reliable sources, thus promoting student's digital literacy skills. It also assesses students' ability to critically apply, analyze or debate an alternative perspective.

Through an analysis project, students log their personal technology use for a 12 hour period and summarize quantitative. Then in a written paper, students analyze use relative to their personal well-being, and relationships (intimate, family, professional) and how the analysis informs their future work as family professionals. This critical thinking project enables a closer examination of behavior that has become familiar, unseen and unfelt to them as a generation who grew up with ICT (Bialek & Fry, 2019) to weigh its value to their health, learning, social experiences and intimate and family relationships. They reflect on the myriad influences on their technology choices and behaviors and identify actions past, present or future to assert balance (e.g., addressing distractions, reducing time on social media as mental health intervention). A grading rubric indicates the quality of the product and ability to applying critical thinking elements to their use.

All class/small group activities in each module emphasize movement beyond critical thinking cognitions to dispositions and actions. These include debates that argue two or more sides, discussion of different viewpoints, factors that influence behavior and actions that represent change. For example, early in the course students debate whether laptops should be prohibited in the classroom (following calls by some in the academic community and learning research). The activity identifies personal motivations for use (or non-use), social impacts (e.g., distractions to others, ability to collaborate), and wider institutional factors that encourage use (or that represent challenges). Following the debate, the class deliberates on preferred community actions to ensure inclusion and group satisfaction. The activity moves students from a place of individual preference to the wider social context of the classroom and institutional policies that affect choice. Other debates include appropriate ages for childrens' smartphone possession, responsibility for consequences of cyberbullying, and privacy concerns when sharing personal information online. Comparative activities include differences in technology preferences, comfort, skill and access that encourage dispositions of tolerance and resource identification. Each activity is selected to build on content awareness and application to more dispositional and action elements of critical thinking.

3. Course impacts and future perpsectives

Assessing student competencies on exams and quizzes, and project and blog grading indicates student achievement on par with other content courses in the major. The majority of students scoring 80% and above. More revealing of the critical thinking acheivement of the course are in student comments. During the initial (2017) and recent (2019) semesters,

students were asked to anonymously complete an open-ended question about the course: *As you consider the range of topics that we've discussed in the course, how or about what, if at all, will you think more critically about technology in our lives and in families' lives?* Thematic analysis appears in Table 1. For both classes, the two most frequent themes were thinking critically about personal technology use and recognizing the impact of technology on relationships. Two additional themes, thinking critically about how technology influences work / life balance and being aware of the digital divide and recognizing individual differences in technology use, were found to have similar frequencies between the classes.

Differences in the semesters may reflect different motivations of the individual class membership. While more targeted and controlled research is needed to test the effectiveness of critical thinking content and activities in the Families and Technology course as designed, intial evidence suggests value for a higher education course that encourages the next generation of professionals and parents' intentional ICT use.

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Table 1. Thematic Analysis of Critical Perspectives from FSOS 3105

Theme	2017 Frequency (n = 39)	2019 Frequency (n = 37)	Sample Quote
Thinking critically about personal technology use	9	9	"I will think more critically about how much time I spend on technology and what I use it for."
Recognizing the impact of technology on relationships	8	9	"Just to be more aware of the impacts on our daily lives and how it affects our relationships on a day to day basis...really spend time with people I care about without technology getting in the way."
Thinking critically about how technology influences work / life balance	5	6	"I think the balance of work and family life will continuously be a stressor and need to be addressed in order to maintain a healthy balance. I hope to be more self-aware as this begins to be a concern in my own life."
Being aware of the digital divide and recognizing individual differences in technology use	6	5	"As a result of this course I plan to stay more informed about the gaps and divides in our communities related to technology. I hope to find and create solutions that will support equal access of technology for all families and individuals."
Thinking critically about the pros and cons of childrens' technology use	7	1	"The many ways children today are submerged in technology. I will think more critically on how to limit that."
Changing perspective to view technology as a tool	0	5	"That technology is a tool, not something that can be good or bad."

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Reliability of multiple-choice versus problem-solving student exam scores in higher education: Empirical tests

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Abstract

Instructors in higher education frequently employ examinations composed of problem-solving questions to assess student knowledge and learning. But are student scores on these tests reliable? Surprisingly few have researched this question empirically, arguably because of perceived limitations in traditional research methods. Furthermore, many believe multiple choice exams to be a more objective, reliable form of testing students than any other type. We question this wide-spread belief. In a series of empirical studies in 8 classes (401 students) in a finance course, we used a methodology based on three key elements to examine these questions: A true experimental design, more appropriate estimation of exam score reliability, and reliability confidence intervals. Internal consistency reliabilities of problem-solving test scores were consistently high (all > .87, median = .90) across different classes, students, examiners, and exams. In contrast, multiple-choice test scores were less reliable (all < .69). Recommendations are presented for improving the construction of exams in higher education.

Keywords: *Exams; internal consistency; reliability, higher education.*

1. Introduction

Many instructors believe multiple-choice (MC) tests offer advantages over other question types (e.g., problem solving or essay): minimal effort to grade, reliability, and validity. We question this wide-spread belief. Many instructors in diverse fields construct what, in our opinion, are poor MC questions (e.g., poorly written alternatives and stems). We suspect that to use MC tests effectively, one must be trained psychometrically. In contrast, instructors in many disciplines commonly employ exams composed of problem-solving (PS) questions (Garg & Lee, 2016). We believe that such exams may provide an attractive alternative for many courses (though they certainly take longer to mark). PS questions offer advantages: they encourage higher-order critical thinking, typically take little time to construct, and seem well suited to the teaching demands of smaller, advanced courses or quantitative courses. We believe student scores on such exams are highly reliable, but are they? The purpose of this paper is to empirically assess the reliability of student scores on PS subtests and compare it with that for MC subtests on the same exam. In a series of empirical studies in 8 classes (401 students) in business finance, we used a methodology based on three key elements to examine these questions: A true experimental design (Lee & Whalen, 2007), appropriate estimation of exam score reliability, and reliability confidence intervals. We first review literature on reliability of exams and then describe the empirical approach used to address our major research question, and end by discussing the results and conclusions.

2. Literature Review

Important academic decisions are based, at least in part, on the marks that students attain on their examinations. Exam scores must be reliable (Brennan, 2001). The greater the reliability of student exam scores, the more confident we can be that differences in grades assigned reflect actual differences in the knowledge and skills being assessed and not the result of random error (Dracup, 1997). The error associated with student scores on an exam increases as reliability decreases. As well, tests with more questions are generally more reliable (Ebel, 1972). "Reliability, however, is not a property of the test itself, but a property of a set of test scores, (p. 25)" (Frisbie, 1988). Thus, an exam is not characterized by a single reliability but varies with the set of test scores. Classical test theory deals with the reliability of classroom exam scores (Nunnally & Bernstein, 1994). Morley (2014) asserts that internal consistency reliability, derived from classical theory, "is appropriate when we want to make statements about the respondent" (students, in our case). It is a measure of how well exam questions assess the learning in an academic course. It can be assessed from a single administration of a test, and it is a frequently reported measure of reliability (Hogan et al., 2000).

Following common psychometric practice, we estimated internal consistency reliability using coefficient alpha (α). Alpha is appropriate for estimating reliability provided all questions on a test are of the same kind and all questions are equally weighted (assumptions required by the tau-equivalent measurement model), as is typically true for MC tests. However, when these requirements are not met, alpha can underestimate reliability (Dunn et al., 2014; Miller, 1995). Estimates derived from a congeneric measurement model are more appropriate when questions are of different types or vary in score value, as they do for mixed-format or PS tests. We, therefore, also used the most commonly recommended measure of congeneric reliability, coefficient omega ω, in these cases (Padilla & Divers, 2013).

One should set a standard for reliability (Fan & Thompson, 2001). We set a minimum target in our study at .70 given practitioners for high stakes MC professional tests use this criterion (Williams et al., 2004) and classroom exams can be for high stakes (from a student perspective). What research has been conducted on reliability of MC and PS exams? Cox (1967) observed that despite the importance of examining, "very few of those actively engaged in it regard it as a field for experiment and research". We found only one paper on PS exams. Hill (1978) assessed 3.0-hr PS final exam scores in engineering courses and concluded that reliability was very poor. However, Hill assessed inter-marker reliability, not internal consistency. His exams consisted of 5-6 questions. At least 10 separately markable questions should be posed on an exam if reliability is to exceed .70 (Garg & Lee, 2016).

We confine our discussion of studies examining MC reliability to four well-conducted ones. First, Jensen et al. (2013) found the reliability (α) of a final exam in introductory biology in two classes (155 students) to be .66, a reliability many would consider too low. Second, Royal & Hedgpeth (2015), for a MC medical exam, also found reliability to be low at .60 (α). Third, for exams in intro physics, Harrison (2014) reports that over the years they were never able to achieve a reliability > .70 for their MC tests. Finally, DiBattista and Kurzawa (2011) report reliabilities in a comprehensive study of MC exams in 16 courses. Half of the classes had reliabilities lower than .70. These results suggest that MC test score reliabilities may not, in practice, be as high as believed. But can PS test score reliability be higher?

3. Method

3.1. Courses, Classes, Students, Instructors, Exams

Over a period of 4 years, 401 students attended one of 8 classes over 2-4 months with 39 lecture-hours at a mid-sized Canadian university in Introductory Finance I (a second-year course). About 50% were male, 50% female, with most aged 19 to 25. International students comprised approximately 50% of all students. While most were in their second

year of an undergraduate business degree, some were in their third and fourth years. This course covered: financial analysis, capital budgeting, working capital management, the tax environment, and the role of financial intermediaries. Two instructors, one male and one female, taught these classes. Students wrote a 3.0-hour final exam, typically worth about 50% of the total marks for the course. Each of these four mixed-format exams consisted of different question types: MC, PS, and, in some cases, a few short-answer (SA) or true-false (TF) questions. The number of alternative answers for each MC question varied between 4 to 6, and each MC question was always worth the same on a given exam (either 1% or 2%). An example MC exam question follows: Con Artists, Inc. has just paid a dividend of $0.55 per share. The dividends are expected to grow at an annual rate of 5 percent indefinitely. How much should the stock be sold for today if the required return is 12.5 percent? (a) $4.62, (b) $7.23, (c) $7.70, (d) $11.55, (e) none of the above. PS questions varied markedly in marks awarded, ranging from 2% to 15%. Such questions were composed of 1 to 6 different parts (with each part worth between 1% and 10%). An example of a PS question follows: Simkins Inc has just developed a solar panel capable of generating 200% more electricity than any solar panel currently on the market. As a result, Simkins is expected to experience a 15% annual growth rate for the next 3 years. By the end of 3 years, other firms will have developed comparable technology, and Simkins growth rate will slow to 5% per year forever. Shareholders require a return of 12% on Simkins stock. The most recent annual dividend, which was paid yesterday, was $1.75 per share. (a) Calculate the current market value of Simkins stock. (b) Calculate the expected market price in one year. (c) Calculate the expected dividend yield and capital gains yield expected during the first year. The university's Research Ethics Board deemed the research acceptable.

3.2. Procedure

Data constituted 8 empirical data sets, one for each class. A data set consisted of a set of n student vectors in a class, each vector composed of marks awarded on each part of each separately markable question on an exam. Marks for each exam (or subtest) that did not sum to 100 marks were then, for comparability, renormalized to a range of 0 to 100%. Thus, a mark of 55 out of a maximum possible 110 on such an exam would result in a grade of 50%.

3.3. Reliability Assessment

To compute coefficients alpha and omega, we used the MBESS package (Dunn et al., 2014) in R. The normal theory bootstrap approach was used as it is superior to other estimates for the small sample sizes typical of our classes (Padilla & Divers, 2013). For questions on the MC subtests, reliability was estimated using coefficient alpha (α_{mc}). The appropriate measure of reliability for mixed-format and PS tests is omega. However, coefficient alpha was also assessed to explore the degree of underestimation of reliability by coefficient

alpha in mixed-format and PS exams. Given the few TF or SA questions, we did not investigate them.

4. Results

4.1. Correlational Analyses

The correlation between MC and PS subtest scores reflects the extent to which these tests measure the same construct (knowledge in these finance classes). Student performance on MC subtests, in general, correlated only moderately with that for PS subtests (median raw r = .40). Estimates of true-score correlations, computed by dividing raw score correlation by the square root of the product of the MC and PS subtest reliabilities (Nunnally & Bernstein, 1994; Charter & Feldt, 2002), were higher with a median of .70. Both sets of correlations suggest that MC and PS subtests were measuring somewhat different learning about finance.

4.2. Reliability Analyses

Table 1 displays the internal consistency reliability estimates for all final exam and subtest scores for the four exams in the 8 classes. As expected, for the full-length mixed-format exams, coefficient alpha underestimated reliability in all 8 classes (all ω_{ex}'s > α_{ex}, median difference = .02). As well, for PS subtests, alpha underestimated reliability in all 8 classes (all ω_{ps}'s ≥ α_{ps}, median difference = .025). Consequently, we relied on coefficient omega to assess reliability for PS and mixed-format tests. For mixed-format final exams, all point estimates of reliability (ω_{ex}) exceeded the high standard of .80 set as our target (all $\omega_{ex} \geq$ .87, median ω_{ex} = .89). The same pattern was repeated for student scores on PS subtests (all $\omega_{ps} \geq$ .87, median ω_{ps} = .90). In contrast, for MC subtest scores, none of the point estimates of reliabilities (α_{mc}) met even the minimal target of .70 (all α_{mc} < .70, median α_{mc} = .41).

4.3. Spearman-Brown reliability analyses

For the exams administered, each MC subtest consisted of fewer questions, fewer total marks allocated, and less time allotted to answer than the PS subtest on the same examination. A fairer comparison between MC and PS subtest reliabilities would be to estimate the reliabilities of MC subtests equated on subtest length. Therefore, using the Spearman-Brown prophecy formula (Nunnally & Bernstein, 1994), we predicted the reliability (coefficient alpha) of a suitably lengthened MC subtest equated for the same final exam on the time allotted to complete each subtest or, equivalently, on the number of marks allotted since time and marks allotted were always confounded in our studies. The median Spearman-Brown reliability point estimate was .72 (mean = .70), suggesting that MC test scores, at least as constructed by these examiners, were typically not highly reliable.

Table 1. Reliabilities (α and ω) for student marks on MC subtests, PS subtests, and final exams

Class	Ex	n	α_{ex}	ω_{ex}	α_{mc}	α_{ps}	ω_{ps}
F1	1	48	.89	.91	.69	.86	.90
F2	1	49	.84	.87	.66	.85	.88
F3	2	48	.88	.89	.06	.88	.89
F4	2	51	.86	.88	.19	.85	.87
F5	3	43	.88	.89	.41	.89	.90
F6	3	56	.90	.91	.52	.90	.90
F7	4	48	.85	.89	.41	.85	.89
F8	4	58	.88	.92	.46	.88	.92

Note. Ex = exam; *n* = number of students; $\boldsymbol{\omega_{ex}}$ = coefficient omega for final exam composed of all types of questions; $\boldsymbol{\alpha_{mc}}$ = alpha for mc subtest; $\boldsymbol{\alpha_{ps}}$ = alpha for ps subtest; $\boldsymbol{\omega_{ps}}$ = omega for PS subtest.

4.4. Differences Between Reliabilities Analyses

For each class separately, we tested the difference between unadjusted reliabilities for MC and PS subtests using Feldt's (1980) repeated-measures *t*-test (null hypothesis H_0: $\alpha_{ps} = \alpha_{mc}$). The mean coefficient alpha for PS subtests were significantly higher (.87) than that for MC subtests (.70) in all 8 classes (all *p*'s < .05). Equating MC and PS subtests for time allotted to complete the subtest (or equivalently, worth the same number of marks), we found reliability for PS subtests to be significantly higher than that for MC subtests in 6 of the 8 classes (all except classes 1 and 2), using an *F*-test (H_0: $\alpha_{ps} = \alpha_{mc/SBtime}$) of the difference between dependent alpha reliabilities (adjusted using the Spearman-Brown formula to equate on number of test questions or test time) (Alsawalmeh & Feldt, 2000). α_{ps} underestimates the true reliability of the PS subtests since coefficient omega always equals or exceeds coefficient alpha for congeneric data (Hogan et al., 2012). Consequently, all of these statistical tests underestimate the significance of the difference in reliabilities between PS and MC subtests.

5. Discussion

Given the importance of making good decisions affecting the future of students, we ask how reliable our exams really are and whether we can increase the internal consistency reliability of grades awarded. Coefficient alpha, the most commonly used measure of reliability, often underestimates it. Instead, reliability of problem-solving exams is best estimated using a congeneric measurement model value such as coefficient omega (Qualls, 1995).

As predicted, PS subtest scores were consistently highly reliable across different classes, students, instructors, and exams (all $\omega_{ps} \geq .87$, median $\omega_{ps} = .90$). Furthermore, reliabilities for PS subtests (ω_{ps}) were always higher than those for MC subtests (equated on time for students to complete subtest, $\alpha_{mcSBtime}$) on the same final exam in all 8 classes. Why are PS tests consistently more reliable? We suspect that MC exams require extensive psychometric training (DiBattista & Kurzawa, 2011) whereas PS exams do not. Are MC tests the best way forward? Many believe so. Our review of the literature and our results argue against this position. MC score reliabilities were often below .70. While MC reliabilities can be improved with training, PS tests require no training. MC and PS subtests were only moderately correlated with one another. They seem to be assessing different knowledge on typical finance examinations, though this theme was not explored further here. Replication of earlier results should always be an objective for researchers (Anderson & Maxwell, 2016). We extended earlier findings of high internal-consistency reliability for mixed-format exams (Garg & Lee, 2016). In the present 8 studies, we found mixed-format exam scores were consistently highly reliable (median $\omega_{ex} = .89$), across different classes, students, professors (or examiners), and examinations. Also, as expected theoretically (Dunn et al., 2014), alpha consistently underestimated reliability (estimated by ω) by about .02 for both mixed-format and PS test scores.

A limitation is that our study was confined to testing only two professors and one course in a single subject area (business finance). Further testing should answer this question. Preliminary results from other classes, courses, and professors have replicated the current results. Finally, some instructors may be unfamiliar with our recommended statistical techniques while others may view them as complex; university statisticians may be helpful.

Instructors have a wide variety of question types to use on their course exams. In this paper, we have attempted to dispel the myth that MC tests are the most reliable type. It is important since critical decisions affecting students depend on the accuracy with which marks are assigned. PS tests, at least in some courses, are highly reliable and more than MC tests. We suspect that this effect is not specific to finance, but is somewhat general, extending to other quantitative courses such as business statistics, economics, and accounting. Any professor can use our methodology to assess the reliability of student scores on their own exams.

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Self-Contained Jupyter Notebook Labs Promote Scalable Signal Processing Education

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Abstract

Our upper-division course in Signals and Systems at UC Berkeley comprises primarily sophomore and junior undergraduates, and assumes only a basic background in Electrical Engineering and Computer Science. We've introduced Jupyter Notebook Python labs to complement the theoretical material covered in more traditional lectures and homeworks.

Courses at other institutions have created labs with a similar goal in mind. However, many have a hardware component or involve in-person lab sections that require teaching staff to monitor progress. This presents a significant barrier for deployment in larger courses. Virtual labs—in particular, pure software assignments using the Jupyter Notebook framework—recently emerged as a solution to this problem. Some courses use programming-only labs that lack the modularity and rich user interface of Jupyter Notebook's cell-based design. Other labs based on the Jupyter Notebook have not yet tapped the full potential of its versatile features.

Our labs (1) demonstrate real-life applications; (2) cultivate computational literacy; and (3) are structured to be self-contained. These design principles reduce overhead for teaching staff and give students relevant experience for research and industry.

Keywords: *Python, Jupyter Notebooks, virtual labs, educational technology, signals and systems, electrical engineering.*

1. Introduction

1.1. Signals and Systems at UC Berkeley

Undergraduates in our Electrical Engineering and Computer Sciences (EECS) Department at UC Berkeley take six lower-division courses: (1 and 2) *Designing Information Devices and Systems I and II*; (3) *Discrete Mathematics and Probability Theory*; (4) *Structure and Interpretation of Computer Programs*; (5) *Data Structures*; and (6) *Machine Structures*. The first three constitute a design and modeling trilogy, and the last three a computation trilogy. Students take these two sequences in parallel during their first four semesters.

Our course in Signals and Systems assumes completion only of the first two courses in each trilogy—constituting a background in linear algebra, basic modeling, and two semesters of programming experience. We cover linear time-invariant (LTI) system theory, Fourier analysis, analog-to-digital sampling theory, and system analysis using the Z and Laplace transforms. Our course is a hub to the upper-division EECS curriculum, including more advanced courses, such as *Digital Signal Processing* and *Feedback Control Systems*.

In fall 2015, our Department's lower-division EE curriculum was restructured, with courses (1 and 2) replacing *EE 40: Introduction to Microelectronic Circuits* and *EE20N: Structure and Interpretation of Signals and Systems*. Our Department used to offer two Signals and Systems courses, one in the lower-division (*EE 20N*) and one in the upper-division (*EE 120: Signals and Systems*, our course). The lower-division course had a significant lab component (Lee & Varaiya, 2003; Liu *et al.*, 2010) with weekly sections where students completed in-person MATLAB or LabView assignments. Many other institutions use something similar in their counterpart courses. After the 2015 curriculum revision, students in our upper-division course in Signals and Systems continued to engage with the material primarily through written homework assignments and weekly discussion sections. However, until recently, the course continued without a substantive lab component.

1.2. Design Considerations

Around the time our Department restructured its lower-division curriculum, the Jupyter Notebook (Kluyver *et al.*, 2016) was published as a spin-off of the IPython suite (Pérez & Granger, 2007), providing an interactive platform for scientific computing ("Project Jupyter," 2020). Since its initial release, the Jupyter Notebook has exploded in popularity as an educational tool in fields such as signal processing, machine learning, and artificial intelligence (Lovejoy & Wickert, 2015; O'Hara *et al.*, 2015; Granado *et al.*, 2018; Herta *et al.*, 2019). Even within our Department, many other courses, such as *EE 123: Digital Signal Processing* and *EECS 126: Probability and Random Processes*, use Jupyter Notebook assignments.

In light of our course's role in the EECS curriculum, we reintroduced a hands-on lab component, and specified three requirements to make better use of the Jupyter Notebook's rich features. First, students should connect lab material to real-world applications, tracing the path from abstract mathematical concepts to concrete engineering.

Second, the programming tasks within the labs should foster proficiency in the modern scientific computing libraries used in industry and academe. Physical labs in a Circuits course teach students the ins and outs of hardware tools, such as oscilloscopes and function generators. Virtual labs in a Signals and Systems course should highlight the techniques essential to modern software implementations, such as vectorized algorithms.

Third, the labs should be self-contained, so they do not demand excessive hand-holding by the teaching staff. This enables scaling to higher enrollments, especially where access limitations to personnel, physical space, budget, and other resources exist.

In this paper, we offer a tour of one of our labs. We discuss how—through a delicate interplay of Python code, embedded media, and graphical representations of data—we've created virtual labs that take advantage of the strengths of the Jupyter Notebook to enhance student learning. Counterpart labs that we've surveyed at peer institutions fall short in at least one of these three design principles. Creating labs that satisfy these criteria has allowed us to cover the gamut from basic theory to state-of-the-art applications, and to limit logistical overhead.

2. The Labs

2.1. Related Work

Signals and Systems courses often use labs to reinforce theoretical content from lecture:

- *Intro to Signal Processing* ("ECE 2026," 2018) at Georgia Tech features MATLAB coding labs that extend conventional pen-and-paper problem sets. Most labs have a strong application focus and concrete visual or auditory components, but demand substantive in-person instructor time for verification of multiple checkpoints.
- *Signals and Systems* ("ELE 301," 2011) at Princeton has MATLAB-based labs, several requiring in-person checkoffs of hardware or software implementation.
- *Signals and Systems* (https://sigproc.mit.edu/fall19) at MIT has Python exercises. As the students implement most exercises using Python primitives, they don't taste the richness of Python's open-source scientific computing libraries, such as NumPy and SciPy for multidimensional arrays and signal processing, and Matplotlib for drawing plots.

The Jupyter Notebook is a useful tool to teach signal processing concepts. However, many collections of notebooks available online, such as the companion GitHub repository for the book "Python for Signal Processing" (Unpingco, 2014), are not intended for classroom use. Furthermore, many are not self-contained. For example, some use mathematical knowledge, such as probability and optimization, without providing sufficient background.

Table 1. Labs for *EE 120: Signals and Systems* at UC Berkeley, Spring 2020.

Lab	Topics
Lab 1: Introduction to Python for Signals and Systems	Essentials of the Python programming language and scientific libraries, rectangular/exponential signal generation, convolution
Lab 2: Applications of LTI Filtering	1D edge detector, simple moving average for denoising, exponential moving averaging of stock price data
Lab 3: Practical Fourier Analysis	Naive Discrete Fourier Transform (DFT), matrix-vector DFT, and FFT implementation, virtual oscilloscope calibration
Lab 4: Heart Rate Monitoring	Spatial averaging of video of patient's thumb for dimensionality reduction, extracting heartbeat frequency through FFT
Lab 5: Deconvolution and Imaging	2D convolution (image blurring and sharpening), deconvolution (audio echo cancellation, Hubble telescope image deblurring)
Lab 6: Control	Closed-loop system analysis, signal filtering, root locus analysis, feedback control of a virtual inverted pendulum

2.2. Summary of Contributions

Table 1 summarizes the Jupyter Notebook labs deployed in the spring 2020 semester. Each Notebook is a single document that consists of text, code, and embedded media "cells" that are rendered or executed. Although teaching staff provide support during office hours and through the Piazza online discussion platform at https://piazza.com, most students complete the labs autonomously and asynchronously because of the labs' self-contained design:

- Specifications are narrow and well-defined, often on a function-by-function basis, to guide students to implement a sophisticated application without going off-track.
- Hints about useful scientific computing library routines and in-text hyperlinks to library documentation build student fluency with computational tools.
- Test cases and juxtaposed plots of expected and actual results help students verify their progress without divulging the algorithm, reducing debugging frustration.
- Extensive references allow students to dive into the literature that inspired the labs.

3. Case Study: Deconvolution and Imaging Lab

Deconvolution and image processing are extensions of the explicit scope of the course. However, we release this lab later in the semester as a wider exploration of the field. By introducing our students to higher-dimensional problems and unexpected contexts, the lab augments their understanding of the operations and transforms taught in the course.

3.1. Real-World Applications

Students often ask, "Can we *undo* convolution?" This lab presents two deconvolution problems. In the first, they remove echoes from corrupted audio data (Eneroth, 2001). In the second, they extend 1D concepts learned in the first problem to deblur 2D image data. Fig. 1(a) shows deep-space image blurring produced by mirror imperfections of the $1.5B Hubble Space Telescope. Inspired by expert proposals of that time (e.g., White, 1992), the lab teaches students how to apply deconvolution algorithms to deblur such images. Fig. 1(b) shows a deblurred image. Students reproduce stunning results through a series of building blocks, such as signal quantization, subtractive image sharpening, and Gaussian blurring—each of which is an important signal processing application in its own right.

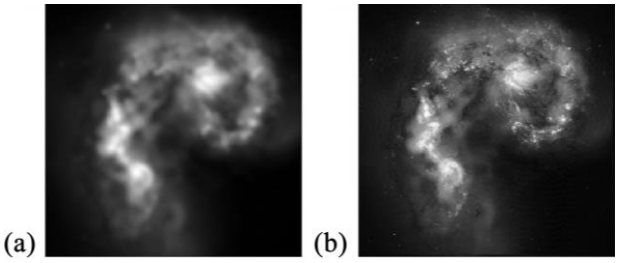

Fig. 1. *Space image deconvolution results. Source: ESA/Hubble, distributed under CC BY 4.0.*

3.2. Computational Literacy

Before students implement sophisticated algorithms, they learn how to load, and understand the structure of, the underlying signal data. In the audio module, they learn how to use the `scipy.io.wavfile` module to read and write a WAV file, understand its matrix dimensions, and recognize its underlying sampling rate. In the image module, they learn how to use the `matplotlib.pyplot.imread` function to read an image and understand how its data matrix renders on the screen. Fig. 2 illustrates how a 1D integer array is converted to a 2D matrix, and how each matrix entry is mapped to a pixel luminance.

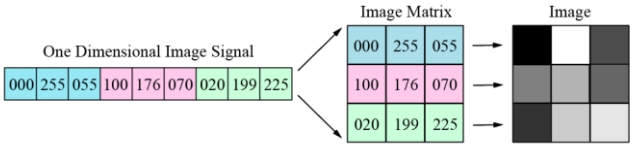

Fig. 2. *Guided example of understanding the underlying image data. Source: Own elaboration.*

Next, the lab shows students how to use, and understand the outputs of, functions from the `numpy.fft`, `numpy.linalg`, and `scipy.signal` modules by solving short subproblems. Students demonstrate their comprehension in subsequent larger programming sections. To reinforce the power of these libraries, the final section of the lab cautions students that their code, if implemented incorrectly or inefficiently, may take too long to converge to a correct solution. An efficient solution that invokes these libraries should take only seconds.

A drawback of functions in high-level scientific computing libraries is that they often accept unwieldy combinations of parameters. Student submissions and feedback helped us find ways to mitigate this. At the first appearance of each function, we embed in the lab direct links to relevant documentation. As the libraries are open-source, students can even study the full source code of each function, if they wish.

Sometimes we instruct students to inject deliberate errors into their code and interpret the results. In this lab, we ask students to blur an image, Fig. 3(a), using a Gaussian filter having an unsuitable convolution parameter, rather than a recommended one. They must then comment on the sudden appearance of a black border in the resultant image, Fig. 3(b). This teaches the effects of parameter modifications, and cultivates debugging skills when students identify similar errors in later exercises.

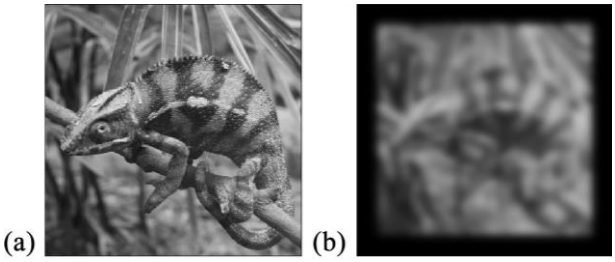

Fig. 3. *Example of purposeful error. Source: Own elaboration.*

Finally, we introduce the parameter sweep, an effective brute force method. Often, there is no simple expression for an optimal parameter value—as is the case when choosing a Gaussian filter for the final deconvolution problem in this lab—and the student's best option is to sweep a range of values to identify which ones produce acceptable results.

3.3. Self-Containment

Jupyter Notebooks eliminate many traditional scalability problems, such as material distribution and access moderation. However, the number of students who require staff assistance still grows with enrollment, which can bottleneck course expansion.

To address this, the lab guides the students through tasks ranging from loading audio data to writing a nested parameter sweep, building skills—as students need them—to complete all the exercises. Furthermore, the Jupyter Notebook's cell-based design allows for students to complete sections in a nonsequential order. For example, if they are stuck on the audio section, they can take a break from it and work on the imaging sections.

4. Student Feedback

After each lab, we conduct an anonymous survey to determine what to fine-tune in the future. Fig. 4 depicts how self-contained, interesting, and applications-driven our students found the first three labs offered in spring 2020. Typically, we receive 20-30 responses—about a 25% yield. Our data suggest that a high percentage of our students believe that the labs adhere to the design principles we've laid out in this paper.

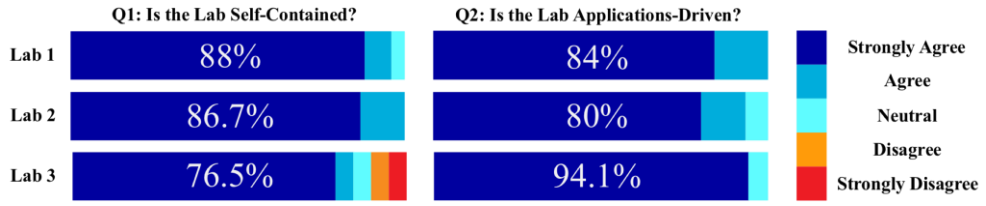

Fig. 4. *Anonymous student feedback.* ***Q1:*** *"The lab was self-contained, and all of the information I needed to complete it was in the instructions or easily Google-able documentation."* ***Q2:*** *"The lab was interesting and applications-driven, with a clear connection between its content and the concepts from lecture and discussion."*

5. Conclusions and Future Work

We have showcased an approach to lab design that emphasizes applications as well as a flavorful use of open-source scientific computing libraries to train and motivate students for research and industry. Every resource needed to complete each lab is embedded therein. So, each lab is self-contained, scalable, and deployable with limited administrative overhead.

We have six labs now, and plan to create four additional ones. We will publish all ten online at https://github.com/dominiccarrano/ee-120-labs, so our colleagues at other institutions can adopt them and give us constructive feedback. We intend to integrate tools for the Jupyter Notebook—such as the *nbgrader* project at

https://nbgrader.readthedocs.io—into our labs, so we can automate lab grading in the future.

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Travel as pedagogy: embodied learning in short-term study abroad

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Abstract

In this paper I discuss a model for creating embodied learning opportunities in study abroad curricula, which purposefully uses students' physical movement through foreign landscapes to inform and enhance their understanding of local social, political, economic, cultural, and historical phenomena. Pedagogical tactics include: challenging and reframing the common distinction between "important" and "unimportant" instructional times and places; loosely structured itineraries that allow for greater student autonomy and collaboration; seeking multiple vantage points (both geographic and textual) from which to observe and analyze locations ; purposeful and attentive travel between study locations that helps connect cognitive to visceral experience. These tactics help students cultivate the ability to read landscapes, a skill that them to understand a landscape not only as historical narrative but also as a social actor that influences and is influenced by the everyday practices of people who inhabit it. To demonstrate these strategies, I discuss how they were implemented in a recent short-term study abroad program to various sites within the former Yugoslavia.

Keywords: *study abroad; embodied learning; spatial learning; experiential learning; intercultural competence; Balkan studies; higher education*

1. Introduction

Social scientists commonly recognize the landscape as a palimpsest wherein structures built in the past, and the ideas that informed and are inscribed in their physical structure, continue to be visible in the present day. Because the built environment requires humans to maintain it, the various dynamics of social action are inscribed upon and can be read from numerous aspects of landscapes (spatial relationships between buildings and other elements; patterns of use, maintenance, and neglect). Once built, landscape elements operate as a further constraint upon human action, both practically and symbolically, and serve as a resource for the construction of collective – and often hotly contested – ethnic, religious, and political identities. As such, landscape elements frequently serve as visible, material focal points for struggles over both resources and meanings. While different forms of media (books, photos, audio recordings, film, etc.) may be used to describe the various relevant aspects of landscapes that contribute to the narrative of place, all fall short in important respects. To fully understand landscapes – their relationship with people and other places, their evolution over time, the multiple and contested meanings inscribed upon them by contemporary and historical constituencies – they must be experienced from multiple angles, over a period of time, with all of their attendant sounds, smells, and sensations, and subject to all of the thoughts and emotions that they may evoke. They must be read, in person, as texts. As with any other type of text, a careful and thorough reading of landscapes reveal multifaceted narratives about the humans who inhabit them.

Here, I describe some considerations in constructing and teaching a college-level study abroad curriculum where the reading schedule consists of landscapes, landmarks, and the spaces that connect them, using a recent short-term program to Yugoslavia to illustrate important strategies involved with this approach. An embodied learning approach moves beyond using travel as a simple practical necessity for visiting multiple sites, and towards using the act of travel itself as a pedagogical tool that imparts a visceral, embodied knowledge of landscapes and the layers of meaning with which they are inscribed.

2. Short term study abroad and embodied learning – challenges and opportunities

Pedagogies of embodied cognition, or embodied learning, are premised upon findings in neuroscience and cognitive psychology indicating that sensory perceptions and processing structures are closely aligned, and in some instances overlap, with processes and structures associated with memory and comprehension (Nguyen and Larson 2015; Skulmowski and Rey 2018). In simple form, we are better able to recall an event with which we associate a specific sensory experience, laying the foundation for better comprehension. Embodied learning approaches range from minimal (creating unique gestures to aid memorization of

vocabulary terms) to immersive (using improvisational skits to develop understanding of micro-sociological theory).

All short-term study abroad programs – meaning, programs in which students travel in a group with teaching faculty, lasting anywhere from one to four weeks – are inherently embodied experiences to some degree though the involvement of physical travel. However, the mere fact of physical movement through space does not in and of itself guarantee embodied learning, which occurs when sensory experiences are directly and coherently linked to learning objectives; ensuring embodied learning requires greater intentionality in planning and executing the spatial and experiential aspects of the curriculum, as well as attention to elements of the framing and execution of programs that may undermine embodied learning objectives.

2.1. The tyranny of "important" times and places

One of the principle challenges to creating deep learning in short-term study abroad programs is the way in which administrative and logistical operations frame and constrain the learning environment. Short-term study abroad programs are a powerful and effective means to increase the availability of foreign travel experience to students who may be otherwise precluded due to time and/or resource constraints (Mills, Vrba, and Deviny 2012). However, marketing materials for these programs often conflate their touristic popularity with their academic importance as a mechanism for attracting student participants, and program itineraries show a strong magnetic pull towards the "important" sites that appear on postcards and figure largely in promotional brochures. Recruiting students based on the touristic appeal of "important" places thus initially frames the program as a touristic experience; no matter how carefully conceived and thoughtfully instructed these courses may be, students who understand certain sites as "important" come to view the temporal and geographic spaces between these "important" sites as vacancies to be filled with down-time activities (texting, chatting, napping, shopping) that are unrelated to course content. This framing is further reinforced by well-meaning program leaders who desire to give students a value-packed experience, and thus afford students scant free time to rest from the myriad physical, mental, and social demands of intensive study travel.

A second and related challenge is the temptation for students to adopt the "tourist gaze" (Urry 1990) during both "important" and "unimportant" time, wherein all aspects of the students' surroundings in unfamiliar places are treated as exotic and representative of a uniquely local perspective and culture. The problem here lies not with the heightened scrutiny that characterizes the tourist gaze – which, if properly directed, can be profoundly beneficial – but instead in its unexamined character. Students may be disinclined to share their personal reflections with faculty, particularly when these observations occur in "unimportant" times and places, due to concerns that their personal experience is irrelevant

to the course (indeed, this notion is sometimes cultivated by program leaders and study abroad staff, who refer to the program leaders' "dual role" as both instructors and chaperones, and who may advise students to remain mindful of the distinction). When the tourist gaze occurs during "unimportant" time, it remains uncritical, unscrutinized, and beyond the reach of faculty who are equipped to provide additional expertise that helps students contextualize, interpret, and curate their observations. Redirecting this tourist gaze from its essentialist and ethnocentric foundation involves harnessing the students' curiosity, regardless of its original direction, and providing a mechanism and a rationale for drawing students' individual sensory experiences into the realm of collective scholarly inquiry.

2.2. Reframing the value and purpose of time and place

Challenging the bifurcated framing of "important/ instructional" and "unimportant/ free/ leisure" times and locations, and the corollary danger of the unchallenged touristic gaze, requires incorporating both practical and symbolic alternatives. If students are expected to remain alert and attentive during times when the group is convened, then as a practical matter they must be allowed sufficient individual time to rest their bodies and minds alike from the heavy demands of instructional travel. As a symbolic matter, the language of "important/instructional" time and place and "unimportant/free/leisure)" time and place must be replaced with the language of "group" time and "individual" time, which vary not by importance or instructional value, but instead by the orientation of each student's attention to collective aims (activities oriented towards group-level analysis of the landscape) versus personal aims (activities that satisfy individual curiosity, needs for rest and relaxation, etc.), neither of which takes precedence in instructional importance and both of which actively contribute to the students' ability to read landscapes. Along with this reframing language, "individual time" must be carefully protected from the temptation to scale it back when the activities occurring in "group time" overrun their time. Students should be allowed some control over group time, including directing the group's attention to sites that aren't on the itinerary and introducing topics and observations of personal interest and inquiry. To allow for student autonomy and serendipitous discovery of landscape elements, itineraries must be flexible enough to be easily changed if the situation demands (for this reason, walking and public transportation are preferred for local travel). For both group and individual time, students should be reminded that their most important discoveries and contributions to the group may occur in what would normally be considered the "unimportant" places and times.

3. Travel as pedagogy

To illustrate the advantages of an embodied learning environment in short-term study abroad, I draw upon my experience co-directing a college-level program across some of the

states of the former Yugoslavia. This 3-credit course, titled "Twice There Was A Country," was taught collaboratively by an historian (my colleague) and a sociologist (me) to develop students' understanding of borders – how they are constructed and naturalized, the ideological work that they perform, and their consequences for human populations – as they occur during the formation and breakup of the Yugoslavian state in the 20th century. Throughout the nineteen day program, during which we traveled through sites in Serbia, Macedonia, Bosnia & Herzegovina, and Croatia, undergraduate students encounter visual evidence of both Yugoslav and post-Yugoslav nationalisms, the human and environmental casualties of the Balkan Wars, the ruin / re-appropriation / resurrection of Communist-era sites and monuments, and the revered and abandoned touchstones of collective historical identity; meanwhile, students read texts written from a variety of disciplinary perspectives as well as from popular media, and keep a journal that records their experiences, perceptions, and ideas as they see fit.

One program day illustrates our encounters with many of these sights, the itinerary which reads in its entirety as follows: "June 4 - Mostar: Old Bridge, Bruce Lee statue, Partisan Monument." During our second day in Mostar, Bosnia & Herzegovina, we began the day by walking from our lodgings to a copy shop, where we ordered each student copies of two articles that my colleague and I located in response to a question posed by a student the previous day. We then walked to the partisan monument on the outskirts of town, a Communist-era park that has since been overtaken by weeds and signs of vandalism, and spent some time exploring and remarking upon its similarity to a photograph of the park from the 1980s that students had seen previously, the placement and content of vandalistic acts, the mood evoked by the architectural elements, and the remarkable volume of insect chatter that was the dominant sound of the place. Our walk back towards the center of town took us through the university section and along shady streets lined with cafes, where we stopped for a few minutes to take in refreshments and discuss students' impressions of the park. After picking up our photocopies, we strolled through a large neighborhood park containing a statue of Bruce Lee; this statue was erected in the early 2000s when the ravages of the Balkan Wars were still fresh in local memory, and during a time when the only statue design that could win the approval of the majority of Mostar residents was of a pop culture figure with no connection whatsoever to the region. Students posed for pictures with the Bruce Lee statue, and then we continued to walk back towards the center of town. We happened upon a small cemetery in a residential neighborhood, occupying a small single-dwelling lot, wherein every grave marker was inscribed with dates of death in the early 1990s – dates corresponding to the siege of Mostar in 1993-94, during which the Ottoman-era Stari Most (Old Bridge) was destroyed by Croatian forces. Our walking route led us across the emerald green Nerevta River, which continues to serve as the de facto border between the Croat/Catholic west side and the Bosniak/Muslim east side of Mostar; we walked past countless buildings that remain in use but still bear visible shell marks from

that period, and towards the heart of the old town surrounding the rebuilt Stari Most, crowded with souvenir shops, restaurants, and tourists. Before reaching the bridge, we ascended the minaret at the Koski Mehmed Pasha Mosque, which offers a panoramic view of Mostar and requires a stomach-churning climb (and descent) of a narrow, steep, winding, and congested 16th century stone staircase. From that vantage point we could easily observe across the river, atop Hum Mountain on the Croat side of town, the enormous Millennium Cross constructed in 2002. We then continued our walk over the reconstructed Stari Most, the stones of which are so smoothly polished by fifteen years of heavy tourist foot traffic that the surface is slippery even under the driest conditions and downright treacherous when wet. A short walk through another residential neighborhood lead back to our hotel, where we allowed everyone a few minutes to refresh themselves before a group lunch. Throughout the morning, we engaged in ongoing discussion with students, either as an entire group (consisting of two faculty and seven students) whenever the group was stationary as well as in smaller ever-shifting groups while walking.

This small portion of our travels, which represents the typical manner in which we conducted group activities throughout our travels, illustrates some of the key tactics we employed to enhance the students' understanding of the landscape's narrative – in this instance, characterized by spatialized ethnic conflict and competing efforts to both commemorate and obscure a difficult recent past – by linking it with their visceral, sensory, embodied experiences within that landscape.

3.1. Crossing borders

This practice (for which our study abroad model is named) aims to give students an embodied sense of borders (political, cultural, ethnic, economic) and their consequences. Many borders – such as the unofficial border marking the high degree of residential segregation between Croat Catholics and Bosniak Muslims – tend to escape the notice of study abroad students but capture their curiosity once they are made known. Physically walking across the border within the span of two minutes creates a visceral understanding of the fact that all borders are socially constructed, and that what may seem to be 'natural' to people within a society (the spatial and social division between Croats and Bosniaks) may be imperceptible to outsiders even when it is marked by an obvious physical feature (such as the Neretva River).

3.2. Travel time as instructional time

No activity that contributes to the group's collective goal of reading the landscape is considered unimportant. Stops at itinerary sites (the Old Bridge, the partisan monument) are on equal footing as visits to unplanned sites (the cemetery, the minaret, the café, the shell-pocked buildings, the copy shop). All contribute to the overall sensory experience of the

landscape – the sound of chirping insects or thousands of tourists' feet, the smell of a pastry shop or dog feces, religious symbols that precipitate a fluttering of joy or sorrow – that students are instructed and encouraged to use in their reading, writing, and thinking about the landscape's narrative, not only as mnemonic aids but also as landmarks in their own right.

3.3. Flexible itineraries that allow for serendipitous learning

Incorporating mundane, visceral, and otherwise "unimportant" experiences into the practice of reading the landscape can only be accommodated when itineraries remain flexible, and students are encouraged to take the initiative in suggesting sites, requesting breaks, and offering questions and interpretations that inspire detours. In this context, faculty are likewise understood as free to opportunistically modify the itinerary, in ways both small (a ten minute stop at a cemetery that illustrates the human toll of the siege of Mostar) and large (an unplanned but highly impactful four hour visit to Tito's bunker the previous day, which had only very recently opened to visitors).

3.4. Bridging scholarly/narrative texts and the visceral/emotional 'text' of landscapes

During our travel, students were assigned readings that provide scholarly perspectives from multiple disciplines, as well as personal accounts that describe the emotional and sensory experiences of places that we visited. For instance, in preparation for our visit to Mostar, students read an autoethnographic piece by historian Fedja Buric (2016) that offers both description and scholarly perspective on his experience as a 'mixed marriage' (Croat and Bosniak) child during the breakup of Yugoslavia. This piece, and others that we assigned, are put forth as models of reflexivity, where authors use personal perspectives / experiences / sensations to describe and inform rigorous scholarly analysis. In both group conversation and their individual journals, students are prompted to pay attention to their own embodied experience as a means to gain insight into the experiences of others, and the reflections of this experience within the landscape itself.

4. Conclusion

Student response to this approach is overwhelmingly positive. In student evaluations administered by study abroad staff, our students reported an appreciation for the degree of reciprocity between faculty and students, the opportunity shared by students and faculty to alter itineraries when serendipitous opportunities presented themselves, and the increase in their understanding of the region. Further, performance on student work was remarkably and consistently high as measured by both course-specific rubrics and by the Intercultural Knowledge and Competence rubric (AAC&U 2009), despite significant variability in

student skills prior to travel as demonstrated by students' transcripts and pre-departure assignments.

The main challenges in implementing the Crossing Borders model relate to the social norms and personal dispositions which are commonly attached to the roles of faculty and student. As with any "pedagogy of experience" (Viera 2010), in order to be successful, the travel group must develop strong norms of transparency, cooperation, and openness to serendipity. Faculty must relinquish some degree of control over the details of both travel itinerary and course structure, while students must not be tempted to confuse this invitation to collaboration with an invitation to mutiny and/or anarchy.

This model – which includes applying embodied learning tactics to short-term study abroad and teaching from a 'reading landscapes' perspective – is widely applicable to programs across the social sciences and humanities, and lends itself to an interdisciplinary and collaborative approach. Many of these tactics may also be adopted for domestic travel experiences, although in this case increased attention must be paid to strategies for stripping away the students' sense of relative familiarity with domestic landscapes to ensure that they remain attuned to its most instructive – naturalized, marginalized, taken-for-granted, "unimportant" – aspects.

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Peer actions for a Service Learning project to prevent drug-facilitated sexual assaults

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Abstract

The service-learning methodology combines active learning processes and community service. This service-learning experience was performed using an interdisciplinary and cross plan. The teachers made a horizontal coordination in the courses, and a vertical coordination in subjects of the Degrees involved. This allowed working together in the students' curricular training process. It also permitted covering various specific skills, as corresponds to the different subjects, whilst optimizing the students' workload.

The service addressed the problem of Drug-Facilitated Sexual Assaults (DFSA) in the youth leisure nightlife. An active learning about the problem was encouraged in the classroom, focused on recognizing myths, attitudes, and risk situations.

The service-learning actions to the community was based on an anonymous survey conducted among the students, which dealt with the problem. The Service Learning was stimulated through the design, planning and development of activities aimed at gaining social awareness of the existing problem while favouring peer learning processes.

The students undertook awareness actions at different levels, spreading their message by means of social networks, high school workshops, and information stands on the street.

Keywords: *Service Learning; peer actions; interdisciplinary; horizontal and vertical coordinations; Drug-Facilitated Sexual Assaults (DFSA).*

1. Introduction

The Service Learning methodology combines active learning processes and community service. As in any Service Learning project, the students apply the topics they studied to the real needs of their environment in order to improve it (Red Española Aprendizaje-Servicio, 2020). These experiences have already been applied at different educational levels (Santos Rego, Sotelino Losada, & Lorenzo Moledo, 2016), and in the university case, they must be considered as civic missions to fulfil (Santos, Sotelino Losada, & Lorenzo Moledo, 2015) and favour its institutional performance.

With this methodology, the students develop a solidarity project that unites knowledge, skills, attitudes, and values related to the educational practice developed in a specific subject. Therefore, it is about curriculum competencies with emphasis on acquiring skills on the social and citizen sphere.

Furthermore, the values that this type of work bring to the students include also the acquisition of pro-social attitudes (commitment to the environment) and life (strengthens social abilities) values and skills. The students realize that they can change their environment, so the Service Learning renders a more effective learning. Consequently, the Service Learning methodology is a tool that improves the educational success and social cohesion.

A Service Learning project can be applied to any subject and environment. This is because any service project is valid as long as it recovers the social sense of education and reinforces the acquisition of knowledge in any discipline. Therefore, the Service Learning should focus on the addressed students, establishing learning activities related to their curricula, providing them with teaching support. This way, the students learn how to reflect and develop diagnose abilities regarding problems in their environment. As a result, they will be able to define a service that they consider socially necessary, and in which they would feel involved.

The teaching team of this project, combining their teaching and research experience, began last year with a Service Learning action on the topic of Drug-Facilitated Sexual Assaults (DFSA, also-known-as Chemical Submission). We understand DFSA as the temporary disability of a person caused by a decrease in her/his volitional and cognitive abilities due to the voluntary or involuntary consumption of psychoactive substance (alcohol and/or illegal or prescription drugs). Since 2010, the National Institute of Toxicology and Forensic Sciences has detected alleged crimes committed through DFSA and concerned psychoactive substances used to nullify the will of the victim (García-Caballero, Cruz-Landeira, & Quintela-Jorge, 2014).

Therefore, the teaching team has identified the young university students as a kind of population at maximum risk. From this analysis, as university educators, we value the importance and need to work on prevention and information with these young people, which are at the same time potential victims and part of the solution for the DFSA problems.

This problem of DFSA has a huge impact on the mass media which includes written press, television, radio or the Internet. Cases as spread as "La Manada" or "The False Shaman", show the attention that DFSA has received in Spain, even to the point that many countries alert their citizens to this threat when traveling to Spain. At the same time, the media and society show a lack of reflection and comprehensive action regarding the problem.

But, above all, this problem occurs globally (Anderson *et al.*, 2017; European Monitoring Centre for Drugs and Drug Addiction [EMCDDA], 2008; McBrierty *et al.*, 2013; Tiemensma & Davies, 2018), affecting from the lack of knowledge regarding the problem, the possible vulnerability of various population groups, the gender equality and respect for people, to other scenarios such as primary and hospital care. It is in these care places where early and adequate samplings are key factors in confirming a diagnosis (García-Repetto & Soria, 2011). This problem also affects the clinical-forensic laboratories (Marc, 2008), which need better detection methods for those involved legal or illegal aubstances, which now belong to a frequent consumption pattern in our society (García-Caballero et al., 2014). The problem also concerns the psychological support of those affected by the post-traumatic effect, or to therapists who facilitate the recovery of the balance and self-esteem of the victims. The DFSA also touch the police and judicial systems responsible for fighting them. This holistic view of the problem clearly shows that the detection, visualization, conflict resolution, and fight against DFSA.

Since the 2017/18 academic year, different teachers from various disciplines have considered the opportunity to collaborate in teaching strategies that would allow us to approach the current social issue affecting our young university students. The selected students will be future professionals with a high social impact.

This Service Learning experience carries out an interdisciplinary and transversal work in order to improve the social service and the students' education in general competences reinforced from other disciplines, and a vertical coordination in the Degrees' subjects. This allowed the teachers to work together in the students' curricular development process, and favouring that the students cover the specific skills on the different subjects.

For all the above, the involved teachers focussed on the need of the future professionals, now students at the University of Alcalá, for awareness, action capacity, and service to the society. This project was tackled in coordinated sequential stages, where the active learning actions were guided by the teaching staff. In the first stage, the students acquired the

curricular knowledge, critical judgment skills, and communication skills on the subject. The second phase was based on a Service Learning action on the community, proposing activities aiming at an education that would prevent the risk behaviours triggering DFSA.

2. Objective

The aim of this project is to implement a peer action for a Service Learning strategy on the Drug-Facilitated Sexual Assaults topic, integrating knowledge with interdisciplinary collaborative actions in three Bachelor Degrees at the University of Alcalá (UAH), Spain. For achieving this aim, the four specific proposals were:

a) performing a horizontal, vertical, and interdisciplinary coordination between the university teachers, that optimizes the student workload;
b) using virtual tools for the project implementation;
c) training students as active citizens and providing opportunities to apply and enhance other generic competencies for science students; and
d) improving of the teaching capacities of the involved academic staff.

3. Project Development

3.1. Framework and involved agents

This Service Learning project implicated seven subjects of three Bachelor Degrees at the University of Alcalá (Spain), during the 2018/19 academic year:

- *Chemistry* (1st year, 1Semester (S)), *History and Fundamentals of Criminalistics and Criminology* (1st, 1S), *Communication Techniques* (1st, 1S), *and Forensic Instrumental Analysis* (2nd, 2S) in the Degree in Criminalistics: Forensic Sciences and Technologies.
- *Principles of Physics and Biophysics* (1st, 1S) *and Study and Prevention of Drug Dependencies* (5th, 1S) in the Degree in Pharmacy.
- C*hemistry* (1st, 1S) in the Degree in Health Biology.

During the preparation of this project, the teacher team analysed and defined the interest topic, working on the definitions of the pedagogical aspects, and planned the management and organization of the project. This was achieved during a presential meeting of the teacher team at the beginning of the course and, then, by email and using a shared course named "Chemical Submission" in the WebCT virtual platform of the UAH, where the different initiatives were collected and shared. The teaching team coordination was made to promote the integration of interdisciplinary knowledge between teachers firstly, and then to the students. This coordination was developed in the three working dimensions: (i) horizontal (coordination between the three subjects of the same course in the Degree in

Criminalistics: Forensic Sciences and Technologies); (ii) vertical (coordination between the subjects of the *Pharmacy* and *Criminalistics: Forensic Sciences and Technologies* degrees); and (iii) interdisciplinary (holistic view of the DFSA problem by working together the chemical, toxicological (both in *Health Biology* degree), and legal aspects or message communication between the subjects from the different areas and degrees involved).

The coordinator had a key role during this horizontal and vertical coordination, not only for the collaborative messages sent to all, but also for using different tools (*i.e.*, shared documents) to work cooperatively among the different academic memebers involved.

Additionally, in each subject, the teacher had the autonomy to monitor the students through face-to-face seminars or through the WebCT virtual platform of UAH, with recommended websites and YouTube videos. This applied methodology of virtual monitoring is consistent with the characteristics of the current university students, adapted to the change in the reasoning and learning methodologies more oriented to new technological resources.

In the involved subjects, the students enrolled annually usually exceed 70 per subject. Therefore, the teaching team relied on flipped classroom strategies for the work with the students. Hence, the students also had access to the reports presented by other participants in the shared course in the WebCT virtual platform of UAH. This project, selected as of institutional interest, pursued the following competencies in the students: (i) promote the cooperative and collaborative work among different degrees; (ii) enhance the critical thinking skills (analyze the studied material); (iii) increase the ability to organize and share information; and (iv) improve the communication skills. Consequently, this experience increased the students involvement in their learning process and social commitment.

3.2. Student approach to the project

To start getting involved in the DFSA topic, the students answered an anonymous and ethical survey (Google Forms).

Next, a joint initial meeting of all the Degrees was held to favour the active learning of the students of different degrees. This allowed highlighting the importance of the integrated knowledge and the transversal actions that they will later propose to carry out. Besides, it also served to point out the Service Learning related to each subject. The speaker in this initial session was a young researcher enrolled in a pre-doctoral Training for University Teacher programme at the UAH. This way, it is evidenced what a “peer learning” is, which is one of the objectives of this Service Learning proposal.

The results of the initial survey, analysed by the teaching team, were shared with the students as an initial element of motivation and analysis of the DFSA problem. It also helped to identify false myths propagated by the media (which enlarge the problem) and served as a tool for designing and building their preventive actions.

The students, organized in groups of up to 10 people, investigated the DFSA problem, planned and designed, as teamwork, a social service they considered interesting and important. Thus, the students became protagonists in prevention and detection of risk situations, in solidarity with other youth groups. In this process, the teachers assisted as

counsellors and facilitators for the students in their respective subjects, guiding them in defining their own service projects following a conventional methodology.

3.3. Service Learning actions

The different groups of students, organized by subjects and the corresponding degrees, defined their own service actions.As result, the awareness actions of the studentes included initiatives in various social networks (*i.e*., https://www.instagram.com/sumisionquimica/, 330 followers; https://www.instagram.com/sumisionquimica_uah/?hl=es, 987 followers), their own blogs and several websites for collecting and disseminating the peers work in the university and high school education fields, videos (*i.e*., https://www.youtube.com/watch?v=U4bWR5FLkbY (1.059 views); https://www.youtube.com/watch?v=EOx4XoVQZ9A (170 views); https://www.youtube.com/watch?v=I-cAmU5S4z0 (196 views)), etc. In those media, the students were from screenwriters to actors, directors and filmmakers. They also carried out numerous talks, as well as awareness campaigns in the street.

From all those activities one stands out: the visits to Secondary Schools, which was carried out during the last three academic years. In these events, various university teachers and students involved in the project gave DFSA-related talks to those institutions' students.These workshops reached a large number of very implicated students belonging to 1st and 2nd bachelor courses. An example is the visit to the IES Cardenal Cisneros in Alcalá de Henares (Madrid, Spain), where about 150 students took part from a total of 540 students of the School. Later, the participants used the philosophy of "peer actions" to give adequated talks to younger students of about 12-13 years old. These younger listeners are at the present in higher risky situation, thus, it was crucial to make them aware of this important danger. This experience has been extended more than 20 Secondary Schools in the Community of Madrid.

Memory of all the acctions were shared in the common course in the WebCT virtual platform of UAH.

3.4. Evaluation

Given the curricular nature, the Service Learning actions were evaluated, according to the subject, by means of the students reports and/ or public presentations. The teachers evaluated the development of cross skills, actions creativity, and impact with quantifiable evidence. The educators also assessed the students analysis and critical judgment, synthesis,

argumentation, and communication skills, in addition to their specific competencies regarding the corresponding subjects.

In addition, the students completed an evaluation wheel as a self-assessment and hetero-evaluation among the students of each group. Those evaluations were collected through the virtual classroom, to centralize the learning results and have them as evidence for the activity evaluation. The students valued this Service Learning experience very positively.

4. Impact

The Service Learning methodology involves the students' active and social learning, as well as their empowerment. In addition, it has a positive impact on the professional development of the teachers because it gives them greater stimulus and satisfaction as well as experience in the implementation of new methodologies and technologies in their teaching practice. Moreover, it also affects positively on the training and active learning of the students since it brings them greater involvement, improvement of their significant learning to better consolidate DFSA-related knowledge, and in the development of their competencies. Some aptitudes they gain are team work and autonomy, critical thinking, interdisciplinary interaction with other students, ability to communicate and an increased social involvement as agents of change and social improvement.

Service Learning, besides supporting the students at their curricular level, achieves their training as citizens capable of changing their environment, and realising that the experience and knowledge they acquire are useful for the community.

On the other hand, it is worth mentioning that this is a multi- and interdisciplinary proposal, which allowed a horizontal coordination of the competencies. At the same time, it permits optimizing the student's workload between different subjects of the same course associated with various knowledge areas. Hence, we consider that it has a wider impact on the students' significant learning.

Another aspect of interest of this proposal is the interrelationship between different subjects and teachers from various faculties. This represents one of the strengths of the project, together with the participation of young researchers.

5. Conclusions and Future Proposals

Teachers in general and university educators in particular, play a key role in Service Learning projects. This is because we ourselves must be open to leaving our comfort area and face the learning process from social challenges that require educational intervention. Consequently, it is necessary to be receptive and recognize concrete social problems and challenges, meeting associations and committed people, having a constructive vision of the

world in which we live, and to be ready to contribute to social changes whilst being able to join curricular elements and social problems.

The university context also encourages scientific research, thus promoting research involving social impact issues will allow transforming the world: making it better. This objective ought to be prioritized while performing research at the institutional, regional, national, and international levels.

Carrying out a Service Learning project does not only generate social benefits but great personal and professional well-being for both the teachers and the participating students.

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Innovation^2: Innovative Course on Innovation Takes On the Lebanese Revolution

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Abstract

The purpose of this paper is to showcase the unique learning outcomes derived from an innovative course facing disruption from unforeseen political events. In spite of the tense events on the streets surrounding the university during the Lebanese revolution, which erupted in the middle of the semester, we were able not only to implement pre-planned innovative teaching methods to challenge student thinking and traditional higher education practices, but also leveraged the revolution context to introduce new topics and approaches to course delivery in the face of road closures and risks to students' wellbeing. Strategic innovation management topics were complemented by the real time innovative strategies to continue education developed jointly by the course instructor and the students, resulting in an Innovation2 effect. Ultimately, the course learning outcomes were reinforced and broadened by embracing the continued uncertainty and relating to the ongoing situation day by day. As Lebanon and AUB enter its second semester of the political revolution, this paper aims to share lessons learned from both, the initial course innovative design, and its delivery in the crisis circumstances of the revolution in order to help faculty dealing with unstable educational context in Lebanon, Middle East and other challenging regions.

Keywords: *Innovation, Revolution, Adaptation, Interactive Learning, Flipped classroom.*

1. Introduction

Innovation management is a popular topic in the business curricula since it is widely regarded as a critical source of competitive advantage in an increasingly changing environment (Dess and Picken, 2000; Tushman and O'Reilly, 1996). Such a course is also an opportunity for instructors to do what they preach and introduce innovative methods of instruction. This time in Lebanon, the circumstances took the challenge to an all new level when the instructor and the students found themselves in the midst of a national uprising half-way through the semester. This paper recounts the story of an undergraduate class at the American University of Beirut (AUB) that stood up to the challenge and completed the innovation management course though creativity, teamwork and innovation. We called this situation **Innovation[2]** to highlight the conditions when the class has to innovate not only as a part of pre-planned innovative teaching methods (explained in section 4), but also in response to new circumstances of an ongoing revolution (explained in section 5).

Innovation is defined as production or adoption, of a value-added novelty in economic and social spheres; it is both a process and an outcome (European Commission, 1995), whereas revolution is a fundamental and relatively sudden change in political power and political organization which occurs when the population revolts against the government, typically due to perceived oppression or political incompetence (Bullock & Trombley, 1999). Both concepts are similar in their aim of a systemic change. While we can easily compare radical innovation and revolution, even an incremental change can be considered a small revolution.

Strategic Management of Innovation course (SMI) is a unique case study that yields interesting conclusions to the academic world. By combining a course centered around educating future professionals about innovation with the revolutionary environment, students linked both concepts together in a way that reinforced their civic and academic development.

2. Background

Lebanon is a small country nestled on the Mediterranean Sea, that has been wrought with instability and political/religious tensions ever since its inception in 1920. Home to a vast array of ethnic groups and religious sects, the country has always been rocked by conflict, with the most destructive being the Civil War (1975-1990), which ended with the Taef Accord (1989) dividing the governmental positions between the different warring sects: the President role has to always be allocated to a Maronite Christian, the Speaker of Parliament must be a Shia Muslim, and the Prime Minister position is reserved for a Sunni Muslim. This set up has effectively an end to the separation of religion and the state, since political

parties are directly affiliated with specific religious sects and foreign allegiances (CIA, 2017). These political parties went on to mismanage the country for the next three decades.

In October 2019, a popular movement uniting many Lebanese under a united national identity, not separated by sects exploded into protests across the entire country, forcing the government to resign and plunging the country into a downwards spiral. The ongoing economic crisis, which was one of the many reasons that pushed protesters to the streets (alongside rampant corruption and governmental mismanagement) grew only worse as the buying power of the local currency fell drastically, resulting in the Lebanese banks starting to limit withdrawals causing a sharp drop in liquidity. Even after a new government was appointed in January 2020, the protests keep going on. Peaceful demonstrations continue experiencing violent police brutality, and the country's future situation remains uncertain. This situation disrupted not only daily lives of the citizens, but also interfered in the academic life as many students and faculty members participated and even spearheaded the revolution.

3. Impact on Various Academic Stakeholders

The higher academic scene of Lebanon is comprised of many private universities as well as the public Lebanese University. Those institutions were severely affected by the revolution. Founded in 1866, AUB is the oldest and the most prestigious academic institution in the country, which *de facto* became the center of action. The university had many challenges, including the safety of its students and faculty dodging roadblocks trying to attend classes. AUB administration had to balance between enforcing academic requirements and allowing students exercise their civil rights. Yet, the semester had to be completed by Christmas with all required learning objectives met. In addition to the revolutionary issue, there was a bigger problem of a sharp devaluation of the local currency which caused further unrest as the students had to pay their tuition fees in an increasingly more expensive US Dollar (USD).

AUB faculty had their fair share of challenges during the revolution. As the local currency crashed, and the academic semester was in peril, the professors had to find creative and innovative ways to keep coursework and instruction going, even when all the classes were being cancelled "until further notice." Many foreign faculty chose to leave the country, which caused a lot of problems and uncertainty, especially for the students taking their classes.

Students represented the group which was most negatively affected by these events. Since many of them were politically active, they were on the frontline during the entire ordeal and had to juggle coursework, attending classes, and protesting for their rights and their dream to live in a country in which they will be able to find work and satisfy their most basic

needs. Moreover, already high tuition fees were starting to become an unbearable burden to the students due to the local currency devaluation. These realities draw contrasts and parallels to the Palestinian and South African struggles. In the Palestinian context, education became an important coping strategy to deal with the instability in society (Alzaroo, & Hunt, 2003). While the South African context, highlighted how high tuition fees can create a crisis outright resulting in attempts to innovate on the university education model by introducing distance learning (Wet, 2016). All of these factors made the students realize that they had an immense stake in the outcome of this revolution, and that they had to improvise and innovate in how they approached the continuation of their academic pursuits, as will be discussed further down below.

4. Strategic Management of Innovation (SMI) Course at AUB

SMI is an undergraduate business elective course that was offered for the first time last semester. Developed by one of the authors based on their research and previous teaching experience, the course had an experimental design, which already included innovative instructional methods as it will be explained later in this section.

There are several instruction methods that provide students with an improved learning experience mentioned in the literature, such as flipped classroom (Walvoord & Anderson, 1998), inverted classroom (Lage, Platt, & Treglia, 2000), peer instruction (Mazur. 2009), and the case method (Apaydin, 2008). All these methods have interactivity in their core, which leads to an integrated learning (Inkpen & Crossan, 1995). SMI incorporated interactivity from the start, and leveraged it during the crisis, building on several complementary methods.

4.1. Student-Centered Classroom Emphasizing Self-Actualization

SMI was designed based on the 3A approach (Awareness→Analysis→Action) (Apaydin, 2014), which makes students aware how they will be taught and why, including theoretical explanations of how humans learn. Pintrich (2002) stresses that students must know about learning strategies, not just practice them, in order to retain those skills. As a result, students not only become aware of the stages of the learning process, but they also become motivated to achieve the top level not only in Bloom's (1956) taxonomy but also in Maslow's (1987) hierarchy, which is self-actualization (Apaydin & Hossary, 2017).

4.2. A Focus on Self Reflexivity and Collaborative Iteration to Reinforce Concepts

Too often traditional education falls victim to the "pipeline business" of creating student "thinking silos" whereby they produce and submit work while isolated from their peers. SMI class introduced a collaborative exercise, "Mind-Mapping" innovation, which synthesized all the required material in one visual. What started as a simple illustration

connecting ideas in a linear fashion quickly saw the congregation of multiple ideas and linkages. Fig. 1 visually showcases the effects of repeated classroom discussion to reinforce concepts. Not only was the first draft missing crucial information while defining innovation, but students were led to believe that this information and definitions were generally isolated. It was after repeated and focused discussions that the students were able to discover that many linkages appear in seemingly unrelated concepts, and that by working together as a team, the explanation of complex concepts can be best explained.

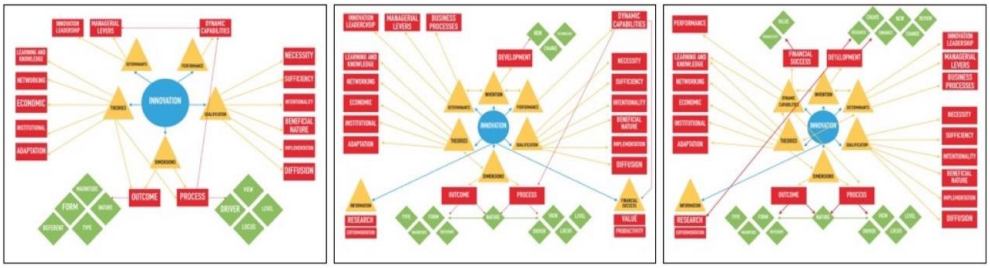

Figure 1. Evolution of Classroom's Mind Map on Innovation

Furthermore, self-reflexivity, an exercise where at the beginning of each class students wrote down everything they remembered from the previous class, was used class to both reinforce concepts and spark discussion. It allowed students to individually recall relevant information, discuss it in pairs, and then finally debate them as a class and depict visually on the board. It operated similarly to how Harvard and Ivey Business Schools present case studies (individual, group, class) to maximize retention and learning (Mauffette-Leenders, Erskine, & Leenders, 2005). This process addresses the problem that students are usually loaded with abstract concepts without understanding the complex relationships between them.

4.3. Diverse Course Content Delivered Through Immersion

Exposing students to global thinking and cross-cultural concepts is an essential part of the academic journey, but coupled with immersion, it can lead to enhanced retention and comprehension. In the Japanese "Design-Thinking" Module, students had to conduct an ethnographic research to identify unspoken needs of their targets, in the midst of an ongoing revolution, and produce actionable recommendations for their target business/location.

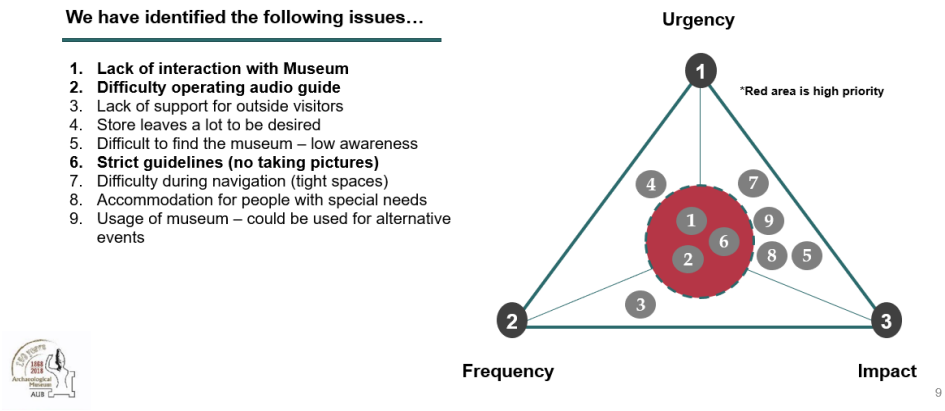

Figure 2. Student Identification of Pain Points

In Fig. 2, students carefully identified pain points faced by the AUB museum after subtly following a group of tourists. The team did not disclose what they were doing to the group in order to not alter the group's behavior. Following this study, they were able to identify several pain points such as the overall "lack of interaction" and the "difficulty operating the audio guide" and make a recommendation to incorporate Virtual Reality solutions in areas where engagement with the Museum was minimal (Figure 3). Thus, design thinking challenged the existing "customer journey" model and ensured innovative solutions.

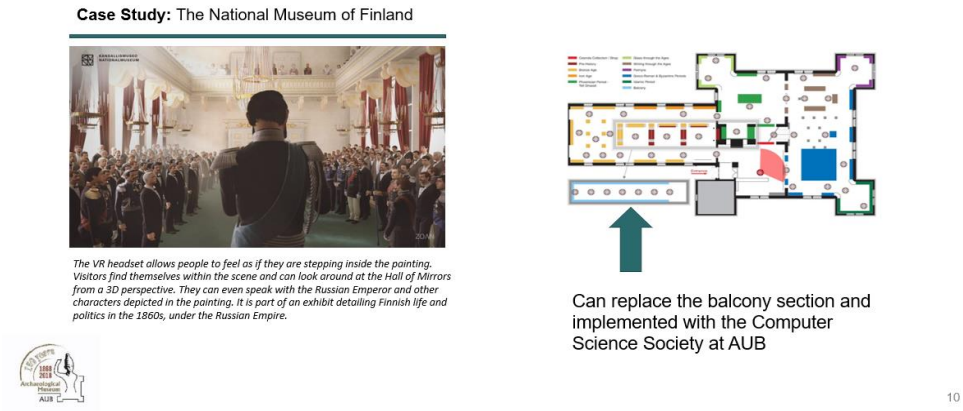

Figure 3. Student Recommendation to AUB Museum

4.4. Students Teaching Students

Known as a flipped classroom (Walvoord & Anderson, 1998), the method of student teaching their peers is extremely effective as it increases retention and ownership of the subject (Glasser, 1986). In SMI, student teams competed in creating various interactive

exercises to explain various pillars of the Organizational Innovation (Crossan & Apaydin, 2010) (Fig. 4).

These were the innovative methods already embedded in the course, but then, due to the on-going uprising, additional changes had to be made, bringing it to what we call **Innovation[2]**.

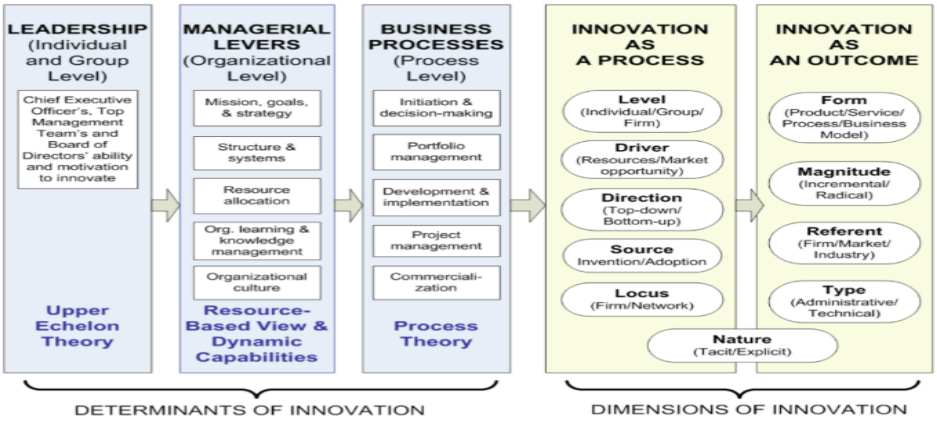

Figure 4. The Innovation Framework

5. Innovative Infusion from the National Revolution

5.1. The Emergence of the Omnichannel Classroom

The most immediate change resulting from the revolution was the lack of classes. For about a month, students were unable to reach university because of road closures and blockades. Even when classes resumed, many students were not able to attend because of their parents' safety concerns. The first change in course delivery occurred when only half of the class attended. When traditional in-class sessions were no longer viable, students proposed utilizing their cell phones to connect remotely (Fig. 5). This became the primary solution to enable all students to participate in the remaining classes, albeit virtually.

5.2. Improvisation Regarding Assignments

Under these extraordinary circumstances, the idea of linking the course and the revolution came about. By comparing the Lebanese and the Bolivian revolutions (depicted in the film *Our Brand is Crisis)*, students were challenged to find structural parallels that led to the planned innovation, represented by a revolution. One student concluded: "*the innovation framework is indeed omnipresent in actual real-life events and even in fictional ones. We*

Figure 5. Embracing Mobile Classrooms

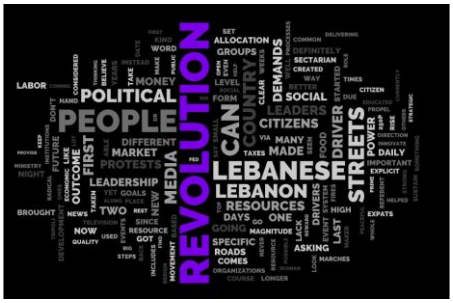

Figure 6. Word Cloud of the Essays on Revolution

can see how things do not happen out of random occurrences. Innovation always depends on challenge the status quo in pursuit absolute goal. […]. If we want to change, we can."

5.3. Synthesizing Core Concepts with Real-Time Examples

Before the revolution took effect, students were assigned to perform an Innovation Audit (Crossan & Apaydin, 2010) of the University Hospital, by assessing parts of the Innovation Framework (Fig. 4). As a result of the protests, the hospital was too busy treating emergencies, and the course found itself in a precarious position. So, a decision was taken to do the Innovation Audit of the Lebanese revolution instead of the hospital. It turned out, the revolution proved to be an admirable expression of innovation by the Lebanese people. After performing this analysis, students were able to discuss the drivers of innovation - in this case the political and structural "inefficiencies" that led to a revolution and show how the revolutionary demands could be measured along each dimension (Fig. 6). One student noted: "*Innovation as an outcome is formed as following: The form is a process of an overthrown government and the effort of working towards the formation of a new parliament with a new, secular structure. Its magnitude is radical, and the referent is the market, mainly people's demands. The type of outcome is administrative with an explicit nature."*

Thanks to these 3 modifications, the course was completed in full, in time for Christmas, with a high grade average for the class (81%), and a high instructor evaluation by the students.

6. Positive Learning Outcomes and Recommendations for Higher Educational Professionals

The lessons learned from this case study illustrate how to maximize learning outcomes and benefits when faced with a disruption as big as a national revolution. Both, content learning goals and skills learning objectives were met. We may add that the students also acquired new skills such as crisis management and communication. By [1] shifting the classroom into a dual-mode offering [2] incorporating alternative assessment procedures and assignments and [3] synthesizing concepts with real-life examples, students have not only been able to absorb information, but more importantly, learn more about drivers of their own revolution.

Higher Education professionals may learn from this case study that what can be perceived as a threat, may turn into an opportunity to improvise and reach **Innovation^{2}** instead of just "Innovation." To do so, we suggest using the above mentioned 3A Approach (Apaydin et al., 2017): 1) Build *Awareness*: be aware of the current situation etc. gather multiple data points and learn; 2) Conduct *Analysis*: Uncover current drivers of present day situation, tailor conclusions; and 3) Do *Action*: Tailor course content, and start a revolution in the classroom!

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The Challenge of Research Supervision: The Experience of Lecturers in Various Academic Disciplines

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Abstract

Research supervision is the highest level of teaching for academics. Yet, in many cases, academics are allocated supervision without any formal training. For many supervisors, their supervision approach will be a mirror of what they have experienced themselves at post-graduate levels. Many supervisors consider that this form of teaching is stressful and onerous due to the responsibility placed on it by the Higher Education Institution and the student ultimately. What can be done to support supervisors in their supervisory journey? There is a void in the academic literature on research supervision with scant aids available to the supervisor (Cullen, 2009). Brew and Boud (1995) outline the importance of instructor knowledge; however, supervisors only gain extensive supervisory experience over the years.

The aim of this study is to better understand the supervisory process. Data was gathered from 12 lecturers engaged in supervision across various disciplines.

Findings indicate that supervisors need to adopt and continually change to differing circumstances and different student personalities while supervising. It is essential that formal supervisory training be provided for all supervisors.

The findings from this evaluation are novel and will be beneficial to research supervisors across various disciplines.

Keywords: *Research Supervision; Multi-Disciplinary; Reflection.*

1. Introduction

Quality supervision in teaching and learning in Higher Education has several challenges. For many, a fundamental understanding of 'what research actually is' is important. How do the student and research supervisor view the research process? When a supervisor meets a student for their first supervisory meeting, they are anxious as to the expectations of the student and, of course, the standard that the student already has in terms of skills, knowledge and experience. Many conflicts exist for example, the fundamental understanding of 'what is research'? What does the student think it will involve? How is research perceived in today's context and in everyday life? Research can mean different things to different students, some, for example, are only aware of research in relation to political polls at election time, others relate to research in relation to nutrition and health and medical research; scientists looking for cancer cures. When it comes to their own personal research in the context of Business, Humanities or Science, how do they perceive this journey, and how does the academic supervisor set the expectations for the journey ahead? The context of this paper is to examine the journey from an academic supervisory perspective in cross-sectoral discipline areas in an Irish Institute of Technology. The participants in this study are all from varying faculties where they supervise students from undergraduate projects, to post-graduate taught and full research thesis, to PhD. The intention of this research is specifically to broaden the author's own personal teaching horizons, particularly the current research supervision practices and approaches in place, to gain insights to improve supervision practice. Research supervision places one at the epicentre of new and exciting empirical data, while equally placing an immense challenge and responsibility on the supervisor, namely, the successful graduation of students under one's supervisory care. This research addresses a dearth in the academic literature (Delany, 2009), specifically in relation to understanding research supervision.

2. Aims & Objectives of this Research

The overarching aim of this research is to examine and understand the fears and expectations of lecturers when they begin their supervisory journey. The main objective of this research is to gain an insight into the issues in relation to supervision, to inform practice, and to move forward in a supervisory capacity with more appropriate informed thinking. Another objective is to develop new processes to facilitate future supervisory student engagement.

3. Methodology

A post-positivistic approach was applied to gather the empirical data. Therefore, for the purposes of this research study, face to face discussions using a semi-structured interview guide (pilot tested to ensure reliability and validity) were held with research supervisors in a Higher Educational setting to ascertain how they viewed research supervision. Twelve lecturers (9

females, 3 males) took part in the study across multiple disciplinary areas from science to humanities. The criteria to be included in the sample comprised of being current full-time lecturers, and participation in research supervision, be it at undergraduate fourth year project, or PhD level. The data was analysed using grounded theory (Strauss & Corbin, 1998) and the themes that emerged are outlined below. All lecturers remained anonymous, and all ethical procedures were ensured and adhered to.

4. Literature

The student and the supervisory relationship are inextricably linked (Armstrong, 2004). The relationship can change throughout the period for various reasons. This is mainly due to the style of the supervision (Visser- Wijnveen *et al.*, 2010). Student and lecturer expectations are often mismatched for various reasons causing anxiety for the student & supervisor (Sorcinelli, 2007). The roles and functions of research supervision are multiple, for students, the ideal supervision helps them to achieve a scientific result, or achieve a personal goal, learn about the research processes, but, specifically, how to conduct research critically and at the right standard (Visser- Wijnveen *et al.*, 2010; Zhao, 2001). Higher education is tasked with engaging students in questioning their preconceived ideas and their models of how the world works, so that they can reach a higher level of understanding (McAleese, 2013). Lack of respectful relationships between students and faculty members are also a concern (Ghadirian *et al.*, 2014), together with ensuring that quality standards at supervisory level of education, training and research are assured (Baptista, 2011).

4.1. Supervisory Styles

Research supervision is the most advanced level of teaching (Zhao, 2001) and is a process of fostering and enhancing learning, research and communication at the highest level in the educational system. The student/lecturer relationships are intricate, and advice is needed (Cullen, 2009); however, the advisory literature available to academics is scant, and hence, many supervisors have a dearth of literature from which to draw (Delany, 2009). It is advisable that the academic community endeavour to bridge the gap and inform practice (Cullen, 2009). In the view of students, optimal supervision helps them to achieve the result, and acquire same within the institutional research standards and processes (Zhao, 2001). Concerns facing the supervisory voyage is managing the overall process and levels of expectations (Sorcinelli, 2007; Visser- Wijnveen *et al.*, 2010). The fact remains that teaching and learning in higher education is a shared process, with responsibilities on both the student and lecturer to contribute to their success and enable the research journey (McAleese, 2013). In the UK, for example, *The Good Supervisory Practice Framework*, acknowledges, for the first time, the wide-ranging, highly complex and demanding set of roles involved in research supervision, such as recruitment and selection, supervisory relationships with candidates and

with co-supervisors, supporting candidates' research projects, encouraging candidates to write, giving appropriate feedback, keeping the research on track and monitoring progress, supporting candidates' personal and career development, supporting candidates through completion and final examination, supporting candidates to disseminate their research, and to reflect on practice (supervision.ukcge.ac.uk).

4.2. Approaches to Research Supervision

In terms of research supervision, various approaches exist (Gatfield, 2005; Lee, 2007), where both offer four approaches to research supervision. Gatfield (2005) presents a model using four main supervisory styles. The four elements proposed by Gatfield are: Pastoral Care—low structure and high support; Contractual Style—high structure and high support, Laissez Faire—low structure low support; and Directorial Style—high structure and low support (researchsuper.chelt.anu.edu.au). Lee (2007) also proposes four models of supervision: Functional (a structured approach), Critical Thinking, Enculturation & Mentoring (the mentor provides all the support but allows the student space to breath, but problems may arise with responsibility). Great care is needed when applying the mentoring approach (Lee, 2007). Conversely, Zhao (2001) outlined the preferred process of strict research plans, encouraging good planning over 'ad hoc' processes.

5. Main Findings & Discussion

The following section outlines some of the pertinent findings from this research study. Only key themes are presented due to the limitations of the paper. Many other themes and sub-themes emerged, but are not included in the scope of this paper.

5.1. An Understanding of the Research Process

Students embarking on the research journey do not realise what is involved. When it came to forth year research projects, supervisors (85%) believe that students do not understand what is involved and view a research project like "any other subject". There are various levels in the process, and the understanding of the research process for a fourth year project and a Level 10 research process are "worlds apart". The main challenge for me, as a supervisor, is to "understand what my students need moving from degree level supervision to even masters level, not to mention the challenges for students going directly onto the PhD register from degree level". "Other comments from participants included, "students do not understand what format the research journey will take for them".

5.2. Understanding One's Approach to Supervision

Most supervisors had never considered what their actual approach to supervision was. 70% stated that when they embarked on the research supervision, they apply a more functional

and instructional approach (Lee, 2007), and when the student has grasped some of the research techniques, they "think" that they become mentors". "Mentoring allows the research student find their own way and breath". "It is important for the student to find their own personal research journey, particularly, and especially, if they want to go on to PhD level". Participants outlined that there are some cases where the students need a more "hands on" direction, and struggle with "self-directed learning"; this is challenging. Other participants from the discussion considered that they actually used "a combination of styles depending on the student ability". One supervisor from the discussions, relayed that, when they started supervising first, they "were more scared" that the student, as there was no available training in supervision for lecturers. The supervisor/student relationship is a very different one, and can be complicated. "Maintaining parameters can be a challenge, and not becoming too personally involved". 90% of participants are concerned about managing the relationship, and afraid of getting too "entangled" with students. It is also important to be positive. Reflecting Visser- Wijnveen *et al.,* (2010), there are many rewards from research supervision. Participants here stated that showing "students what is exciting about research is vital".

5.3. Critical Thinking

Critical thinking is 'key' to all research and the basis of what the research student is trying to achieve. Challenges for research supervisors included trying to get students to think critically. This was particularly evident for early researchers (Visser- Wijnveen *et al.,* 2010), but the anxiety for supervisors was no less as they still had to see the student through the process. "One of the key challenges for me, particularly at fourth year project level, is trying to get the student to be critical". "How do you get students to evaluate a conceptual framework?" "Getting students to engage in a lot of questioning can be interesting". Another supervisor advocated training in terms of both supervisor and student to ease the pressure. "We and the students need training".

5.4. Adversarial Students

Participants in this study discussed that students can be challenging and vocal and that it can be difficult to manage the supervisory meeting (85%). This applied to all disciplines and levels. Some students do not want to take direction and do not understand that the advice is not personal. Students are not fearful of voicing their opinions (Lewis, 2010). Students exercise control over the quality of their learning by "evaluating their teachers' performance" (Sorcinelli, 2007: 2); findings from the supervisors mirror this. Giving student feedback was another concern and "fear" for some supervisors, but Brown (2007) believes that some students fail to consider the feedback in a positive way. "It challenging to give feedback as some students do not take it very well". 80% of the participants in this study agreed; one stated that they often worry about giving back research work with lots of "mark-ups", as students contest some suggestions strongly.

5.5. Reflection to Aid Learning

In line with Moon (2001), reflection for the research student is an important part of the process. Participants in this study were strong advocates of reflection believing that reflection leads to enhanced learning and deep reflection impacts well on the research process. "More encouraged now as part of the research journey, reflection is vital". "I was delighted that reflection now forms part of course content". "This will make the supervisory process less 'dictatorial'". "Encouraging students to keep a reflective journal that can be reviewed during and after their research journey has been very useful and helpful along the way". "For me, asking the students to keep a reflective journal has helped with the feedback process too".

5.6. Responsibility

Students are concerned with results (Race, 1993), to graduate, and this was voiced by participants as a grave concern. Participants outlined that it was an "onerous task to take on supervision, particularly PhD supervision". The concerns that were outlined are in relation to the responsibility of the Viva Voce (55%). "There is an expectation to pass when one has gone through the PhD research process, but I have seen cases where this has not happened, and the supervisor is left with 'egg on their face', and blamed". "It would be much easier for me to just teach regular classes at undergraduate level". "I try not to think of the responsibility".

6. Recommendations

Many issues came to the fore in this study in relation to the challenges of research supervision. Some of the main concerns centered on the onerous task. Supervisors stated that they are not given specific training in terms of research supervision. "I have been supervising for years without any specific training". Proper formal training is a strong recommendation of this study, together with continuous review. We must put practice "under the spotlight", (Biggs, 1999:73). Formal 'train the trainer' programmes must be implemented. It is important, therefore, that all faculties give relevant support to lecturers who supervise. Awareness of the issues needs highlighting to other fellow academics within and beyond the faculties where workshops and support groups should be encouraged. It is important that supervisors improve practice (Harvey, 1998), and this can only be achieved through continuous evaluation, reflection and learning. Supervisors must understand the issues to improve personal practice and student learning (Ramsden, 2003; Visser- Wijnveen *et al.*, 2010). All Higher Educational institutions need to support supervisors and provide ongoing training. Collaboration with other Higher Education institutions would be of benefit to see what processes are in place through proven evaluated programmes. Students are not sure what is needed from them when it comes to research projects, therefore more formal class work with supports would be very beneficial, together with clear roadmaps (Gatfield, 2005). To avoid issues in relation to difficulties with structure, work progress, and problematic abandonment of the

endeavour entirely, formal timetabling of supervision must be factored over 'ad hoc' approaches reported by some supervisors.

7. Conclusion

Every supervision is a unique relationship and it is important, as a supervisor, to recognise this dynamic. Research students differ wholly in constitution; each one brings a unique ability and personality to the research process, and capabilities vary enormously. Some students thrive on freedom; others do not, with more needing constant contact, guidance & support. For the research supervisor, it is vital that one understands what the student is going through in order to have successful outcomes. Supervisors must adapt to the varying situations. Academic outcomes at the higher research level are vitally important as the contributions are the bedrock of progress in each discipline, together with enriching the world about us. No two research situations will ever be the same, but, as a supervisor, how can one ensure consistency in practice and success with our research students? The process has the optimum opportunity of delivering worthwhile results when the best and most applicable path is taken by the students, while supported by a fully prepared and introspective supervisor.

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Building a Student Success Model at GMIT: student centred learning opportunities, employability and the professional development of teaching

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Abstract

GMIT provide a range of student engagement and teaching development opportunities to support retention and to empower learners to be successful at third level and in their future careers. GMIT has faced a number of challenges including: supporting students as they transition into higher education; retaining students on STEM programmes; developing the teaching community; an increasing demand for academic writing and maths support; research and academic integrity; and the need to support students as they transition out of higher education and into employment. In 2015, in response to these challenges, GMIT agreed strategic priorities and assigned resources to develop initiatives across various functions and academic departments.

This paper will present the GMIT student success model that emerged in 2019, following the collaboration of multiple functions and discipline groups. This paper will discuss initiatives in GMIT that enable student success, support student engagement, promote employability and the professional development of teaching in higher education.

Keywords: *Student Success; Employability; Student Centred Learning; Health & Wellbeing; Transitions; Teaching Development.*

1. Introduction

Student success can mean several things and it can be achieved in many different ways. At its core, is a belief in the capability of higher education, to give each student the support they need to recognise and fulfil their potential (National Forum, 2019). Student success thrives in a higher education institute whose staff, including the academic and professional services community. consider themselves to be enablers of student success. Student success is driven by individuals working in higher education who are committed, enthusiastic, student centred focused and whose work is informed by continuous professional development in teaching and evidence-based research and good practice. In summary, student success is the centre of everything we do in higher education (National Forum, 2019).

GMIT provide a range of student engagement and teaching development opportunities to support retention and to empower learners to be successful at third level and in their future careers. GMIT has faced a number of challenges including: supporting students as they transition into higher education; retaining students on STEM programmes; developing the teaching community; an increasing demand for academic writing and maths support; research and academic integrity; and the need to support students as they transition out of higher education and into employment. In 2015, in response to these challenges, GMIT agreed strategic priorities and assigned resources to develop initiatives across various functions and academic departments.

The student success initiatives developed, focus on teaching enhancement and providing student-centred learning opportunities, to enable students to be successful in GMIT and in their future careers. Student services, the library, teaching and learning, and academic departments have all worked collaboratively to deliver a range of initiatives from pre-entry, first year level to final year, and this has resulted in the emergence of a Student Success Model (see Figure 1). The overall impact of the range of initiatives includes changes to institute policies, an expansion of student support services, a focus on employability skills, new approaches to programme design and evaluation, and a significant increase in the academic community engaging with teaching development courses. In addition, several initiatives have addressed some significant national higher education issues including employability and graduate outcomes, managing diversity and student engagement, retention and the first-year experience.

This paper will present a suite of initiatives available in GMIT that enable student success. It will also highlight student perspectives from a national study and the impact the GMIT initiatives are having on student engagement, employability and the professional development of teaching.

2. GMIT Student Success Initiatives

GMIT provide a range of student engagement and teaching development opportunities to empower learners to be successful at third level and in their future careers. Each initiative develops core skills from the first-year experience to the final year of a programme of study (see Figure 1). The student engagement initiatives are available to all students and they are designed to engage the learner and create a sense of belonging from day one. Students gain an opportunity to develop skills in learning and innovation, creativity, leadership and communication, research integrity, community-based learning and entrepreneurship.

Figure 1. Building a Student Success Model at GMIT Source: Ginty (2019)

The teaching development initiatives are open to all staff and include a suite of postgraduate awards in teaching and learning and a flexible online learning environment supported by a range of practical design workshops. The teaching community gain an opportunity to develop student centred learning strategies, technology enhanced learning skills, programme design approaches, assessment strategies and a teaching portfolio. GMIT recognise that building an enriching student learning experience requires the ongoing development of the teaching community and working with students as partners. GMIT are continuously supporting flexible teaching models to enhance the student experience. In 2020, a postgraduate special purpose award in Digital Teaching & Learning was developed, to build digital capabilities and pedagogic expertise, in order to design, deliver and support flexible, distance and online learners.

The description on the range of student success initiatives presented in Figure 1, includes the following items from 1 to 16:

1. Get Ready Education was designed in 2015 to address the needs of students making the transition from 2nd to 3rd level education. The MOOC was made available to second level students in Ireland from transition year to leaving certificate. The course materials are also embedded in the GMIT first year skills module LIS. The MOOC combines online content with optional teacher led classroom activities, online forums and quizzes. Digital Badges are awarded to participants.

2 & 7. Peer Assisted Study Sessions (PASS) first launched in 2009 and it is designed to help first year students cope better with all these aspects of life at third level. It plays a key role in enhancing the experience of first year and easing the transition to third level. PASS is timetabled in the first semester for one hour per week and is led by student PASS leaders who are trained and engage with the Peer Learning Leadership module (L7, 5 ECTS) and an online learning resource. The impact of PASS is highlighted in Figure 5. Since the introduction of PASS in 2009, over 800 student leaders have led study sessions in GMIT. In 2017, an online course in PASS was introduced to support the training of leaders through a flexible flipped learning approach.

3. The First 5 Weeks is a five-week programme (set up in 2016) to help first-year students settle into college life and to make the transition to third-level education easier, whether they have come directly from secondary school or have been out of education for some time. In addition, the Schools Liaison Office and Access Office have set up an ATS initiative (Attract, Transition & Succeed) for incoming students to GMIT to help them choose the right course. The ATS initiative covers a Collaborative Innovative Strengths Profiling Programme of development (SPMD) for second level students, highlighting the importance of identifying their strengths when choosing a third level course. The programme involves input from key

influencers, online assessments, the SELF model of exploration, the Strengths Wheel, group activities and a panel GMIT student speakers.

4. Learning and Innovation Skills (LIS) is an academic skills development module (first introduced in 2009 and updated in 2016) and it is available to all first-year students (2,000) annually. This is an active learning module that is contextualised for each discipline area and its aim is to ease the transition to third level and gain the skills to be successful on a course. This module is all about learning actively, developing creativity and being innovative.

5. Thrive Volunteering Programme is the GMIT President's Award for Volunteering and it was established in 2019 to celebrate civic engagement by students and staff in Galway, Mayo, Letterfrack and Mountbellew campuses. Student volunteers who complete a required number of hours, qualify for the President's award.

6. Drop in Before you Drop out is a stay on course initiative (set up in 2017) and it operates as a career clinic service that helps students understand their exam results, recommends who to talk to and what to ask, undertakes online profile assessments (if required) to assist students understand their personality type, interests and motivators and how this self-awareness helps them to decide on suitable courses and career choice. The clinic also guides students on various course pathways available and if they are unsure about the course they are on, guidance is provided on switching and the implications of changing course direction.

8 & 9. GMIT Step Forward – NStEP Student Engagement Programme (first introduced in GMIT 2011 and revised in 2017) was inspired by the Scottish Universities student leadership initiative Sparqs (http://www.sparqs.ac.uk). This initiative now forms part of the National Student Engagement Programme. Student class representatives are trained on how to engage with the various forums, programme boards and committees in GMIT. The initiative aims to support student engagement in the quality of the learning experience.

10. The Academic Writing Centre (established in 2016) enable students to fulfil their potential in the academic writing tasks which are part of their course work. The Centre offers focused academic writing tuition to students of the Institute at all levels, in all years (including postgraduate), and across all disciplines. The tuition available takes the form of pre-bookable, thirty-minute, one-to-one sessions, directed by individual student need.

11. The Maths Learning Centre (MLC) was established in 2015 as a School of Engineering student success initiative. The centre operates a drop-in centre for students. The aim of the MLC is to encourage students to take responsibility for the development of their own maths capabilities. Students are encouraged to take their maths problems to the MLC for the tutors to work through with them.

12. The Healthy Campus is an initiative promoting health and wellbeing in GMIT. There are a range of activities open to students and staff from Marchathons, Mental Health Groups to

the Staff and Student Choir and lots more. The initiative launched in 2018 and it is having a positive impact on students and staff.

13. A Community Engagement module and assessment opportunities are available to students from first year to final year. Community Engagement/Service Learning encourages students to explore societal issues, both inside and outside the classroom. Students learn by actively engaging with communities including non-profit organisations, charities, community associations or organisations with a focus on social responsibility. In 2020/21, an online version of this module will be developed for GMIT students, to enable wider access to the module and learning experience across all campuses.

14 & 15. Entrepreneurship and developing portfolios forms part of several academic programmes in GMIT across five campuses. Students gain an opportunity to create a business idea, collaborate with industry and the GMIT Innovation Hub, develop a business plan and pitch for funding to bring their business idea to the next level, post their undergraduate degree. Portfolios form the capstone assessment of many programmes in GMIT. They provide an opportunity for students to showcase their learning journey at third level and tangible evidence on their academic achievements, as well as their participation in community learning projects.

16. The Next Step – Employability Toolkit (the module was first introduced in 2015 and the online employability toolkit in 2019/20) aims to support students as they transition out of GMIT. Students develop both professionally and personally and are equipped with the skills and knowledge they need to enable them to plan for and achieve their career goals. Students analyse an occupation and industry sector and devise a career strategy. They also undertake a skills audit, complete a personality assessment, prepare a CV, develop an elevator pitch, prepare for interviews and develop a LinkedIn profile.

3. Student Perspectives in Ireland on Student Success

In 2018, the National Forum for the enhancement of teaching and learning in Ireland undertook a student success study and collected data from 1,041 Irish higher education students. Responses were reviewed and coded into themes listed in students' understandings of student success. Where a respondent listed more than one factor, multiple themes were coded and included in the analysis. Figure 2 represents the key categories that emerged from the data analysis. Five themes were identified that enable student success including: *Engagement and Student Partnership; Professional Development and the Centrality of Staff Who Teach; Evidence-based Decision-making; Supporting Transitions and Cultivating Belonging; and Assessment and Feedback.* Responses from this study are consistent with other research studies on student success and engagement (O'Shea & Delahunty 2018; Kuh, et al., 2008), with a focus on degree completion, academic achievement and employability.

Health and wellbeing and the teaching experience are also placed as a high priority to enable student success.

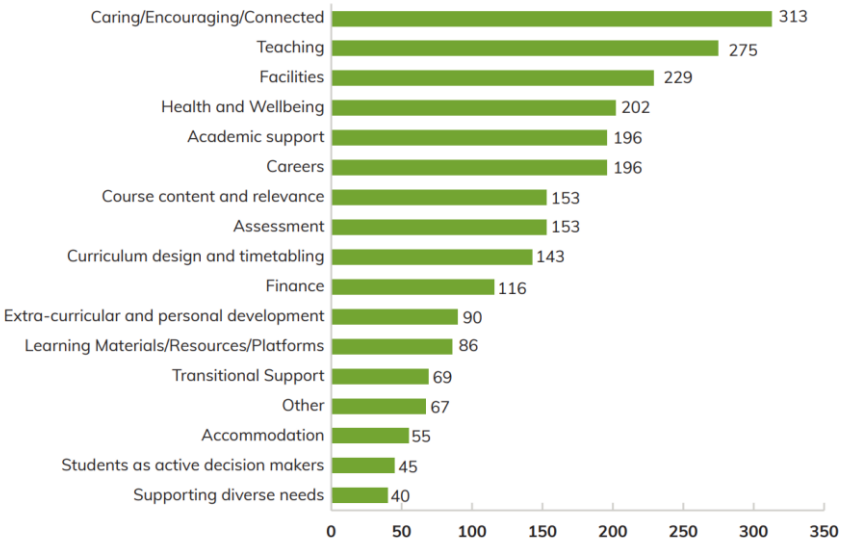

Figure 2: Student responses on institutional priorities for student success.
Source: National Forum (2019).

The GMIT Student Success initiatives align well with the national and international themes that enable student success in higher education institutes (see Figure 3).

National & International Themes to Enable Student Success	**Relevant GMIT Student Success Initiatives**
Engagement and Student Partnership	PASS Programme, NStEP, Entrepreneurship, Portfolios, Community Engagement. Healthy Campus, Academic Writing and Maths Centre.
Professional Development and the Centrality of Staff Who Teach	Teaching & Learning CPD Courses, Postgraduate Programmes & Teaching Resources.
Evidence-based Decision-making	Enabling Policies and Procedures at GMIT.
Supporting Transitions and Cultivating Belonging	PASS, LIS, Healthy Campus, First Five Weeks, Next Step, Employability Model. Academic Writing & Maths Centre.
Assessment and Feedback.	LIS, Community Engagement, Teaching Development, Portfolios, Entrepreneurship, Academic Writing & Maths Centre.

Figure 3. GMIT Student Success Initiatives Aligned with National and International Student Success Themes.

4. Impact of GMIT Student Success Initiatives

The initiatives in place (see Figure 1 and 3) have addressed national higher education issues under several Higher Education Authority (HEA) Ireland System Objectives including skills and employability, the first-year experience, graduate outcomes, managing diversity and student engagement, and this has resulted in significant improvements and increased student and staff engagement in the following areas:

- At an institutional level, outcomes have informed the **development of new policies and the review of existing institute policies and procedures** e.g. GMIT Retention Policy, LTA Strategy, RPL Policy, Online Learning Policy, External Examining and many more (see https://www.gmit.ie/general/quality-assurance-framework and https://www.gmit.ie/sites/default/files/public/general/docs/gmitltastrategicobjectives20192023lowres-2.pdf).
- **There has been an expansion of student support services available including:** The First 5 Weeks programme; Career Planning Clinics; Drop in before you Drop out clinics; GMIT Maths Learning Centre; Academic Writing Centre; the Healthy Campus initiative.
- **Each year 2,000 first year students undertake a module called Learning and Innovation Skills (LIS)**, providing students with a foundation in a wide range of skills to support their engagement with their programme of study. There is evidence students' greatly benefit from this mandatory module and it has an impact on their learning and development, as they progress into year two and beyond.
- There have been **significant improvements in first-year student progression rates** moving from 71% in 2014 to 79% in 2017 (i.e. First year progression is based on the HEA definition i.e. the presence of students on March 1st who were registered as full-time, new first time in year 1 on March 1st the previous year). In 2017/2018 GMIT achieved 80% retention (i.e. retention is students passing plus those allowed progress and carry as a percentage of students registered on the programme).
- With regards to **employability,** in 2018/19 GMIT recorded 93% of graduates were either in full time employment or in further study, on the completion of studies at GMIT.
- The Healthy Campus initiative has driven the **development of a Healthy Campus Action Plan,** which reflects locally identified needs and national health priorities for the purpose of promoting health and wellbeing throughout the Institute's strategic objectives. Notable actions implemented from 2019-2020 include: the introduction of a Clean Air Policy in three GMIT Campuses (e.g. smoke-free/vape-

free); a Nutrition Traffic Light System to foods prepared on campus; and hosting a healthy themed week during GMIT's #First5weeks induction programme.

- Engagement with industry **and an increased focus on employability** has resulted in developing a GMIT Employability Model and Statement (see Figure 4).

Figure 4: GMIT Employability Model. Source: GMIT (2019).

- There is strong evidence that the **Student Success initiatives have supported a culture of teaching and learning enhancement in GMIT.** This is demonstrated in the academic community's engagement with teaching development courses and specialist workshops including: the postgraduate, Certificate, Diploma and MA in Teaching and Learning (T&L), with over 120 staff engaging in one level 9 module or more since launching the L9, T&L suite of modules in 2017. In addition, over 400 staff in GMIT and partner higher education institutes have engaged with the online teaching and learning platform. www.cpdlearnonline.ie suite of short CPD courses and resources since launching in 2017. A study on the impact of CPD in earning and teaching is currently underway with GMIT Teaching and Learning Office and the findings will be published in 2020/21.

- There has been **increased collaborations** between faculty, students, the library, student services, research, careers function, the student's union and the teaching and

learning office in developing student success. All work groups established include members from multiple disciplines and student leader representatives.

- The development and enhancement of extra curriculum opportunities available to students has increased**.** The student **PASS study sessions** have grown from an offering of just three programmes in 2009 (see Figure 2) to 40 programmes in 2019, offering weekly one-hour sessions to first year students**. The Learning and Innovations Skills module** is available to all first-year students and a full suite of student engagement offerings covering academic and social needs is now supporting students as they transition into and out of higher education.

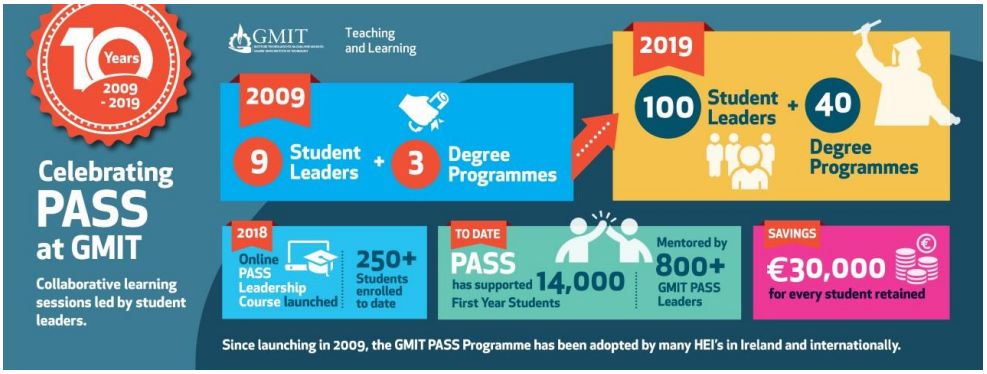

Figure 5: The Peer Learning Programme, weekly PASS study sessions for 1st year students + a student leadership programme for senior year students. Source: Ginty (2019).

- **GMIT has been recognised for several** awards in teaching and learning excellence including the National Forum DELTA Award scheme and the National Education Awards see https://www.gmit.ie/about/teaching-and-learning-project/teaching-and-learning-awards).

- A significant number of **conference and invited presentations** to other HEI's in Ireland and internationally have been delivered, about the range of student success initiatives showcased in Figure 1. In addition, several of the student engagement initiatives have been adopted by other HEI's in Ireland and internationally.

- **GMIT ISSE National Student Engagement** figures continue to rate equal or above the national average in Student/Faculty Interactions (2018 Indices 16.8 GMIT – all THEI's 15.4), Quality of Interactions (2018 Indices 40.0 – all THEI's 39.7) and Effective Teaching Practice (2018 Indices 35 – All THEI's 35).

For further information on the GMIT Student Success Model presented in this paper contact Dr. Carina Ginty, GMIT Teaching and Learning Office, ***carina.ginty@gmit.ie***

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