

INNODOCT/17

“ INTERNATIONAL CONFERENCE ON INNOVATION,
DOCUMENTATION AND EDUCATION”

Editores

Fernando Garrigós Simón

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María José Verdecho Sáez



UNIVERSITAT
POLITÈCNICA
DE VALÈNCIA

EDITORIAL

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UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Colección Congresos

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INNODOCT/17

“INTERNATIONAL CONFERENCE ON INNOVATION, DOCUMENTATION AND EDUCATION”

En esta publicación se presentan los artículos presentados a la conferencia INNODOCT/17 que tiene como objetivo proporcionar un foro para académicos y profesionales donde compartir sus investigaciones, discutir ideas, proyectos actuales, resultados y retos. La conferencia tiene como objetivo proporcionar un foro para académicos y profesionales que permita compartir sus investigaciones, discutir ideas, proyectos actuales, resultados y retos relacionados con las Nuevas Tecnologías de Información y Comunicación, innovaciones y metodologías aplicadas a la Educación y la Investigación, en áreas como Ciencias, Ingenierías, Ciencias Sociales, Economía, Gestión, Marketing, y también Turismo y Hostelería.

COLABORAN



In memory of Isabel Estellés Miguel

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PROLOGUE

As Dean of the Faculty of Business Administration, it is an honour for me to write this prologue that precedes the book of Proceedings of this great Conference that is INNODOCT 2017 (International Conference on Innovation, Documentation and Teaching Technologies), which has had place from the 25th to 27th of October at the Universitat Politècnica de València. That is why I am very grateful to the Organizing Committee.

The celebration of INNODOCT in 2017 has focused on the results concerning to the *New Information Technologies, Communication and Methodologies applied to Education and Research* in broad areas of knowledge that we develop in Universities. This Conference is a great opportunity to participate in an excellent forum to discuss, exchange of ideas, experiences, results and new challenges that enrich and value the work of researchers.

This document collects the papers presented in this new edition of 2017, that have been accepted after a rigorous system of peer review, and shows us the latest trends in innovation, documentation and education, thus promoting progress in learning and sharing new technological tools to the service of educational improvement in the University.

The European Higher Education Area requires incorporating new methodologies in our daily work and in this sense, the Universitat Politècnica de València and our Faculty of Business Administration are absolutely committed to it, so all these contributions will undoubtedly make us better

In this way, we contribute effectively to make a real methodological change in the classrooms to give a better response to the training needs of our students. In this way we can be better and our contribution to the formation of knowledge in the society will be increasingly excellent.

Attending to the quality of this latest edition, I have no doubt about the importance of these initiatives and I encourage the organizers to continue in this effort contributing to raising the excellence of our work in the areas of Sciences, Engineering, Social Sciences, Economics, Management, Marketing, Tourism and Hospitality.

María del Mar Marín-Sánchez

Dean of the Faculty of Business Administration

Decana de la Facultad de Administración y Dirección de Empresas

Universitat Politècnica de València

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PAPERS

ENGLISH

Examples of prAPPticals for physics at the UPV

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Abstract

Technology has changed our way of communication and represents an important and necessary element in our lives. Technology has also become a new interacting element in the teaching and learning process that strengthens digital competences and helps meeting the different needs of students. E-books, online platforms, electronic blackboards, online tools, the possibility to assign tasks and check it online, are nowadays usual elements at the universities. In this challenging context as part of the new active teaching strategies, we have introduced for our laboratory of Physics some prAPPticals with an integrated use of free apps. Our approach will bring the learning to a personal, more attractive, stimulating, motivating and portable environment (smartphone). For example, in the acoustics prAPPtical we use an app as a sound/noise source and we measure ground noise and acoustic levels in dB at specific locations with a sound meter (app). Previously the enclosure is described through another app (metric survey). Two other examples (lighting and elasticity) will be presented and discussed in the paper as well as the related innovative aspects. A special focus will be also put on the training of competences or skills (cooperative learning, language training, improving digital skills) embedded in this new activity and the consequences on the assessment.

Keywords: *learning process, active teaching, apps for mobiles, physics practicals.*

Introduction

Technology has changed our way of communication and represents an important and necessary element in our lives. Technology has also become in the last years a new interacting element in the teaching and learning process that strengthens digital competences and helps meeting the different needs of all kinds of students through the use of internet (Kaminski, 2005).

Education at universities has become more creative, participatory and socializing. The new generations of students show an increasing interest in collaborative working and universities must meet their new educational needs (West & Knight, 2012).

E-books, online platforms, electronic blackboards, online tools, online just in time research of information, the possibility to assign tasks and check it online, are nowadays usual elements at the universities. The perspective in the classroom has changed in order to become student centred. At the same time there is a growing need to create in the classroom a kind of community that can better encourage, support and develop the learning process (Cognition and Technology Group at Vanderbilt, 1992).

We are already beyond classic lectures where the teacher by using slide presentations explains theoretical and practicals contents. Students just could take notes almost without any options to solve doubt in the classroom or simply ask for further information. Nowadays more participative learning activities and strategies are used. The current teaching methodologies include new tasks and assignments to adjust the knowledge acquired by students with the new meta-competences (problem solving, teamwork, metacognitive aspects and use of new information technologies), as indicated by Garcia et al. (2002) and Lopez Aguado (2010).

Outside the classroom smartphones represent a primary tool for communication, information exchange, new experiences, networking in this very connected world. Imbriale (2013) explains how student's engagement and personalized learning arise by using integrated digital tools and how a kind of customization of the learning process can be achieved. Students enhance their self-concept and motivation by developing inventive thinking (Sivin-Kachala & Bialo, 2001).

Furthermore the theoretical and field studies of Bråten & Olaussen (1998) and Pintrich (2000) explain how emotional and motivational competences are increasingly important beyond the teaching aspect, since they influence the learning process and the final result of this process. It is important to convert students into active actors in their learning process by promoting a deeper and more strategic approach for the internalization of the final objectives as indicated by Tapia (1997). Motivation is a crucial issue and a key element of the learning process, as stated by Keller (1983). In this context, the Kolb's theory can be considered an important theoretical reference point. Four main elements are included in the learning process: concrete experience (CE), critical observation (CO), abstract conceptualization (AC) and active

experimentation (AE), as indicated by Lozano (2000) and Sauaia (2010). By combining those elements four learning styles can be developed: diverging CE+CO, assimilating AC+CO, converging AC+AE and accommodating CE+AE. Processing and reflection are the two fundamental variables (axes) of the process. There is undoubtedly a direct relationship between this model and the active methodologies. Students, after experiencing, observing and reflecting, will better assimilate abstract concepts with the possibility of giving feedback through new associated experiences. This is also the case of the Experiential Learning Theory (ELT) as described by Baena & Mattera (2015). Students internally process the experiential information and can either act consequently or wait and observe actions made by others for a later reflection. Kuhn, Vogt and Hirth (2014) also present some examples of practicals using smartphones.

In this challenging context as part of the new active teaching strategies and in order to increase student satisfaction and motivation, we have introduced for our laboratory of Physics some prAPPTicals with an integrated use of free apps. Our approach aims to bring the learning process to a personal, more attractive, stimulating, motivating and portable environment (smartphone) according to the new given background situation.

This paper first shortly discusses the pedagogical background of learning process, motivation and application of new technologies in classroom. Second we describe all used apps and third we present three prAPPTicals for lighting, acoustics and elasticity. Finally we will present some conclusions and final comments.

1. Description of used APPS

In this section we describe the main features of the used apps with some extra data. All apps (or very similar ones) are free and available for Android and/or iOS devices. The last app is a virtual physics laboratory where different experiences can be performed.

1.1. MagicPlan (by Sensopia)

MagicPlan easily creates plans with professional quality through taking photos of the enclosure. Objects, comments, pictures and other elements can be easily added for a better and more exhaustive description of any enclosure that can be used for further technical reports.

1.2. Light/Lux Meter FREE (by Patrick Giudicelli)

In construction a light meter measures the illuminance, a crucial factor for any natural or artificial lighting design project. In photography, a light meter is often used to determine the proper exposure for a photograph. This app displays the amount of light in lux, the shutter speed, the ISO and the focal.

1.3. Decibel 10: Noise dB Meter, FFT Frequency Analyser (by SkyPaw Co. Ltd)

Decibel 10 is one of very few noise/sound meter apps giving highly reliable and pre-calibrated measurements. It can measure directly and professionally sound or noise (acoustic level and background level) in dB. The option of measuring dBA or dBC is not free of charge.

1.4. Sun Surveyor Lite - Sun, Sunrise & Sunset Position Visualization and Prediction Tool (by Adam Ratana)

Sun Surveyor allows architects, solar industry professionals and real estate agents to check the natural lighting conditions and the sun elevation and azimuth for a further study of sun captation or shading devices and as well as photographers and filmmakers to get the perfect shot.

1.5. Physics Toolbox Accelerometer (by Christian Vieyra)

This accelerometer sensor app measures and displays a graph of G-force vs. time (s) and acceleration (ms^{-2}) vs. time (s) in x, y, and/or z dimensions, as well as the total magnitude. Total magnitude of acceleration or G-Force data can be recorded and exported by e-mail as a .csv attachment for a further use of the collected data. Settings permits to plot data against elapsed time or clock time, to change the plot line thickness, or to change data collection rate. A brief tutorial is also available.

1.6. Signal Generator (by RadonSoft)

This easy to use app (Android) generates white and pink noise. Frequency (0 - 20,000 Hz), amplitude (~volume) as well as the shape of the sound wave (sin, square, triangle, and saw-tooth) can be modified by the user. This app can be used in science simultaneously to a sound meter to determine the inverse-square law for sound intensity, or with another tone generator to produce audible beats (by combining two tones of slight different frequencies). There is a similar app for iOS too (*Signal Generator: Audio Test Tone Utility* by Media Punk Studios).

1.7. Physics Toolbox Spectrum Analyser (by Christian Vieyra)

By using a Fast Fourier Transform (FFT) a real-time spectrum plot of the captured audio is displayed. Frequency check is always interesting due to differential sensibility of humans to frequencies especially to low frequencies (16-256 Hz).

1.8 Fluid Mechanics (by Adil Chauhan)










This app calculates capacity, velocity, flow depth and percent flow for a circular pipe using Manning's equation. This application can be used by engineering students for preliminary hydraulics analysis under open channel flow conditions.

1.9. Physics Studio (by Sridhar Sundaram)

This app is a virtual laboratory for physics. Many concepts in Physics (electricity magnetism, inertia, atoms, states of matter and waves) are presented through play games and experiments are created virtually on smartphones. The visualisation of molecules, electric current and magnetic field helps forming a clear picture in student's head of how these things work. The white-box experiments go way beyond laboratory experiments.

Other visited websites with further examples of prAPPticals can be found in the references (Measure of acceleration, Smartphones en physics classroom, Verier Video Physics App). Table 1 finally summarizes the main characteristics of the apps and the involved physical magnitudes.

Table 1. Characteristics of the apps

APP	logo	Physical magnitude	available on
MagicPlan		metric survey (dimensions for a plan)	<input checked="" type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Light/Lux Meter FREE		illuminance	<input checked="" type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Decibel 10		noise/sound level	<input checked="" type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Sun Surveyor Lite		latitude, azimuth, solar elevation	<input checked="" type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Physics Toolbox Accelerometer		acceleration vs time G-force	<input checked="" type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Signal Generator		sound source, power level	<input type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Physics Toolbox Spectrum Analyser		frequency, amplitude, power	<input checked="" type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Fluid Mechanics		capacity, velocity, flow	<input type="checkbox"/> iOS <input checked="" type="checkbox"/> Android
Physics Studio		virtual physics laboratory	<input checked="" type="checkbox"/> iOS <input checked="" type="checkbox"/> Android

2. Examples of prAPPticals

This section includes three examples of the most representative newly introduced prAPPticals regarding acoustics, lighting and elasticity. Those prAPPticals have been developed for three subjects of two different degrees with the aim to improve student's motivation and satisfaction by creating a smarter, portable, reproducible and more exciting

learning environment. Students becomes main actors and the teacher role is set on a second layer.

Students always previously receive some instructions about the prAPPtical and the associated app through the online platform. The use of the app is shown and explained at the beginning of each laboratory session. In some cases apps in English are used as part of the language training.

2.1. PrAPPtical of Acoustics

The main objective of this prAPPtical is to check the inverse-square law for sound intensity and to better understand some characteristics of the behaviour of a sound wave. This prAPPtical covers part of the programme of the subject Physics for Technical Architecture in the degree of Building Engineering.

Students start the dimension survey of the laboratory with the app *MagicPlan* and take some pictures as part of the crucial information for the final survey and report. In this practical we use the app *Decibel 10* to measure ground noise and the acoustic level in dB at representative positions (1, 2, 4 and 8 m from the source). At least five measures are taken at each point and average values as well as the standard deviation will be calculated. The sound source is created through the app *Physics Toolbox Tone Generator*. We also simulate the acoustical behaviour of the enclosure in order to calculate the power level (LW). Furthermore students are asked to apply acoustics rays (room acoustics theory) for calculating direct and reflected level at the same positions in order to better understand all acoustics magnitudes and related phenomena. Students can also finally perform a frequency check of the ground noise by using the app *Physics Toolbox Spectrum Analyser*.

2.2. PrAPPtical of Lighting

The main objective of this prAPPtical is to check the illuminance in the laboratory. Light is an important topic of the subject Light, Sound and Heat in the degree of Building Engineering.

Illuminance is defined as the amount of light reaching (illuminating) or spreading over a given surface area. It represents a key magnitude in order to check the lighting quality of an enclosure. After a preliminary description of the enclosure by *MagicPlan*, students can study the lighting conditions by measuring the illuminance in lux by considering two different scenarios (natural lighting, artificial + natural lighting) according to a grid of representative measuring points (A to F and 1 to 4) with the app *Light/Lux Meter FREE*.

At least five measures are taken at each point and all data will be statistically checked. Students share finally through the online platform all measured data in order to create an isolux map as shown on Figure 1 as part of the collaborative learning.

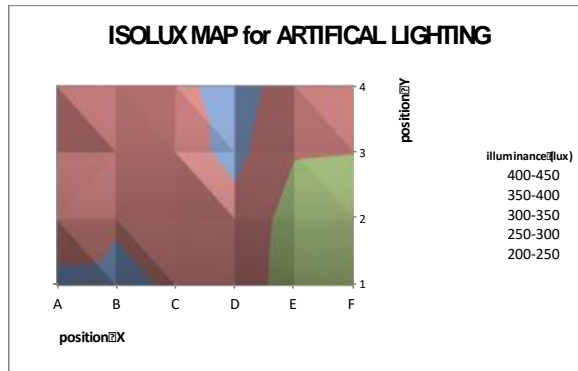


Figure 1. Resulting isolux map for the artificial lighting scenario

2.3. PrAPpticals of Elasticity

The main objective of this prAPptical is to indirectly calculate the elastic constant k of a spring by applying the law of Hooke under dynamic conditions as part of the subject Fundamentals of Physics in the degree of Mechanical Engineering.

Students prepare a “spring+mass+smartphone” system and start recording the oscillations the system (spring+mass+smartphone) with the app *Physics Toolbox Accelerometer* after pulling the mass on the spring and releasing it for the system to oscillate as shown on Fig. 2. At least 15-20 oscillations should take place in order to get correct results. Different masses from 50 g to 500 g, depending on the characteristics of the spring, may be used.

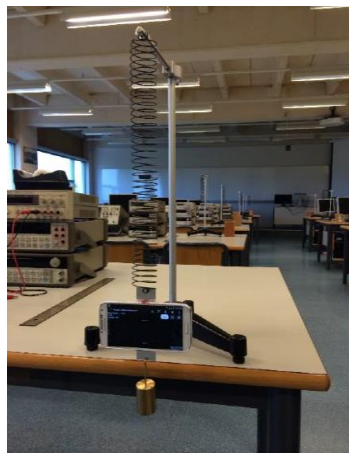


Figure 2. “Spring+mass+smartphone” oscillating system.

Static conditions are also considered by using some mass and by measuring the new length L that can be compared with the initial one L_0 . The calculation of direct and indirect errors is

also asked in order to have a more exhaustive overview of a laboratory data collection experience.

3. Conclusions

The feedback by students confirmed the great acceptance of this new way of approaching laboratory practicals. The creation of a new, more exciting, personal and customized working/learning environment has improved student's engagement and satisfaction.

The portability of many measuring devices in the smartphone and the reproducibility of the laboratory experience also in other environments (outside the laboratory) are an added value. The training of competences and skills (cooperative learning, language training, improving digital skills, autonomous learning) related with this new activity is undeniable as students took on a greater role and lecturers becomes simple facilitators, though maintaining an adapted teaching profile.

Figure 3 shows the results of a survey where (standard) practicals and new prAPPticals have been evaluated according to five horizons (competences and satisfaction) on a radar diagram with values from 0 (not matching) to 5 (very developed). The form and the size of the pentagon of the prAPPticals (continuous line) shows without a doubt the increased reached level of competences and satisfaction compared with standard practicals (dotted line).

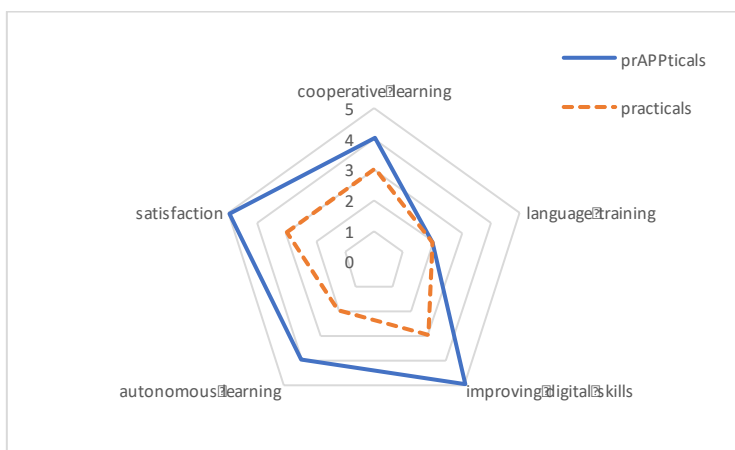


Figure 3. prAPPticals vs practicals

This new approach and new relationship between students and lecturers brings finally to a significant improvement of the quality of the laboratory reports with direct and positive consequences on the assessment. We have in mind to improve the implementation of prAPPticals throughout more subjects and more physics topics.

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Image, Credibility and Reputation: Perceptions of Deceitful Corporate Communication in the Classroom

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Abstract

In 2013, Drummond Ltd., a coal mining company, concealed and lied about the occurrence of a major coal spill on Colombia's northern coast. In light of a pedagogical exercise in an executive education context, this paper analyzes international observers' perceptions about the deceitful behavior of this multinational company when communicating with stakeholders after the mentioned accident took place. I do it by testing three constructs—perceived corporate image, credibility, and reputation—on a two-round basis, i.e., before and after the revelation of the company's deception through its official ex-post communications. For that to happen, a combined exercise of group-based inquiries and individual self-administered surveys was performed. Respondents were 174 professionals of diverse nationalities and backgrounds, all of them enrolled in several graduate programs at an accredited French school of business. When both moments of measurement were compared, results showed a clear decrease in the mean value of all three constructs, but an increment in variability of responses. Theoretical and practical implications are discussed in light of the effects of deception in corporate communication, and the importance of this topic for managerial education in general.

Keywords: *Corporate communications, corporate image, corporate credibility, corporate reputation, managerial education.*

Resumen

En el año 2013, la compañía minera Drummond Ltd. le ocultó y mintió a sus stakeholders sobre la ocurrencia de un delicado incidente medio-ambiental en la costa norte Colombiana. En este trabajo se analiza la percepción de algunos estudiantes internacionales acerca de dicho comportamiento engañoso. El ejercicio académico se hace mediante la medición de percepciones de tres constructos al nivel de la compañía: imagen, credibilidad y reputación. A través de un proceso de consulta grupal y de diligenciamiento de encuestas auto-administradas se desarrolló una consulta en dos rondas, esto es, antes y después del descubrimiento del engaño ejercido por la compañía a través de su proceso comunicacional posterior al incidente en mención. La muestra estuvo compuesta por 174 estudiantes profesionales de diferentes nacionalidades y pertenecientes a diferentes programas de maestría de una escuela de negocios Francesa acreditada internacionalmente. Al procesar los datos obtenidos en las dos rondas, se observó un claro decrecimiento en el valor promedio de los tres constructos medidos, pero con un incremento en la variabilidad de las

respuestas. Finalmente, se discuten las implicaciones teóricas y prácticas de dichos resultados, lo cual se hace a la luz de los efectos del engaño en las comunicaciones corporativas y en la importancia de este tópico para la educación gerencial en general.

Palabras Clave: *Comunicación corporativas, imagen corporativa, credibilidad corporativa, reputación corporativa, educación gerencial.*

Introduction

Being the second most biodiverse country worldwide makes Colombia the holder of a noteworthy environmental wealth. Its natural resources are a determinant aspect for the economic development of a significant portion of its 48.2 million inhabitants and their future generations. In this respect, an important number of companies have been attracted by the possibility of exploiting, acquiring, and trading those resources for their own benefit in exchange for attending some needs and expectations of that country's government, communities, and society at large. Sometimes, due to many reasons, those needs and expectations are not only overlooked but also transgressed. For instance, acts of environmental wrongdoing committed by companies have been part of the everyday Colombian reality for many decades—hydrocarbon spills, abusive use of clean water, air industrial pollution, uncontrolled explosions, and shedding of minerals and waste into water are only a few examples. When these things become notorious, the companies involved are usually compelled to respond by communicating officially through various means in a discreet way for the sake of maintaining the validity of the social approval that they ultimately need. Disturbingly, in such communications, some companies are not able (or not willing) to report what has really happened.

The Colombian mining industry seems to provide an appropriate scenario to illustrate the organizational behavior mentioned above. Companies belonging to this economic sector once claimed a status of “being good corporate citizens” and tried hard to display an image according to the label of “responsible mining.” Nevertheless, the evidence shows that they were not as responsible as they pretended to be. Specifically within this industry, the company Drummond Ltd. (Drummond hereinafter) is well known for being one of the main characters in some socially and environmentally harmful events that have been infamous in recent years (Garay et al., 2013; Huertas et al., 2012; Jiménez, 2014; Otálora, 2015; Shaefer, 2014). One of the most salient of these episodes is the incident analyzed in the present study: the coal spill of January 2013.

This paper presents a basic description of a pedagogical exercise and the data collected under its purview within the course of Corporate Social Responsibility (CSR) taught to master's degree students of an accredited French school of business. The case study methodology was applied in the classroom (Ellet, 2007). Its implementation is framed on the Drummond coal spill, a major environmental case of wrongdoing that occurred on the Colombian shoreline

during January of 2013. The company's decisions and actions on that day and after the event are analyzed in light of students' perception of Drummond's corporate image (PCI), corporate credibility (PCC), and corporate reputation (PCR). In this sense, the purpose of this work consists of analyzing Drummond's PCI, PCC, and PCR in the eyes of international observers, on the basis of its behavior when communicating with stakeholders after the incident in question took place.

1. Theoretical Background

1.1. Corporate Image

Corporate image is described as the overall impression made on the minds of the stakeholders by an organization (Barich and Kotler, 1991; Dichter, 1985; Finn, 1961). It is related to the various physical and behavioral attributes of the organization, such as business name, architecture, variety of products/services, tradition, ideology, and to the impression of quality communicated by each person interacting with the organization's costumers (Nguyen and Leblanc, 2001).

1.2. Corporate Credibility

Credibility, in general, can be seen as an entire set of perceptions that receivers hold toward a source (Bettinghaus, 1969). By Newell and Goldsmith's (2001) definition, corporate credibility is the extent to which stakeholders feel that the firm has the knowledge or ability to fulfill its claims and whether the firm can be trusted to tell the truth or not.

1.3. Corporate Reputation

After displaying a considerable number of perspectives from which the concept of reputation can be defined (economics, strategy, accounting and marketing, among others), Fombrun et al. (2000) came up with their own definition. According to them, corporate reputation calibrates an organization's relative standing internally with employees and externally with its other stakeholders, in its competitive and institutional environments. A reputation is therefore a collective assessment of a company's ability to provide valued outcomes to a representative group of stakeholders (Fombrun et al., 2000).

2. Drummond and the Coal Spill

To date, Drummond is the second largest thermal coal-mining company in Colombia, which in turn is the world's fourth largest coal producer country and holder of the biggest coal reserves in the Americas (Simco.gov.co, n.d.). The company has existed since 1987 and represents the most important project of Drummond Company Inc., the 210th largest private firm in the US (Forbes.com, 2016). Currently, this product is entirely extracted from open-pit mines located in the northern region of the country. In addition to extracting and

transporting coal, Drummond's process incorporates operations in its own deep-water ocean port, from which until 2014 the final product was finally exported through a system of barges, which were in charge of transporting the coal from the port to the corresponding cargo ships. Drummond is one of the most important suppliers to European thermal coal power plants, as well as to plants in the USA and Israel.

At 11:50 pm on Saturday, January 13, 2013, as part of a normal operation in the port operated by Drummond, and taking into consideration bad weather conditions in the area, one of the company's barges, loaded with 1,870 tons of coal, was towed and left moored to a buoy. The idea was to wait for the weather to improve before resuming operations. However, the storms and high waves continued, and water began to enter the moored vessel, causing the barge semi-submersion. Around seven hours after, and thanks to the sunlight, the morning-shift supervisor could observe the situation and activated the emergency alarm. As part of the company's rescue protocol, it was ordered that cranes be deployed and start removing the coal and throw it into the water until the point at which the barge could recover its buoyancy. The entire load of the barge at the time of the accident, that is, 1,870 tons, was later presumed to have been dumped into the sea during that day as a consequence of those actions and decisions (Anla, 2013, 2014).

In the aftermath, Drummond decided not to disclose the incident to the public immediately after its occurrence. However, in an extraordinary turn of events, 17 days later, an independent journalist published on his personal blog some images of the accident, which were rapidly broadcast by the official Colombian media. To top it off, from that moment on, Drummond was brazenly deceitful, particularly by making clearly contradictory statements about the amount of coal dumped into the seabed (Contreras-Pacheco, Rodríguez, & Barbosa, 2016). In the end the company was formally accused, and ultimately found guilty, of causing a major catastrophe in the Colombian environment on that day (Molinski, 2014).

3. Methodology

The pedagogical exercise basically consists of measuring three different constructs before and after becoming acquainted with Drummond's decision to conceal the facts and alter reality by reporting different amounts of coal spilled into the ocean. These measurements were taken on a two-round basis, i.e., (1) after learning the facts of the incident and (2) after analyzing several documents (media items and company reports) with explicit mentions of the amount of coal presumably spilled during the accident addressed by the company. The respondents were 174 professionals of diverse nationalities and backgrounds, all of them enrolled in several master's degree programs at a triple-accredited business school in western France. A questionnaire instrument was constructed using 19 randomly organized items measured on a 5-point Likert scale (1 being "strongly disagree" and 5 "strongly agree"). The questionnaires were self-administered, web-based for the first round and paper-based for the second round.

In order to afford full attention to all participants, the full classroom activity was performed in five different groups distributed into two weeks of the winter session 2017 (February) and developed as follows:

- **Initial Review:** In advance of the class, Drummond's 2013–2014 sustainability report (SR; Drummond Ltd., 2015) was digitally delivered to every student to review. A special recommendation to read the company's final description of the incident was made. In this description the company stated that the amount of coal was between 300 and 500 tons.
- **First-Round (Before) Survey:** Every student was invited to fill out an online survey (using the SurveyMonkey.com platform) after finalizing the review.
- **Classroom Dynamic:** During the class, students were asked to read *Semana.com*'s 2013 article (previously translated into English). The weekly magazine *Semana* was by that time one of the most reputed and credible media outlets in Colombia, and this particular article was one of the first descriptions documented by the media after the accident. In it, students became acquainted with the way in which the incident was actually revealed to the public after Drummond's effort to cover it up. The article also depicts the probable spill of 1,870 tons of coal into the seabed (instead of the between 300 and 500 mentioned in its SR). The link to the blog of independent journalist Alejandro Arias (Arias, 2013), the whistleblower who posted the pictures, was also provided for students to examine those pictures.
- **Group Work:** Students were asked to get together into subgroups of four or five people. Seven subgroups were finally formed in each group. Each subgroup was given a web link to a specific document, media item, investigation proceeding, or Drummond press release. Six of them were translated into English. For the case of the investigation proceedings (Anla, 2013, 2014), and taking into account their volume of information, specific page numbers were provided. Every one of these documents contained, in one way or another (interview, declaration, conference, and official statement, among others), a different mention of the coal amount addressed by the company. The documents delivered, together with the SR, are referenced and compared in Table 1.
- **Case Discussion:** At this stage, it was expected that, besides confirming the company's intent to conceal the facts of the incident, students would also take notice about the evident contradictions of Drummond's executives when referring to amount of coal spilled by the company during the accident. Since this activity was a case study discussion, the instructor followed the suggestions of Ellet (2007).
- **Second-Round Survey:** Every student was asked to fill out a paper-based survey after the case discussion. Needed to say, all the items in this second survey were the same items of the first one.

For the sake of the data analysis, all of the variables were reorganized into the three constructs examined: PCI, PCC, and PCR. After that, a statistical diagnosis was performed by using IBM® SPSS® V22. In this way, relevant descriptive outcomes as well as every construct value and reliability in both rounds were obtained. Finally, in order to find out any signal of statistical significance in variation of results, a t-test was applied among results of every construct between both rounds.

Table 1. Documents delivered to students before discussion

No.	Type	Date	Description	Figure Mentioned by Drummond	Reference
1	Press Release (a)	14-feb-13	Drummond Ltd.'s Declaration – Results of the barge accident's internal investigation	110 tons	DrummondLtd.com (2013)
2	Interview	17-feb-13	300 tons, the amount dumped into the ocean: Drummond says	300 tons	Eltiempo.com (2013)
3	Newspaper clipping	22-feb-13	Miners promise to reduce extreme poverty of Colombia (Drummond's conference)	150 tons	Layton (2013)
4	Internal Magazine	01-dec-13	Findings of the barge's contingency	A small amount	Drummond Ltd. (2013)
5	Investigation Proceedings # 1	18-dec-13	Environmental Authority's 1st. Resolution (Drummond's statement)	35 tons	Anla (2013)
6	Press Release (b)	19-jan-14	Drummond Ltd. responds with FACTS and Asks WHY?	200 tons	DrummondLtd.com (2014)
7	Investigation Proceedings # 2	14-jul-14	Environmental Authority's 2nd. Resolution (Appeal; Drummond's statement)	180.66 tons	Anla (2014)
N/A	Sustainability Report	27-oct-15	2013-2014 Drummond's Integrated SR	Between 300 and 500 tons	Drummond Ltd. (2015)

Source: Author

3.1. Measures

Measures were extracted from relevant literature. All three scales were reproduced and applied in both rounds. Scales and corresponding references are in Table 2. Items included in these scales are displayed in Appendix 1.

Table 2. Measures and references used

Measure	Details
PCI	Three-item instrument proposed by Nguyen and Leblanc (2001)
PCC	Eight-item instrument proposed by Newell and Goldsmith (2001)
PCR	The Reputation Quotient SM : Nine-item instrument proposed by Fombrum et al. (2000)

Source: Author

4. Results

Relevant results of arithmetic means and standard deviations for both items and constructs are displayed in Table 3. Cronbach's Alpha for every construct is also calculated and shown

in order to have a previous idea of all three constructs' reliability. Since no model was being tested with this work, no item was dropped in order to increase reliability. Every result was calculated for both rounds.

4.1. Perceived Corporate Image (PCI)

Based on the first round, it was evident that most people were undecided about Drummond's PCI. Based on the standard deviations obtained, this was especially true when addressing the item "In my opinion, Drummond Ltd. has a good image in the minds of its stakeholders" (s.d. = 0.82). Probably these kinds of results were obtained because some respondents assumed the company's image within its context, while others considered their own perceptions about the company instead. However, taking into account the entire scale, a significant number of people strongly agreed (38 out of the 174 respondents) that the company possessed either a good or a very good image in round 1, even while acknowledging the incident.

For the second round, all three variables of this construct dropped significantly. However, the most substantial change concerning respondents' view of the PCI was the relative position of Drummond's image among its competitors (similar companies). This figure dropped by 29.30% from one round to another. Intriguingly, this result was obtained regardless of the scant knowledge of the audience about the other actors in the Colombian mining industry.

On the other hand, regarding the perception of the image projected to its stakeholders, this variable did not change to such a high degree in the second round, and the results were divided similarly among the "disagree," "undecided," and "agree" categories. This may indicate that students have different perceptions of who the most important stakeholders for Drummond are. Nevertheless, results can be explained by the company's evident inability to deliver on its promises to the media and the government.

As can be seen in Table 3, variability in results increased from one moment to another (n.d.), displaying a significant degree of divergence in perceptions in round 2. However, construct reliability (Cronbach's Alpha) improved considerably between these two moments. Figure 1 shows the contrast in the responses concerning Drummond's PCI.

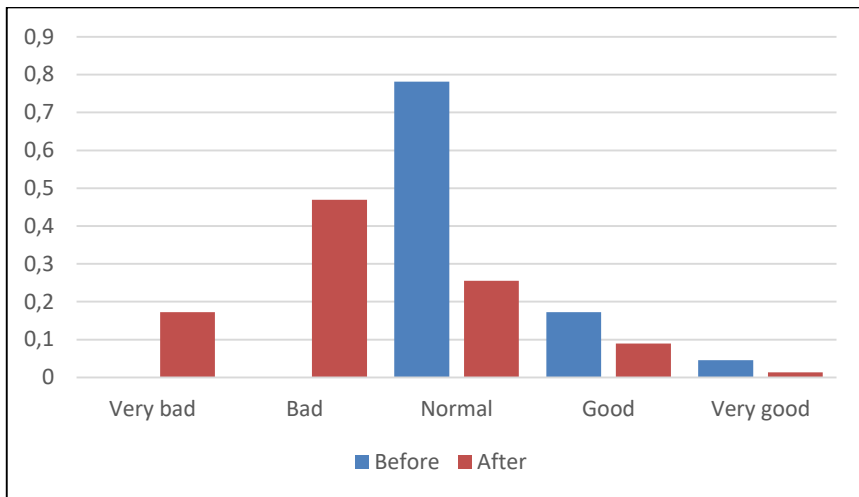


Figure 1: Drummond's Δ PCI (round 2 vs. round 1)

Δ PCI = μ (PCI round 2) - μ (PCI round 1)

Δ PCI Estimation: -0.6404

95% CI for Δ PCI: (-0.7620; -0.5188)

T test for Δ PCI = 0 (vs. \neq); t-value = -10.34; p = 0.00; DF = 717

4.2. Perceived Corporate Credibility (PCC)

According to the data collected in the first round, one can see that Drummond apparently had a decent level of corporate credibility among the respondents. However, there are two aspects to take into account. First, the respondents generally did not perceive that the company had vast experience, which probably led them to think that Drummond was not a reliable company. Second, it seems that Drummond was perceived as a company skilled in its field and honest in its actions (probably because of the appealing Sustainability Report rhetoric and the way the incident was narrated in the SR itself).

However, after the deception was revealed, respondents' general perceptions with regard to this construct were visibly affected in a negative way, and, like the PCI behavior, with less consistency in the responses (from a 0.56 in round 1, the construct s.d. rose to 1.12 in round 2). For the second round, although most students still considered that the company had extensive experience, most of the answers were clustered around "undecided." Moreover, there were diverse results concerning Drummond's skills, experience, and honesty among the sample, and there was no clear tendency in the answers. Furthermore, construct reliability in this round was extremely low (Cronbach's Alpha = 0.31), which questioned some aspects related to this measurement and/or the relevance of some items within the scale. Consequently, what these results suggest is that further studies should be conducted to

determine differences according to respondents' profiles and/or establishing a greater reliability and validity of the measures. Figure 2 shows the contrast in responses (Δ) concerning Drummond's PCC between round 1 and round 2 (before and after the discussion).

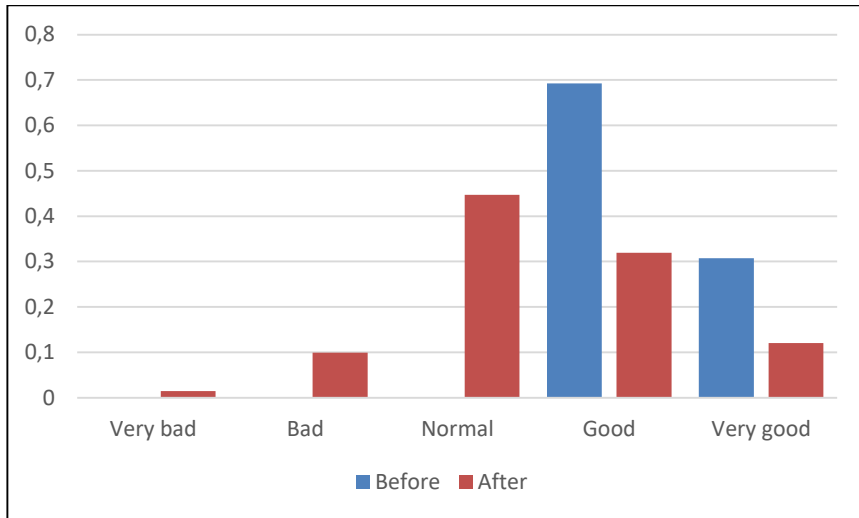


Figure 2: Drummond's Δ PCC (round 2 vs. round 1)

Δ PCC = μ (PCC round 2) - μ (PCC round 1)

Δ PCC: -0.2798

95% CI for Δ PCC: (-0.3507; -0.2089)

T test for Δ PCC = 0 (vs. \neq); t-value = -7.74; p = 0.00; DF = 1604

4.3. Perceived Corporate Reputation (PCR)

Similar to the PCC, Drummond's PCR exhibited two identifiable trends in the first round. On the one hand, many respondents considered that the company maintained a high standard in the way it treated people, this being reflected in good perceptions (feelings) concerning the company and the way it is managed. On the other hand, even though Drummond's SR focuses on this matter, respondents did not seem either to identify or agree that the company is a good employer or has good employees. Nonetheless, generally speaking, and with a very decent level of reliability (Cronbach's Alpha = 0.74), it can be stated that Drummond's PCR at this stage was acceptable (Group Mean = 3.21).

However, analyzing the behavior in the responses, one can suggest that Drummond's PCR was evidently affected (the construct's mean decrease reached 18.38% from round 1 to round

2). This result was perhaps a consequence of the shortcomings in information shared with the company's stakeholders, generating a lack of trust and affecting corporate confidence (the scores for the item "I trust companies like Drummond Ltd." were also very low). Conversely, in spite of this fact and the evident deception, some students indicated perceptions of an honest company.

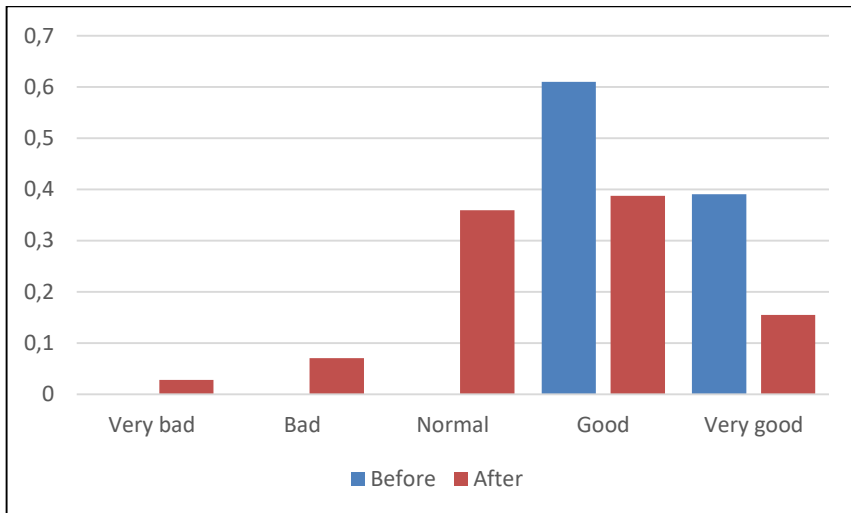


Figure 3: Drummond's Δ PCR (round 2 vs. round 1)

$$\Delta\text{PCR} = \mu (\text{PCR round 2}) - \mu (\text{PCR round 1})$$

Δ PCR Estimation: -0.5785

95% CI for Δ PCR: (-0.6461; -0.5110)

T test for Δ PCR = 0 (vs. \neq); T-Value = -16.79; p = 0.00; DF = 1918

Furthermore, there was no unified vision with respect to the items concerning the company as a good place to work, with a solid management structure and employees (i.e., "It seems that Drummond Ltd. is well managed," "It looks as though Drummond Ltd. is a good company to work for," and "It looks as though Drummond Ltd. is a company that would have good employees"). Apparently, the responses varied depending on the background of each student, which suggests the need for further analysis taking into account the demographic characteristics of respondents. Nevertheless, taking a general look at the results, respect and admiration for Drummond did not decrease significantly in this second stage. Presumably, the latter aspect was still influenced by the information contained in the company's SR about the way it treats employees. As this information was checked in the first round and had nothing to do with the incident itself, the overall results were maintained in the second stage.

Table 3. Items and constructs results

Cod.	Before					After				
	Mean	DesvSt	Cronbac h's Alpha	Group Mean	Group DesvSt	Mean	DesvSt	Cronbac h's Alpha	Group Mean	Group DesvSt
<i>IMA</i>	<i>Perceived Corporate Image</i>									
IMA.1	3,22	0,63				2,67	1,09			
IMA.2	3,43	0,82	0,56	3,32	0,73	3,03	1,02	0,73	2,68	1,10
IMA.3	3,31	0,73				2,34	1,08			
<i>CRE</i>	<i>Perceived Corporate Credibility</i>									
CRE.1	3,13	0,49				2,76	1,02			
CRE.2	3,26	0,68				2,59	0,86			
CRE.3	3,18	0,58				3,46	3,54			
CRE.4**	3,08	0,39				3,10	1,09			
CRE.5*	3,07	0,37	0,79	3,17	0,56	2,43	1,11	0,31	2,89	1,12
CRE.6	3,18	0,58				2,23	0,95			
CRE.7	3,23	0,64				2,90	1,00			
CRE.8**	3,21	0,61				3,92	1,11			
<i>RPQ</i>	<i>Perceived Corporate Reputation (The Reputation QuotientSM)</i>									
RPQ.1	3,33	0,75				2,35	0,96			
RPQ.2	3,24	0,65				3,67	1,07			
RPQ.3*	3,07	0,37				2,43	1,11			
RPQ.4	3,23	0,64				2,81	0,99			
RPQ.5	3,18	0,58	0,74	3,21	0,61	2,62	0,93	0,77	2,63	1,10
RPQ.6	3,09	0,42				2,73	0,94			
RPQ.7	3,17	0,56				2,01	0,90			
RPQ.8	3,22	0,63				2,00	0,91			
RPQ.9	3,34	0,76				3,06	1,08			

* Variable shared by both constructs CRE and RPQ. Their treatment is separated.

** Variables reverse coded.

Source: Author

Finally, it was noted that responses concerning Drummond’s projected corporate social responsibility (CSR) changed drastically from one round to another in an unfavorable way. This particular item’s (RPQ.8) arithmetic mean dropped from 3.22 to 2.00 (37.89%) with a not-too-drastic change in variability. The final perception of the company’s CSR salience was that the company was not environmentally responsible, nor did it support good causes; this affected perceptions of the company’s reliability as there were negative impressions concerning the way in which decisions were made about this particular concern. Figure 3 shows the contrast in responses regarding Drummond’s perceived corporate reputation.

5. Discussion

The fact that Drummond is a powerful multinational company, performing in a sensitive industry of a developing country, means that its actions and decisions will of necessity be

under constant scrutiny by different observers. In fact, before and after the coal spill, Drummond's actions profoundly affected its image, its credibility, and its reputation with its stakeholders (Garay et al., 2013, Huertas et al., 2012; Jiménez, 2014; Otálora, 2015; Shaefer, 2014). However, sometimes, perceptions of external observers are relevant in order to understand a particular reality and to assess special episodes in a more objective way. Executive education classrooms seem to be proper spaces to share those perceptions; there is the time and disposition to analyze particular external cases and transform them into valuable insights (Ellet, 2007). And although the evident goal of this kind of dynamic is to enrich the decision-making process of participants when facing similar problems in their work life, students can also play the role of those international observers and be able to “kill two birds with one stone.”

In this way, this work is aimed at sharing a pedagogical experience performed in the conceptual atmosphere of CSR and stakeholder communication fields, utilizing a real case study. Drummond's coal spill deception was tested in terms of its PCI, PCC, and PCR (attending definitions and scales of Barich and Kotler, 1991; Dichter, 1985; Newell and Goldsmith, 2001; Fombrun et al., 2000) before and after acknowledging the deception performed through its communications. Students became aware of causes and consequences of such self-defeating acts (for the sake of the company they work for), and also presumably from a standpoint of the moral value of being honest with stakeholders, especially in crisis situations (because it is the “right thing to do”).

With few exceptions, results obtained were diverse and mostly reliable. From the analysis of the data collected before (round 1) and after (round 2) becoming acquainted with the deception about Drummond's coal spill, it is evident that all three constructs, but especially those involving image and reputation, suffered negative changes in terms of the respondents' perceptions. Doubtless, this was due to the alteration in the version of the incident produced and conveyed by the company as part of its communication to its stakeholders. In some way, respondents felt negatively affected by that deception and expressed that feeling in the second-round survey. In any case, a deeper analysis should be performed to establish correlations among these constructs, and the potential mediating or moderating roles of different variables.

From the practical point of view, this article can represent a call for present and future company executives to be quick, consistent, and open with their responses in moments of CSR crisis (Coombs, 2015)—not only as a sort of strategic decision, but because it is a moral issue as well. It is something that companies and their representatives simply should do. Something must be clear: no company has the right to deceive its stakeholders; there is no such thing as a “corporate right to lie,” not even when companies are pushed by legal and/or business-driven constraints. On the one hand, consequences of deception can be even more deceitful than the crisis per se, and on the other hand companies should always behave

responsibly and with consciences so that, instead of being part of the problem, they can be part of the solution.

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Appendix 1: Scales of PCI, PCC and PCR

IMA	Perceived Corporate Image
IMA.1	I have a good first impression of Drummond Ltd.
IMA.2	In my opinion, Drummond Ltd. has a good image in the minds of its stakeholders
IMA.3	I believe that Drummond Ltd. has a better image than similar companies
CRE	Perceived Corporate Credibility
CRE.1	Drummond Ltd. has a great amount of experience
CRE.2	Drummond Ltd. is skilled in what they do
CRE.3	Drummond Ltd. has great expertise
CRE.4	Drummond Ltd. does not have much experience
CRE.5	I trust companies like Drummond Ltd.
CRE.6	Drummond Ltd. makes truthful claims
CRE.7	One could say that Drummond Ltd. is honest
CRE.8	I do not believe what Drummond Ltd. tells everybody
RPQ	Perceived Corporate Reputation (The Reputation QuotientSM)
RPQ.1	I have a good feeling about Drummond Ltd.
RPQ.2	From what I saw, I can say that I admire and respect Drummond Ltd.
RPQ.3	I trust companies like Drummond Ltd.
RPQ.4	It seem that Drummond Ltd. is well managed
RPQ.5	Looks like Drummond Ltd. is a good company to work for
RPQ.6	Looks like Drummond Ltd. is a company that would have good employees
RPQ.7	Looks like Drummond Ltd. supports good causes
RPQ.8	Looks like Drummond Ltd. is an environmentally responsible company
RPQ.9	Looks like Drummond Ltd. maintains a high standard in the way it treats people

Importance of innovation in the tourism sector

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Abstract

The main objective of this work is to transmit the importance of tourism innovation for companies and in public institutions to promote the application of new technologies to the tourism sector. We conclude that actions that allow dissemination and sharing of experiences are required in order to boost ideas and knowledge. Thus, innovations in the tourism sector from companies and individuals would be revised, tourism intelligence would be related as a concept of tourism innovation, and different opinions on new innovations in the sector would be analyzed to select the main topics that concern all the agents in the market. All these facts allow to deepen in the applications of the tourist innovations, necessary for the adaptation to the continuous change that takes place in business world and therefore in the tourism sector. Thus, we present some classifications of the innovations, some reflections about innovations in the tourism sector and propose some action lines to join real business with scientific and academic world.

Keywords: *Congress, Innovation, Knowledge, Tourism Intelligence.*

Introduction

According to the World Tourism Organization (UNWTO, 2017) there has been a growing trend in the tourism sector for years that also meet recent statistics: in 2016 tourist arrivals worldwide increased to 1,235 million, while in 2015 were 1,184 million. In Spain, tourism is fundamental in the composition of the GDP: in 2016 increased by 9.9% the number of tourists who visited the country, a total of 75.3 million (La Vanguardia, 2017). With these evidences we can affirm that the good economic development of our environment depends a lot on the tourism industry. As predicted by UNWTO, it is expected that by 2020 the number of tourist arrivals will be 1.6 billion. Although tourism in the international context is a source of progress and wealth that reaches developing economies, in the case of Spain it is one of the main economic pillar, contributing to reduce higher unemployment rates.

This is the main reason to implement new tourism models, especially with regard to the adoption of technology (Requena et al., 2007). The arrival of the intelligent world to the tourism sector has meant a revolution in which the competition in producing and distributing tourism applications is such that users, companies, and public institutions (including educational institutions) must be aware of the need of bringing closer technologies (San Román et al., 2016). They have to take into account the initial training of future entrepreneurs and workers and create a touristic environment, called tourist intelligence, which is the result of making and applying innovations in the tourism sector (Hosteltur, 2016).

We can read several definitions of innovation. According to Gee (1981) innovation is the process in which an useful product, technique or service is developed from an idea, invention or recognition of a necessity, and it is commercially accepted. According to Pavón and Goodman (1981) innovation is the set of activities registered in a certain period of time and place that lead to the successful introduction on the market, for the first time, of an idea in the form of new or better products, services or management and organization techniques. According to Nelson (1982) innovation is a change that requires a considerable degree of imagination and constitutes a relatively deep break with the established way of doing things, by creating new capacity.

If we join the meaning of tourism and innovation, we have the definition of tourist intelligence: It is a strategic management tool that converts data and information into knowledge, so that managers can anticipate the needs of tourists (Intelitur, 2017). Obviously, it directly affects the competitiveness of companies and tourism organizations (Segittur, 2016). It is useful to know what happens in the sector, to make more accurate decisions, to identify new micromarkets, to analyze competitors, to discover new distribution channels, and to improve the services and destinations specialization (Pérez and Llaudes, 1999). On one hand, the system provides enough information for making decisions that increase production capacity, boost competitiveness and evaluate the return of actions to promote

tourism. On the other hand, it contributes to increase the benefits to the visitors adapting the offer to new preferences and needs.

In this paper, first, we show some data about tourism sector to demonstrate its importance in the economy. Second, we define what is innovation and relate this concepts with tourism, taking into account the needs of tourists to satisfy. Third, we present different classifications about innovations we can find in the tourism sector. Fourth, we show some highlights about the organization of an event to match tourism and innovation, and, finally, we write some reflections and conclusions.

1. Why this need to innovate in the tourism sector?

As it is well known, tourism is a generator/receptor of economic activities. Tourism practices imply different services such as accommodation, refreshment, catering, travel, leisure, transportation, information, etc. to satisfy tourist's needs (Santandreu-Mascarell et al., 2013). Tourism is experiencing significant variations in the type of competition and is facing new challenges that demand new perspectives (Novelli, Schmitz and Spencer, 2006). In this context, innovation appears as an essential element to ensure competitiveness and future survival. This situation is even more pronounced in cases such as the Spanish tourism, characterized by a large dimension, a relatively mature product (sun and beach tourism) and traditional markets that are close to saturation (Rivas, 2009).

Traditionally, the tourism sector has been a mature sector strongly supported by proven management and marketing models. Continued changes in markets, such as the emerging of new information and communication technologies (ICT) or new business models, suggest the adoption of new strategies, processes or products. They have to take into account a constant adaptation to maintain and improve services. It is necessary to increase the competitiveness of companies in the sector by conducting research, development and innovation projects in areas of interest to tourism (Macías, 2011). In addition, it is important to investigate the current and future behavior of potential tourists, the sociological and psychological trends about tourists regarding their processes in the purchase decision to anticipate their changes by providing competitive advantages.

It is important that the current and future professionals of the sector begin to know these new advances that are indispensable for the future, and that will allow the tourism sector to create synergies and improvements, both in companies and destinations, which will be reflected in the improvement of customer services, in reducing the level of risk in service changes, and in the creation and implementation of strategies (Clavé and Moreno, 2010).

2. Which are the main innovations known in the tourism sector?

Currently there are several concepts that encompass innovations applied to tourism (Libro verde de la innovación, 1995), but a reference model to know the different innovations that

are applied in companies to update and/or improve their services is not found. According to the Spanish Chamber of Commerce the types of tourist innovations are the following:

- **Product or service innovation.** Is based in the introduction of new (or significantly improved) products or services in the market. It includes significant changes in the current technical specifications, components, materials, software or in other functional characteristics.
- **Process innovation.** It is the implementation of new (or significantly improved) manufacturing, logistics or distribution processes.
- **Organizational innovation.** It is the implementation of new organizational methods in the business (knowledge management, training, human resources assessment and development, value chain management, business reengineering, quality management, etc.), in the organization of the work and/or in the relations with external stakeholders.
- **Marketing innovation.** It is the implementation of new marketing methods, including significant improvements in the merely aesthetic design of a product or packaging, price, distribution and promotion.

Another traditional classification is done taking into account the degree of application of the innovation, that is, the level of application and how progressive it has been (Albaladejo et al., 2008):

- **Incremental.** It has evolved over time with periodic applications by showing how they adapt to society needs.
- **Radical.** It is a fast and direct application. Due to this aggressive strategy, companies can be succeed if they have enough research results, or not if products have a high cost or they are not accepted by the market (even can plunge products with great success in the past).

On the other hand, we have different companies in the tourism sector: restauration companies, accommodation companies, transport companies, tour operators, travel agencies, entertainment companies, services companies, etc. With this, the next step is to identify and classify innovations in different companies in the tourism sector according to their business (strategies and procedures are different in a travel agency and in a hotel, as an example).

3. Our proposal: an event about tourism and innovation

This congress is based on the importance of the exchange of information, so that the future professionals of the sector begin to know new technological advances indispensable for the future. Moreover, it is based in a second pillar that is to gather a percentage of the tourist sector with the intention to create synergies and improvements, both in companies and

destinations, from the knowledge center of tomorrow, the university. Because the Tourism Degree is taught in Gandia Campus from Universitat Politècnica de València, our proposal is to develop this meeting in Gandia, a well-known touristic destination. Gandia Campus has adequate facilities and space for conferences and round tables in which different realities in tourist innovations, their applications and future will be discussed. In this sense, students and lecturers, members of the innovation group in the Campus and professionals will participate together by listening some experts in innovation and tourism from the public and private sector and by giving new ideas all together.

Then, the objectives of the congress are:

- To show innovations in the tourism sector to companies and professionals.
- To relate tourism intelligence with innovation.
- To analyze opinions about new innovations in the tourism sector to select interesting topics.
- To know different applications of tourism innovations in the region.

Another purpose of the congress will be sustainability, that is, the compatibility of tourism with the development of the daily life in the region. It is important not to suffer a rejection by our community represented by citizens and local government. It is also interesting to create a sustainability plan identifying potential investment in innovation, thinking in the maintenance of all infrastructures.

Together the scientific committee and the organizing committee are a key point of the success of the meeting. Scientific committee will be formed by researchers and experts in different touristic fields. Because the event will be held in the Universitat Politècnica de València, some lecturers (experts in tourism) can participate in collaboration with managers from public institutions.

4. Conclusions

Innovations in the tourism sector require the use of new technologies and the development of actions to share applications, how to make them and analyze what they suppose for the company and the tourists. In this sense, we propose some action lines to join real business with scientific and academic world. From universities and other educational institutions research, development and establishment of tourism innovations in the sector to improve the quality of the tourist experience have to be promoted. For example, an annual meeting can be held to present every year new innovations and boost knowledge to the tourism sector (through professionals and academics work). In this line, presentations, workshops and specialized lectures would be developed to prepare professionals and future professionals (university students) in their knowledge about the new innovations. Of course, questionnaires

would be performed to know different opinions (from companies and from University). The last task is to spread new results to increase the knowledge in tourism sector and promote continuous improvement. Our proposal is to create an event, a meeting about tourism and innovation with expert speakers in an attractive touristic destination.

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The use of animals in the tourism industry

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Abstract

Animal exploitation in the tourist industry has different forms, such as shows, traditions, interaction, captivity and sightings. In Spain, it is possible to find variations of each of these manifestations, where ethics and responsible practices towards animals are not clear whether for cultural or economic reasons; or simply ignorance. Then, tourists can do different activities as photography, riding, swimming, shighting, bird watching, take care of injured animals, etc. In this context, a number of non-governmental movements and organizations have emerged in recent years, trying to inform and raise awareness not only within the people but also among responsible companies in charge of providing tourist activities. Some limitations exist to be faced, for example, the heterogeneity in laws, enacted by Spanish national, regional or local governments. In this paper we show a list of the different uses of animals related to tourism and the different approaches that can be taken in this regard, suggesting an ethical debate that is already present in our society.

Keywords: Animals, Awareness, Ethical approaches, Tourism.

Introduction

A relationship between the natural environment and society currently exists in a reciprocal way. People influence the environment around them, and likewise, the environment conditions the people's way of life. However, human intervention over the environment has disproportionately increased over the last decades, even leading to highly urban and modern areas, far from the natural world (Junta de Andalucía, Consejería de Medio Ambiente y Ordenación del Territorio, 2002). This is one of the main reasons because the human being wants to approach nature (FAADA, 2016). In addition, people not only try to get closer to nature, but also, in general, they are interested in the environment and its conservation.

The UN General Assembly has declared 2017 the International Year of Sustainable Tourism for Development, while the World Tourism Organization (2016) defines sustainable tourism as tourism that takes full account of the economic, social and environmental current and future impacts to meet the needs of visitors, industry, the environment and host communities. It also specifies that it must make optimal use of environmental resources, which are a fundamental element of tourism development, by maintaining essential ecological processes and conserving natural resources and biological diversity".

In this sense, it is considered that tourism based on nature has special importance in the constant search for sustainable alternatives. This type of tourism generates experiences and opportunities for direct contact with nature, and consequently offers a strong educational message. Some studies show that direct encounters with the natural world, in many cases, cause an emotional affinity, which can lead to the desire to preserve the environment visited (Kals et al., 1999).

According to this idea, many of the current practices in the tourism industry should be questioned. Too often, animals become the main attraction, and their customs and basic needs are either compromised or totally ignored. Entertainment activities should remind the tourist and society that we are part of nature and facilitate a reconnection with it. Nowadays, it is thought that animals are here for fun and profit of the human being, establishing as a priority economic benefits; this degrades animals and society (FAADA, 2016). Therefore, tourists, as consumers of the service, have the power to demand responsible activities and improve these conditions. On the other hand, business men should have as a priority the education and offer quality activities that do not affect animals.

1. Methodology

To develop the analysis presented in this paper we have faced some limitations. The field of study to be analyzed is very broad, diverse and in many cases subject to the opinion of the one who interprets the information. There is a large number of necessary secondary sources of information as well as a lack of homogeneity in the data found.

The analysis of the current situation of different forms of using animals in the tourism industry found in Spain was carried out by using data obtained from the following secondary sources:

- Statistical reports from Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente; Ministerio de Cultura (Subsecretaría de Tauromaquia); Instituto de Estudios Turísticos, etc.
- Official tourism websites of the different regions, when applicable.
- International, national and regional laws.
- Publications in newspapers.

About the international law, it is opportune to establish those norms or recommendations at European level or even at world level. Globally, and in a very general way, the World Organization for Animal Health established in 1965 the so-called "Five Freedoms". They recognize the right to welfare of animals and affirm that they must be provided with: an appropriate environment, a proper diet, opportunities to express natural behaviors, protection against fear and distressing states, protection of pain, damage or illness.

At European level, Article 13 of the Lisbon Treaty of 2007 states that the Union and the Member States shall take full account of the welfare requirements of animals, such as sentient beings, while respecting legal or administrative provisions and the customs of the Member States relating, in particular, to religious rites, cultural traditions and regional heritage. As a consequence, European Union create the Animal Welfare Action Plan, which specifies the obligation to provide welfare to wild animals in captivity. (European Commission, 2012).

2. Results

Animal-based tourism, also called wildlife tourism, is not a homogeneous expression of tourism, but it takes different forms and variations. This kind of tourism can be defined as a form of tourism based on encounters with non-domesticated (non-human) animals. Such encounters can occur both in the natural environment of the animal and in captivity. It includes non-consumption activities, such as sightings or photography, as well as those activities that include killing or capturing animals, such as hunting or fishing (Cooperative Research Center for Sustainable Tourism, 2004). The FAADA association in its Responsible Tourism Dossier lists activities involving animals, in one form or another (see Table 1).

Table 1. Use of animals in touristic activities.

Interactions	Shows	Traditions
<ul style="list-style-type: none"> • Animal photography • Swimming with dolphins • Swimming with sharks • Camel rides • Horse, donkey or carriage rides • Elephant rides 	<ul style="list-style-type: none"> • Animal races • Dolphinariums • Raptor birds exhibition • Circus • Parrot shows or similar 	<ul style="list-style-type: none"> • Snake charmers • Bears dancers • Rodeos • Popular festivals • Rituals
Captivity	Sightings	Souvenirs
<ul style="list-style-type: none"> • Cocodrile farms • False rescue centers • Turtle farms • Elephant sanctuaries • Tigers' centers • Zoos • Aquariums 	<ul style="list-style-type: none"> • Primates • Sea birds • Seals • Cetaceans • Safaris • Other sightings 	<ul style="list-style-type: none"> • Any kind of souvenir made with a part of an animal.

Source: Own elaboration.

The difference between these activities lies in how these practices are carried out, and if they consider other aspects besides the economic well-being of the companies that offer them. Hughes (2001) proposes three different approaches to carrying out animal activities, depending on a higher or lower level of ethics and consideration for animals.

The first approach, based on environmental ethics, proposes that any action is ethically justifiable as long as it does not break into the integrity of ecosystems. According to this idea, it would be acceptable to use or even kill an animal if this act does not lead to bigger repercussions and if the survival of one or more species is not threatened. In the tourist industry this implies that attractions such as rodeos, bullfights, circuses with animals, etc., are considered environmentally friendly. On the other hand, it condemns the hunting and fishing of endangered animals and promotes captivity, as well as programs for the reproduction in captivity of those animals in danger.

The second approach is focused in animal welfare. It proposes to balance interests of animals and interests of people. Those who support this theory agree that the suffering of an animal can be justified if the benefits to the human being (or to the welfare of all species) are greater than the cost. This position condemns tourism activities involving animal abuse (such as those mentioned in the previous approach). More naturalistic exhibitions with animals are preferred, as opposed to the circuses or other shows. It also emphasizes education and preservation, both linked with animal attractions. Finally, it seeks to prohibit those methods that cause pain, discomfort or suffering in animal performances.

The last approach is that focused on the rights of the animal. It gives consideration to animals for the simple fact of existing, and, in particular, for their ability to feel physical and psychological pain (Singer, 2003). Supporters of animal rights ethics see animals as equals, and therefore any act that affects the welfare of any animal is morally wrong. Therefore, it is preferable the observation of animals in their natural and wild environment, and not in captivity. According to this approach, tourist attractions free of animals are proposed, like eco-circuses that do not involve animals, as well as to prohibit those acts or practices with animals such as rodeos, circuses, etc.

Despite the fact that patterns and attitudes indicated in the first approach are directly or indirectly accepted in daily life, there is growing evidence that those practices that show some kind of consideration towards animals, and not just the environment, have a positive effect on today's society. The actions of animal rights movements and organizations are clearly visible, and impact on the laws of many countries that promote animal welfare (Shani and Pizam, 2008).

3. Conclusions

In this paper, we present different ways in which animals are used in the tourism industry and three approaches for this topic based on ethics and respect to animals. Legislation in this area is complex and leaves in many cases an option for free interpretation. There is a Spanish Law that follows the European standards applied to the biodiversity protection. However, different regional laws, even local laws, can be found about animal rights. Then, there is not an homogeneous law about this topic and we consider this as a limitation. The Spanish available offer to enjoy activities involving animals is wide and varied, depending on the motivations of the tourist. There are a lot of tour operators or other professionals offering activities or different entertainment interactions with animals. Moreover, the management model of each activity will define its sustainability for all parties involved.

Although the traditional offer, such as zoos or aquariums, is widely developed, alternative options, such as visits to rescue or shelter centers, are positively growing and developing. Another option are the centers of reception or recovery of animals. These usually receive those species from illegal traffic, with injuries that prevent them from being reintroduced to nature, or other similar situations. In Spain, there are numerous centers of this style that combine in their visits the recreational aspect, with the educational one. Wildlife centers seek to establish a series of long-term objectives and always taking into account the protection of fauna and the environment in general.

In addition, the innovative proposal "ZooXXI" is the first international proposal that seeks to change the traditional model to a zoo adapted to the ethics and knowledge in which the society of this century is submerged. The initiative claims that the current model of zoo has become obsolete, and that studies show that animals are feeling beings, with their own needs, expectations and objectives. The proposal is based on five fundamental pillars: Active

participation by citizens, conservation of species developed in their own habitat, integration of virtual technologies, encouragement of education that generates empathy towards species as well as towards medium, and finally the gradual conversion of the current zoological facilities into centers for the recovery of native fauna. It will seek to increase current knowledge about species, ecosystems and habitats in which they live, through interactive educational content with audiovisual technologies, offering a more conscious, interesting and didactic zoo.

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How to learn skills necessary for innovation

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Abstract

Innovation pedagogy is an educational approach that aims at producing innovative graduates. It is designed to lead to an output of future-oriented, subject-based competences and to innovation competencies. Innovative behavior demonstrates itself gradually during studies and especially once graduates enter working life. To reach the aim of innovation pedagogy, several new arrangements are needed in the learning environment. Among the necessary cornerstones for innovation pedagogy to succeed are also several novel educational research, development and learning methods. The aim of this paper is to introduce one of the methods developed to enhance the creation of innovation competencies. This method is called Project Hatchery and it is designed for the very beginning of studies.

Keywords: Innovation pedagogy, learning outcomes, learning methods

Introduction

Background assumptions

Innovations are a popular topic in modern society. The earnings logic of companies is increasingly based on innovations, and in all fields of knowledge creation, the challenge of how to create added value is encountered. There are problems that are becoming increasingly difficult to solve within a single method, be that a discipline, a profession, or area of expertise. However, it is important to remember that knowledge is at the core of innovation and that innovation very often emerges at the boundaries of different knowledge domains. (Kairisto-Mertanen et al. 2007, 2009, 2010, 2011; Konst 2017).

Turku University of Applied Sciences is situated in Southwest Finland, in a region where the main field of industry is export-driven technologies. Of all the workforce in the region, one third is employed by this industry. To remain competitive on the export markets, these companies are required to focus constantly on renewing their processes and products, as well as on investing in research and development.

These significant changes should be considered when planning education at the university level. The changes in Finish career prospective during the past 40 years can be summarized with four factors: 1) the educational level of Finnish people has risen, 2) the Internet plays a large role in workplaces, 3) the boundaries of domestic and foreign markets has become obscure, and 4) work based immigration started (Piilotettu osaaminen 2016.) It seems

obvious that there are going to be big changes that arise in the future. Once our present students enter working life after university studies, they are most likely to find fewer situations where the goal of work and the methods to be used are pre-determined. Instead they will find themselves in situations where the methods to reach a goal are not carved in stone. Sometimes, even the goal itself might be left open (Oivallus 2011; Kairisto-Mertanen et al. 2012; Kairisto-Mertanen & Mertanen 2007; Konst 2017).

However, at universities, we still tend to educate students with traditional methods meant originally for a stable world, emphasizing the learning of explicit knowledge. Methods better suited for a constantly changing world focus on activating students in learning and include unofficial and exceptional situations. It is a crucial step for any nation to be able to educate future generations so that they are equipped with the tools and understanding needed in the present and future world. It is also a crucial step for any university to be able to adapt their studies to these needs and continue to develop new approaches to meet them.

Aim of the paper and method used

The aim of this paper is to introduce a novel way of learning, innovation pedagogy, and to discuss its application. The paper begins by introducing innovation pedagogy and its desired learning outcomes: innovation competencies.

The paper focuses on one selected method of innovation pedagogy named Project Hatchery. Project hatchery is one of the research, development and innovation methods (ERDIM) created and developed at Turku University of Applied Sciences. The general experiences gained from this method are presented. The method used is case study and the implications presented are a result of action research, where the researcher reflects results of his own actions.

1. Innovation pedagogy

1.1 Innovation in innovation pedagogy

An innovation can be defined as an idea, practice or object that is considered new (Rogers 2003), or a solution that brings economic benefits (Sitra 2006). In innovation pedagogy, we use the definition of Finland's national innovation strategy (Innovation Strategy 2008), where an innovation is understood as a competitive advantage based on knowledge. According to this definition, innovation can also be understood as a process that can be already existing but new in the circumstances where it is being applied (Lehto 2011; Kairisto-Mertanen et al. 2010).

1.2 A comprehensive model towards organizing education

Universities have a big role in developing a new generation of professionals whose conceptions of producing, adopting and utilizing knowledge make innovative thinking and

creating added value possible (Lehto et al. 2011; Putkonen et al. 2011). A challenge is to integrate applied research and development, entrepreneurship and flexible curricula to meet the multi-field customer needs in regional and international networks (Kettunen 2011). It has become necessary to develop learning and teaching processes so that they provide improved competences for the students and enable personal and professional growth. Learning is deeper when the previously gained knowledge is continuously applied in practical contexts (Kairisto-Mertanen et al. 2009.)

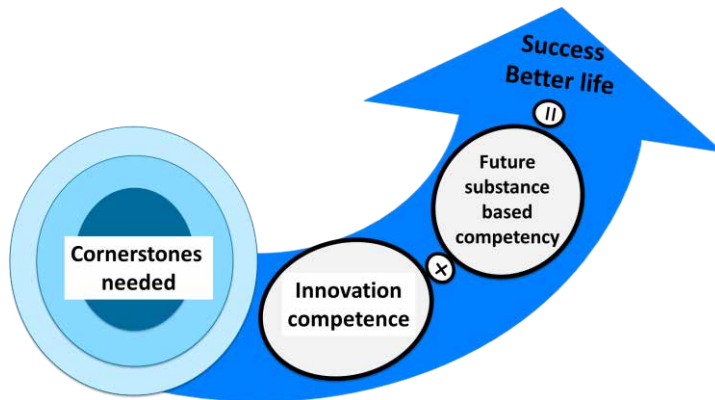


Figure 1. Innovation pedagogy, basic model © Liisa Kairisto-Mertanen 2017

To a big extent, the role of education has traditionally been to give knowledge-based readiness, which later would be applied to practice in various innovation processes in working life. Innovation pedagogy is a new approach to learning that introduces how the development of students' innovation skills from the very beginning of their studies can become possible. (Kairisto-Mertanen et al. 2010). It is a new strategic approach to learning and the innovation culture to be followed in the university.

As Figure 1 shows, the ultimate aim of innovation pedagogy is to equip the students with such competencies that they will have access to a good life, and at the same time, will have opportunities to be successful in their future careers. To reach this aim, during the educational process, they should gain the core competencies of their own subject matter and also learn to become active contributors in the different innovation processes they face when working as entrepreneurs or employees. It is essential to define the desired goals, knowledge, skills and attitudes referring to the learning outcomes that are related to the capability of being able to act innovatively. These learning outcomes are called innovation competencies and they can be grouped to include the individual, interpersonal and networking competencies needed to produce innovative knowledge (Kairisto-Mertanen, Penttilä & Nuotio 2011).

1.3. Innovation competencies

The work of defining innovation competencies and creating a tool to measure them has been done under the following EU-financed projects: INCODE, INNOKOMPPI and FINCODA. In the FINCODA project, which will end in December 2017, the participants, a significant number of universities and innovation-intensive companies from five countries, are working together to develop a tool to measure innovation competencies.

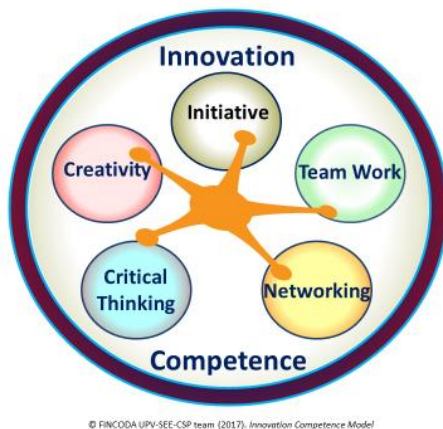


Figure 2. The FINCODA model of innovation competence © Fincoda UPV-SEE-CSP team 2017

The FINCODA Model of Innovation Competence, presented in Figure 2, is based on five equally important dimensions: Creativity, Critical Thinking, Initiative, Teamwork and Networking. For the definitions of the elements that make up the model, see Marin-Garcia et al. 2017.

1.4 The cornerstones of innovation pedagogy

The cornerstones, or meta-innovations, presented in the beginning of the arrow in Figure 1 are essential requirements for innovation pedagogy to succeed. They form the basis of the everyday application of innovation pedagogy as they are enabled in the learning environment.

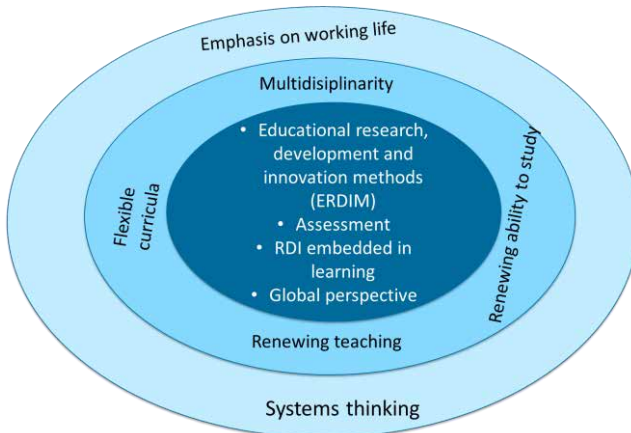


Figure 3. The cornerstones of innovation pedagogy © Liisa Kairisto-Mertanen 2017

As Figure 3 presents, the cornerstones include ERDIM-educational research, development and innovation methods that activate learning, versatile assessment methods applied by the faculty, RDI embedded in learning and internationalization leading to a global perspective. Further, the cornerstones include flexible curricula, multidisciplinarity in learning and in the learning environment, as well as new approaches in teaching and learning.

2. Educational research, development and innovation (ERDIM) methods

2.1. About ERDIM methods in general

In learning, a problem is sometimes created when learning in one type of setting is not accessible after the learner is moved to another setting. This transfer problem can be, at least in part, avoided by creating identical elements in education and working life (Kettunen 2011, 2013; Illeris 2009).

ERDIM methods are created to serve the purpose and the aim of innovation pedagogy. This means that different methods must be developed so that the cornerstones of innovation pedagogy can be found in the learning environment.

2.2. Project hatchery

Project hatchery is one of the ERDIM methods developed in Turku University of Applied Sciences. It is a study unit delivered for all 500 first-year students in the multidisciplinary faculty of technology, environment and business. This study unit combines real-life assignments, peer counselling and working in multi-disciplinary groups while including the international aspect in all work.

As Project Hatchery is a study unit offered to all first-year students at the university, it is also the first experience with the active methods applied in the faculty. Its main objective is to

make the students understand and experience a different way of learning and activate them to take responsibility of their learning. The students are given a very general assignment and they start working on it as a group. Their first task is to understand and define it in a concrete way, with goals they can reach during the autumn term.

They are expected to start creating new ideas as they work with people who might have different agendas and ways of thinking. It is very fruitful to be able to start bonding with students with different aims and learn how to turn problems and differences in interests to a creative resource base (Lyytinen 2011). Since this study began, a clear difference could be observed in the atmosphere of the faculty. Students from different study programs started to hang around and work together when they were not forced to doing so.

The learning goals of the Project Hatchery are defined as follows:

1. learn to apply a research-minded approach to working and learning
2. learn to search and utilize information independently
3. learn to work in a multidisciplinary team
4. become familiar with different degree programmes of the faculty
5. begin to create networks useful for the future working life
6. improve skills related to working in projects
7. learn effective presentation and communication skills
8. begin to develop innovation capabilities
9. learn to tolerate insecurity
10. learn to define aims and targets for their work

The goals are discussed with the students when the study unit is started. We also have found it very important to make learning visible through constant reflection. The student tutors are advised to start every session with discussions about learning experiences so far. New students very often do not realize the progress they are making regarding the expected learning outcomes. The expected competencies are often seen as soft skills that do not produce valuable results. We have to make them aware about the importance of these learning outcomes.

2.3. Two study units running simultaneously

The extent of the Project Hatchery study unit is 5 ECTS credits and it starts during the first week of studies, when new students arrive. The working groups, consisting of 12-15 students, are formed to include as many different students as possible. The setup for the Project Hatchery study unit and for the simultaneous “leading a group” study unit is presented in Figure 4.

According to Figure 4, the execution of the Project Hatchery study units includes first-year students participating in the Project Hatchery study unit, along with second-year students participating in leading a group study unit and acting as student tutors for the first-year students. It also involves teachers who act as coaches for the student tutors, and at the same time, support the first-year students. Among the faculty members, there is one lecturer responsible for the program's execution. Her role is to run the work counselling sessions for the teacher tutors and be responsible for the practical arrangements of both study units.

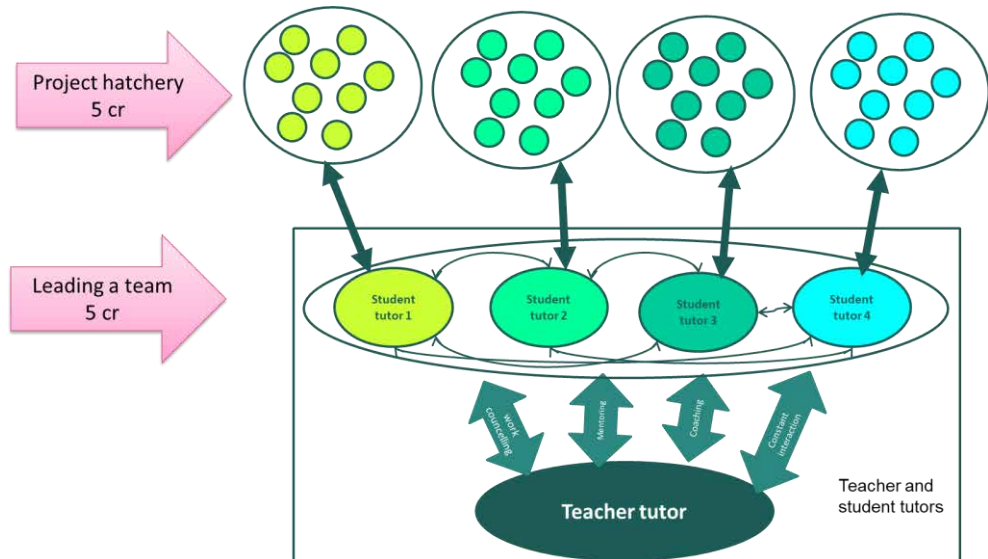


Figure 4. Two study units simultaneously: Project Hatchery and leading a group © Liisa Kairisto-Mertanen 2017

Every teacher working in the project is responsible for supervising the work of four student tutors who are participating in the “leading a group” study unit. The role of the teacher tutors is mostly to help the student tutors; although when needed, they are accessible for the Project Hatchery students, as well.

During the “leading a group” study unit, the student tutors learn about group dynamics, leadership and group behavior in general. They have weekly meetings with their teacher tutor, who acts as a mentor and coach. During these meetings, the students are being coached by the teacher, and get support, guidance and work counselling. The extent of the leading a group study unit is also 5 ECTS.

2.4. Practical arrangements when running the two study units

The student tutors have to be prepared to take their groups and start working with the new students when the process begins during the first week of the new autumn semester. This means that the “leading a group” study unit has to start during the previous spring term before summer holidays. The future student tutors come together for two intensive days and are given reading on the topic in advance. Usually, there are around 40 students participating in the “leading a group” study unit.

In the beginning of the Project Hatchery study unit, the students are given a short orientation to the implementation and aims of the study unit, after which they are put into groups and given the general topic on which each group will work during the autumn semester. At the beginning, very few students are familiar with each other or with the university of applied sciences as a working and studying environment. Thus, one of the first challenges is to help the students to identify themselves as members of the Project Hatchery team. The second important task is to help the team to assign roles to each team member. They have to select the project leader, the secretary and assign other roles to the rest of the team members.

The student tutor helps the team members in the beginning and also along the entire process, whenever needed. The student tutors try to get involved in the process as little as possible, but when needed, the group can turn to them for help. The Project Hatchery group is expected to elaborate on the assignment and find the angle from which they want to approach it. This is supposed to teach them about taking responsibility for whatever they do. They are expected to start developing an intrinsic approach and motivation to their work.

Studies in both study units contain independent work and weekly contact lessons. The timetable of the first-year students includes a period of four hours each Wednesday morning reserved for the work in the hatchery. The groups may choose their working methods freely, but attendance on Wednesday mornings is compulsory. Brainstorming, ideation and other creative activities mostly take place outside of the compulsory lessons. Each group is encouraged to find the most suitable working methods for itself, as one of the aims is to learn how work will be done in the future. In such, the students have to learn to set their own goals and choose the best methods to reach those goals.

The hatchery study unit also contains a few predetermined compulsory tasks allocated to each group involved. Every group has to: 1) draw a project plan for their work, 2) design and prepare a poster reflecting what they are doing, 3) make a presentation and present their work in a creative way, and finally 4) write a final report on their activities and results.

The assignments for the hatcheries include tasks given by our external stakeholders like companies and other organizations. They have to pay a minimum sum of 500 € to have an assignment done by the hatchery group. Some of the assignments are topics included in the internal research and development projects in the university. In the latter cases, the teacher’s salary is included in the cost of the projects.

As Figure 4 shows, there is one teacher responsible for four student tutors, with which they arrange meetings at required intervals. These meetings take place at least once a month. Also, the teachers participate in work counselling. They gather together approximately once a month to discuss topics related to both study units. These meetings are considered very fruitful by the teachers, as teachers' work is usually very isolated and lacking contact with other colleagues.

3. Discussion

Introducing innovation pedagogy in the faculty represented change in the university's educational culture. Leading to the right direction of change requires both understanding and foresight, especially from the faculty leaders, but also from the faculty members. Making these changes requires that right measures of leadership to be taken by the university management in the usually very traditional world of higher education. When the whole pedagogical approach of the institution is questioned, it can be experienced as a threat by the people involved. It requires introducing a totally new culture. Changing a culture is a complicated task that should be initiated by top management (Schein 1999).

Since the Project Hatchery study units were first introduced some eight years ago, the process has been characterized by continuous development. After each execution, it has been important to reflect and get feedback. Every year, this feedback has been used to improve and modify next year's round. During the first years, there was a lot resistance among students; but as experiences have been gained, the study unit now forms an essential and important part of their studies during the first semester. Its reputation has reached the employers, as well, who give positive feedback about the results and about the learning outcomes they observe in the students.

There are 2,700 credit points earned every autumn in these two study units. One of the remarkable things of this program is that, in addition to the quality learning it offers, its cost is nearly covered by funds coming from elsewhere than from the internal funding of the university. Being able to generate income is, at least in Finland, one the new important aims of any university.

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Classroom based assessment and flip teaching: an analysis of construct irrelevant variance

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Abstract

The aim of this study was to investigate the extent to which flip teaching can affect the outcomes of students in classroom based assessment. The CIV was investigated to avoid distortion when assessing flip teaching activities. In this assessment procedure, two English teachers judge the different activities carried out by students and the amount of variation of the different activities was calculated. It was analysed if assessors assigned the same score to all students' performance or if more variation was found in the assessment of flip teaching activities. A considerable amount of variation was found in the evidence reported by both teachers. Classroom based assessment was not carried out equally when flip teaching was incorporated in the subject assessment. In this sense, it was concluded, after the analysis of the results, that the scoring guide and the conceptual framework for assessing teachers' coaching competence should be revised when new teaching techniques are incorporated in classroom based assessment.

Keywords: *construct irrelevant variance, flip teaching, assessment, validation.*

Resumen

En este estudio se analiza el constructo de varianza irrelevante para determinar si existe distorsión en el tipo de evaluación que se realizaba mediante el método de aula invertida. Concretamente se estudió si los evaluadores le asignaban la misma puntuación a las actividades realizadas fuera y dentro del aula o si existía variación al evaluar las actividades del aula invertida. Para ello, se tuvieron en cuenta los factores contextuales del constructo y la evaluación que se planteaba en el programa de la asignatura. En los resultados extraídos del estudio se observó que no existía una consistencia en la forma de evaluar las tareas comunicativas realizadas dentro y fuera de la clase y tampoco se realizaban cambios en las evaluaciones si las actividades se realizaban dentro o fuera del aula. Finalmente, recomendamos incluir un estudio del constructo de varianza irrelevante en las clases que combinan distintos tipos de tareas.

Palabras clave: *constructo de varianza irrelevante, docencia inversa, evaluación, validación.*

Introduction

In this research, I have taken into account that testing has suffered the influence of sociolinguistics due to the influence of researchers such as Hymes (1967), Canale and Swain (1980) and Savignon (1983). These researchers consider that language skills are multi-componential and dynamic rather than static, that is, testing should stress the sociolinguistic and communicative facet of language use. Other researchers (Fuertes-Olivera and Gómez-Martínez, 2004; Jang, Wagner and Park, 2014) have emphasized other factors such as the cultural barriers of assessment or the use of mixed method research in language testing and assessment. More specifically, Rea-Dickins (2007: 507) explains the different uses and interpretations of the terms testing (measure of language proficiency) and assessment (as outcomes from instruction). She also states that “This emergent view of classroom-based assessment where learner performance is analysed in terms of learning goals and instructional processes rather than a finished product introduces an important interactional perspective into assessment, critical to effective formative classroom language assessment”. Thus, this author emphasizes the evaluation of learner performance without taking into account the environment or if the instructional process is carried out during class time or outside the classroom.

Rea-Dickins (2007: 516) recommends to take into account that “The quality of teacher feedback and the impact of this feedback on student uptake and output become important”. In this study, I focus on the quality of teacher feedback in classroom based activities and in activities that should be done autonomously by learners. Rea-Dickins (2007: 516) suggests that the following characteristics for good practice should be developed to obtain quality in classroom-based assessment: “to be part of effective planning; to reflect how students learn; to be central to classroom practice; to be key professional skill; to have an emotional impact; to affect learner motivation; to promote commitment to learning goals and assessment criteria; to help learners know how to improve; to encourage self-and peer-assessment and to recognize all achievements”. Furthermore, an important aspect that should be incorporated is the training of the different language assessors to be sure systematic and objective evaluation criteria are followed.

In this study, I analyse the formative assessment carried out by two teachers involved in a flip teaching subject. As Yorke (2003: 478) explains, formative assessment aims to “contribute to student learning through provision of information about performance” and it is conducted in a continuous and ongoing way. Lee (2007: 183) suggests six characteristics of feedback to promote formative assessment for learning: “Assessment is prospective [...]; information is communicated clearly [...] fostering a close link between teaching, learning and assessment; students are provided with opportunities to act on teacher feedback; students play an active role in managing their own learning; students enhance their motivation and self-esteem; feedback is used to improve teaching”. These characteristics were taken into

consideration to analyse if the teachers involved in this study promoted formative assessment for language learning.

In this paper, three key aspects have been taken into account: validity, construct irrelevant variance and the flip teaching approach. The first aspect, validity, is defined by Messick (1996: 8) as “It is an integrated evaluative judgement of the degree to which empirical evidence and theoretical rationale support the adequacy, appropriateness, meaningfulness and usefulness of the inferences and actions based on test scores”. Without accurate validity, assessment is useless, as validity involves the interpretation of a score. Panahi (2014: 334) adds to this idea: “validity is the extent to which inferences made from assessment results are appropriate, meaningful, and useful in terms of the purpose of the assessment”.

It should be taken into account that there are three conceptualizations of validity: validity is a property of tests, rather than of test score interpretation; test scores should measure some unsupported construct directly in order to be valid and score validity is a function of whatever construct is intended to measure. In this paper, I am interested in establishing the validity of assessment, that is, if validity is being used for an appropriate purpose, as part of formative assessment. The ultimate purpose of measurement is to improve the ratio of correct to incorrect decisions (Newton and Shaw, 2014). Taking into account that validity is the most important characteristic of a test or assessment technique and involves the interpretation of a score for a particular purpose or use, it was considered a key aspect in this study to determine if assessors were evaluating English learners correctly.

The second key aspect in this paper is the concept of construct validity (Bachman and Palmer, 2000), that is a combination of reliability (i.e. the consistency of tests scores); authenticity (i.e. tasks characteristics and the characteristics of tasks in real world); interactiveness (i.e. the engagement of the test taker’s characteristics, e.g. language ability, background knowledge, motivation, etc.); practicality (i.e. test implementation) and changes depending on context. A construct is the trait or characteristic that interests in a research, it may be referred to as a target. It is connected to validity as it addresses how well an assessment technique provides useful information. The construct validity (Bakker, Beijaard, Roelofs, Tigelaar, Sanders. & Verloop, 2008) can be identified taking into account two possibilities:

- a. Construct underrepresentation, when the test does not assess all of the construct, that is, not all the learning aspects are assessed.
- b. Construct irrelevant variance, when the test assesses skills or aspects that are not really part of our construct, they are not learning targets.

In this analysis, I focus on the concept of construct irrelevant variance (CIV), which is the introduction of abnormal, uncontrolled variables that affect assessment outcomes and are not part of the goal of assessors. There are two factors that may threaten validity arising from the misapplication of tests or the misinterpretation of score meaning, as being pointed out by Messick (1989). The first is when the tests scores are influenced by factors irrelevant to the

construct being measured and the second is when there are variables that systematically interfere with the ability to meaningful interpret scores.

Similarly, the construct can be affected by contextual factors such as the physical setting, the topic and the participants. Bachman (1999) considers the construct can be ability-focused, task-focused or interaction-focused, these concepts being mutually inclusive.

The third key aspect in this study is flip teaching that is an approach in which students work at home contents that are assessed later during class time. Specifically, Brame (2013: 1) defines it as: “The flipped classroom describes a reversal of traditional teaching where students gain first exposure to new material outside of class, usually via reading or lecture videos, and then class time is used to do the harder work of assimilating that knowledge through strategies such as problem-solving, discussion or debates”. This change of paradigm has been of interest to several researchers such as Walvoord and Johnson Anderson (1998), Lage, Platt and Treglia (2000), Berrett (2012), Brame (2013), O’Flaherty and Philips (2015) or Sohrabi and Iraj (2016). Calimeris y Sauer (2015) explain that learner-focused studies are more frequent and this may be one of the reasons of the popularity of flip teaching, but one problem that should be faced is that some collaborative methodologies that are implicit in flip teaching sometimes cannot be carried out as content learning makes it difficult due to syllabus design. Sohrabi and Iraj (2016: 514) precise that: “what has been traditionally done during class time is shifted to home activities and what has been traditionally done at home is transferred to as class activities”. In this sense, learners may have more time to interact during class time and content activities can be finished at home.

Taking all these three aspects into consideration, the main objective of this study is to investigate the extent to which the methodology followed in a flipped classroom can affect the assessment of students and if language assessors take into account the validity of their assessment, designing a rubric that differentiates the activities done during class time and outside the class. Consequently, the research questions of this analysis are:

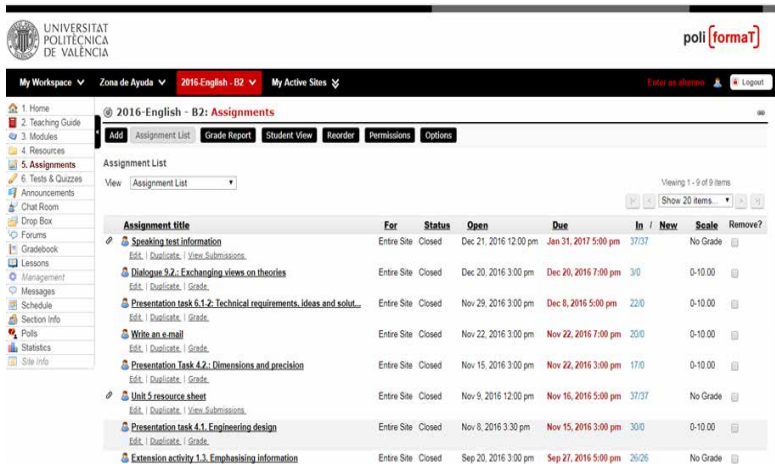
1. To what extent do assessors justify the scores assigned to students’ performance at home?
2. What kind of evidence do assessors report to students about their performance during class time and outside the class?
3. To what extent do assessors report evidence (a rubric) and arguments in the syllabus of the subject that correspond with the assessment of flip teaching activities?

1. Methodology

In this analysis, ninety students enrolled in an engineering degree at Universitat Politècnica de València participated in this study. The students were also enrolled in an English for specific purposes subject that followed a flip teaching approach. After 90 hours of training, students who passed the subject could obtain a B2 level of English proficiency, following the Common European Framework of Reference (2001).

The students under study were assessed during the first semester of the two academic years: 2015-16 and 2016-17. In this assessment procedure, two English teachers evaluated the different activities carried out by students and the amount of variation of the assessment of the different activities was calculated. The construct irrelevant variance was investigated to detect distortion in the assessment of flip teaching subjects. In this sense, it was analysed if assessors assigned the same score to all students' performance or if variation was found in the assessment of flip teaching subjects. A total number of 900 written tasks assessed by the teachers were compiled during the two academic years. From those, 450 activities were written by students during class time and 450 were activities written outside the classroom. The contextual factors of the construct that were taken into account in the assessment of the subject and the analysis, as being explained in the previous section, were: the physical setting, the topic and the participants. The aspects of the construct considered in the study were if the assessment was ability-focused, task-focused or interaction-focused. In the analysis, the assessment scores included in the syllabus of the flip teaching subject. Assessors included the following scores: written tasks on an engineering topic were graded up to 10% of the overall score; oral presentations of a technical concept were graded up to 20% of the overall score; two written tests were graded up to 40% of the overall score and the activities to be done at home were graded up to 30% of the overall score. Summing up, the activities to be done during class time could be graded up to 30% (written tasks and oral presentations) and the activities performed outside the classroom could be graded up to 30%.

The scoring procedure followed by the two assessors was the following one: the assessors downloaded the tasks from the online platform Poliforma-T (Drop Box section) and then they evaluated the different tasks using a rubric that incorporated different aspects: outline and context and writing competence, which included grammar, vocabulary, coherence and cohesion. The platform used to upload the assignments and the corrected writing activities can be seen in Figure 1:



The screenshot shows the '2016-English - B2: Assignments' page on the Poliforma-T platform. The interface includes a navigation menu on the left, a top header with the university logo and 'poli[formaT]' branding, and a main content area with an 'Assignment List' table. The table lists various assignments with columns for title, for, status, open, due, in, new, scale, and remove?.

Assignment title	For	Status	Open	Due	In	New	Scale	Remove?
Speaking test information	Entire Site	Closed	Dec 21, 2016 12:00 pm	Jan 31, 2017 5:00 pm	37/37		No Grade	
Dialogue 5.2 - Exchanging views on theories	Entire Site	Closed	Dec 20, 2016 3:00 pm	Dec 20, 2016 7:00 pm	3/0		0-10.00	
Presentation task 6.1.2: Technical requirements, ideas and solutions	Entire Site	Closed	Nov 29, 2016 3:00 pm	Dec 8, 2016 5:00 pm	22/0		0-10.00	
Write an e-mail	Entire Site	Closed	Nov 22, 2016 3:00 pm	Nov 22, 2016 7:00 pm	20/0		0-10.00	
Presentation Task 4.2 - Dimensions and precision	Entire Site	Closed	Nov 15, 2016 3:00 pm	Nov 22, 2016 3:00 pm	17/0		0-10.00	
Unit 5 resource sheet	Entire Site	Closed	Nov 9, 2016 12:00 pm	Nov 16, 2016 5:00 pm	37/37		No Grade	
Presentation task 4.1: Engineering design	Entire Site	Closed	Nov 8, 2016 3:30 pm	Nov 15, 2016 3:00 pm	30/0		0-10.00	
Extension activity 1.3: Engineering information	Entire Site	Closed	Sep 20, 2016 3:00 pm	Sep 27, 2016 5:00 pm	26/26		No Grade	

Figure 1. Learning platform Poliforma-T. Source: Intranet, Universidad Politécnic de Valencia

The platform allows assessors to correct the assignments and upload the corrected version of the activity, and so the students receive feedback. In this sense, and following Rea-Dickins (2007), assessors' evaluation affects learner motivation, promotes commitment to learning goals and assessment criteria and helps learners know how to improve.

Then, the assignments were analysed, taking into account the evaluation carried out by the assessors, extracting the results and finally, conclusions were drawn.

2. Results and discussion

The results extracted after the analysis can be seen in Table 1. The mean was calculated taking into account the assignments that were assessed following the same criteria and incorporating comments to improve language performance. Then, the standard deviation and the significance were also calculated.

Table 1. Data of assessment of assignments. Source: Results from experiments

Assignments	N students	Number of assignments	Mean	Std. deviation	Significance
Class time	90	450	99,10	13,00	0,00
Outside the class	90	450	49,32	19,14	0,00

The results showed that the assignments were assessed in a different way depending if they were done during class time (the assessors corrected all the parts of the writings and included comments to improve language performance).

Then, the results associated to the research questions of the study were considered to discuss the results. The first was related to the way assessors justified the scores assigned to students' performance of the tasks done outside the classroom. Taking into account the unrelated to construct parameters (construct irrelevant variance), it should be highlighted that assessors applied extraneous criteria. After the analysis of the assignments and the scores, it was observed that they considered the timing or the length of the tasks to assign a score. This information was not included in the syllabus nor in the rubric, so assessors differed greatly in the score of the assessment reported. Also, it was noticed (see Table 1) that overall scores were given to the tasks without considering the different assessment guidelines described in the syllabus, i.e. outline and context and writing competence (grammar, vocabulary, coherence and cohesion). Finally, the assessors scored the tasks considering the overall language proficiency of students but not the specificity of some assignments and the interaction when tasks were performed in groups.

The second question was aimed at knowing the evidence that assessors reported to students about their performance during class time and outside the class in order to improve motivation and feedback about language proficiency, as described in formative assessment.

I believe that assessors should contribute to students learning through provision of information about performance. After an analysis of the assignments taking into account the unrelated to construct parameters (construct irrelevant variance), it was observed that assessors penalised late delivery in out-of-class activities but they did not explained or described this criterion. Also, assessors used evidence and arguments that differed in their level of abstraction as some comments referred to aspects not included in the teaching guide. Furthermore, assessors gave different scores to class time and outside classroom activities, so students did not feel motivated to finish out-of-class activities, as they were given a lower score. An example of an assignment corrected by one assessor can be seen in Figure 2, below:



Figure 2. Example of assignment assessed and commented. Source: Students' material

In this example, the assessor commented and assessed the writing tasks helping learners to improve their language level. On the contrary, other assignments were not assessed and an overall score was given.

The third research question of this study was related to the evidences and arguments that corresponded specifically with the scoring guide of the subject for assessing flip teaching. After the analysis, it was noticed that there was a misinterpretation of score meaning. The unrelated to construct parameters which contaminated the measurement (CIV) were: first, abstract inferences were found in the scoring of tasks and tests; second, evidence was coded as 'judgment' when assessors made statements such as 'good' or 'bad', third, assessors did not differentiate the assessment of the tasks performed in and outside the classroom. All these scores irrelevant to the construct has several consequences for English learners, as in this case, as in the second research question, learners considered the tasks carried out outside the classroom were not necessary. It was also noticed that learners' writings were assessed but no special attention was paid to students that could not finish the tasks or had a lower level of language proficiency. As a consequence, 17% of students failed the subject (average data from academic courses 2015-16 and 2016-17).

In general, after the analysis of the assignments, it was observed that a considerable amount of variation was found in the evidence reported by the assessors. Also, it was noticed that classroom based assessment and the rubric were not modified when the flip teaching approach was incorporated in the subject. The content of the subject was modified, including more activities, but the assessment criteria were not updated by the assessors.

3. Conclusions

To interpret the results considering construct validity (Bachman and Palmer, 2000), it could be said that there was not a combination of reliability in the assessment of the assignments, that is, there was no consistency in the tests scores. It should also be noticed that interactiveness, that is, the engagement of the test taker's characteristics, e.g. language ability, background knowledge, motivation, was not also considered in the assessment of the assignments. Regarding practicality, that is, test implementation or changes depending on context (in class activities and out-of-class activities), assessors did not considered this item in the assessment of the subject.

After the analysis carried out in this paper, I recommend an analysis of construct irrelevant variance should be carried out to enhance the validation of assessment when more than one assessor is involved in the assessment. It should also be considered essential when a new approach is implemented, such as flip teaching, as the score should be adapted to the activities.

Furthermore, a previous rubric with precise coding for level of abstraction should be discussed by assessors and the different criteria applied between in and out-of-class activities should also be reflected in the teaching guide and in the overall score.

The unrelated to construct parameters (CIV) identified were the following ones: assessors did not justify the scores assigned to students' performance at home, there was no evidence reported by assessors to students about their performance during class time and outside the classroom and assessors did not report evidence and arguments that corresponded with the rubric of the subject for assessing flip teaching. As O'Flaherty and Philips (2015: 94) state, "Academics also see flipped classroom as an opportunity for curriculum renewal and developing a more curriculum centred approach [...] however there is a danger that educators renewing their curriculum may not fully understand the pedagogy of how to effectively translate the flipped class into practice". In this case, it was observed that the update of the curriculum was not indicated in the assessment criteria of the subject.

I think that further work should be done in this field, as the scoring guide and the conceptual framework for assessing teachers' coaching competence should also be assessed when new teaching approaches are incorporated in classroom based assessment.

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The European project of formation Cosmet. Evidence based Learning Outcomes

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Abstract

Evidence based Learning Outcomes, is to develop smart metering learning outcomes which reflect building sector needs and which can be integrated into existing Vocational Education Training (VET) offerings for construction site managers. These evidence based learning outcomes will address the skills needs of site managers in smart metering technologies and services, delivering a European-wide comprehensive pedagogical structure. This paper explains the collection and analysis of sector and VET evidence on the current and future smart metering site manager skills and training needs (covering power, gas, heat and water meters) in the six partnership countries.

Keywords: *Construction site managers; Smart metering; Specific training; Efficient learning.*

Resumen

Evidencias en los resultados de aprendizaje, debe desarrollar unidades de aprendizaje sobre medidores inteligentes que reflejan las necesidades del sector de la construcción y que pueden ser integrados en las ofertas existentes de formación para jefes de obra de construcción. Estos resultados abordarán las necesidades de habilidades de los jefes de obra en tecnologías de medición inteligentes y servicios, ofreciendo una estructura pedagógica integral a escala europea. Este documento explica la recolección y el análisis de datos del sector y centros de formación sobre las capacidades actuales y futuras en medición inteligente y necesidades de formación de los jefes de obra (medidores de electricidad, gas, calor y agua) en los seis países de la Asociación.

Palabras clave: *Jefes de obra; Medición inteligente; Formación específica; Aprendizaje eficiente.*

Introduction

This article shows the Evidence based Learning Outcomes for the European training project (Cosmet Project, 2017), which began in 2015 (ERASMUS+ Programme agreement number

2015-1-UK01-KA202-013406), and whose objective is to analyse the training needs of building managers in relation to smart metering and design courses to provide them with updated knowledge and skills (Cárcel & Peñalvo, 2016).

Training of site managers varies across the EU depending on each country's qualification framework and approach. In most countries, site managers usually get Vocational Education Training (VET) courses or in-company workplace training in the context of 2-3 year apprenticeships; building up experience in work areas such as estimating, planning, and buying; and assisting construction engineers and technicians (European Commission, 2017). Following specific EC and national regulation (e.g. the Building Directive EPBD 2010/31/EU; the Commission Recommendation on preparation for the rollout of smart metering systems 2012/148/EU; the Energy Efficiency Directive 2012/27/EU; and the European Commission Task Force on Smart Grids Experts Group 2), a strong policy drive in most EU countries supports the timely roll-out of smart meters. This introduces a new challenge for the construction sector to employ up-skilled site managers trained in smart metering services (ESML, 2013). A 2012 CEDEFOP report (Green Skills and Environmental Awareness in Vocational Education and Training Synthesis Report) documents the smart metering skills shortages for construction site occupations as a result of the implementation of national and EU resource efficiency measures and initiatives; and insufficient modern training provision for site managers.

Beyond the installation and commission of smart meters that is being carried out in most EU countries by qualified installers, smart metering infrastructures are interconnected to other features of the building site works. Site managers need updated training in order to acquire additional knowledge to respond to modern construction site needs that involve smart metering solutions for power, gas, heat and water (EU Skills Panorama: Construction Analytical Highlight, 2014).

There is a need to address the smart metering skills gap of site managers by developing a modern VET course about general smart metering principles and technical and organisational challenges generated by the interconnection of site infrastructures (Cárcel & Peñalvo, 2016). To address modern training needs of site managers in terms of practicality, flexibility, cost-effectiveness and EU accessibility, there is a need to develop Open Educational Resources that ensure easy and free access to on-line educational material, promoting self-education and self-assessment that can be carried out in a persons own time, place and pace.

1. Project Objectives & Target Groups

The project objectives are to:

- Develop appropriate learning outcomes and a training course to address power, gas, heat, and water smart metering skills needs, to enhance relevant VET provision for site managers;

- Introduce modern training methods in the form of OERs (teaching and assessment material) and Massive Open Online Course (MOOC); and
- Facilitate mutual recognition of the developed learning outcomes across EU.

The main target groups of the project are:

- VET students intending to work as site managers;
- Site managers working in the construction sector in Europe;
- VET providers for construction site managers;
- Stakeholders and associations in the construction sector.

The objective of Output O1: Evidence based Learning Outcomes, is to develop smart metering learning outcomes which reflect sector needs and which can be integrated into existing VET offerings for construction site managers. These evidence based learning outcomes will address the skills needs of site managers in smart metering technologies and services, delivering a European-wide comprehensive pedagogical structure.

This paper explains the collection and analysis of sector and VET evidence on the current and future smart metering site manager skills and training needs (covering power, gas, heat and water meters) in the six partnership countries; and presents the findings from that research. It is based on national and European desk and field research activities that involve the project target groups and relevant stakeholders, namely VET providers, smart metering field experts, sector representatives and associations.

2. Methodology

Data collection consisted of two on-line surveys which were conducted in November and December 2015. Each survey was addressed to different groups of stakeholders in each of the six partnership countries (United Kingdom, Greece, Spain, Germany, Lithuania and Poland). Desk-based research was also carried out to identify specific qualifications and courses with smart metering content in each country (Cosmet Project, 2017).

The survey for sector representatives, identifying the training needs of site managers in smart metering, consisted of 17 questions. It was sent to companies operating in civil engineering, building, construction, building installation, building Services engineering, and estate Management as well as associations of employers and employees.

The survey for VET providers, identifying smart metering training issues was composed of 6 questions. It was sent to VET providers and trainers for the construction industry; and associations of trainers and VET providers involved in the lifelong learning education of individuals that fit the profile of a construction site manager.

The target for participation across both surveys was a minimum of 100. Each country partner agreed to provide at least 9 participants in each survey. The actual participation numbers by country are in table 1.

Country	Industry responses	VET responses	Total
Germany	11	18	29
Greece	9	9	18
Lithuania	11	10	21
Poland	15	10	25
Spain	32	14	46
United Kingdom	9	16	25
Total	87	77	164

Table 1. Participation numbers by country. Source: Cosmet Project

The purpose of the programme provision research was to identify any training programmes in each country which deliver training in smart meters.

3. Data validation, consolidation and analysis

Upon receipt of the completed surveys, the gathered data was produced in the form of Microsoft Excel spreadsheets in partner native languages. Partners translated data into English and data was then validated (to confirm the accuracy of data) and consolidated (by merging into one spreadsheet).

Statistical computations and analyses assume that the variables have a specific level of measurement and are appropriately defined during the construction of the questionnaire. Consequently, variables can be defined as nominal, ordinal or interval to avoid nonsensical results.

- Nominal or categorical variables are based on mutually exclusive responses but not ranked or ordered categories. Yes / no, multiple choice or demographic questions (e.g. country, job description etc.).
- Ordinal variables are based on categories that can be ordered or ranked and therefore questions could include a rating scale. Offering an ordered set of choices, ordinal variables are more flexible than nominal variables and allow for the evaluation of priority issues, opinions or levels of agreement.
- Interval variables are based on categories which are ordered and the intervals between the values of the interval variable are equally spaced.

Prior to data processing, valid responses were reviewed and mapped into specific variables based on the type of the question. In the case of ordinal variables, responses were recorded in numerical values to facilitate quantitative processing.

Basic tools of descriptive statistics like counts, means, and percentages were employed (where questions allowed this) to extract useful information.

3.1. Research sample

A total of 89 individuals responded to the survey. The numbers by company/organization type for each nation are in table 2. The question asked:

“What type of organization do you represent?” and could select more than one answer. They could also choose to not answer the question):

Table 2. Numbers by company/organization type for each nation. Source: Cosmet Project

	Germany	Greece	Lithuania	Poland	Spain	United Kingdom	Total
Civil engineering	0	1	0	0	1	0	2
Building	0	1	3	4	2	0	10
Construction	3	4	1	0	7	0	15
Building installation	0	1	1	6	1	0	9
Building services eng.	0	0	4	0	6	5	15
Estate management	0	0	1	1	1	0	3
Employers association	0	0	0	4	1	1	6
Employees association	0	0	0	0	0	0	0
Other*	7	2	0	2	13	3	27
Total	10	9	10	17	32	9	87
Actual responses	11	9	11	17	32	9	89

4. Research results (Industry/Stakeholder research)

Respondents were asked to identify “to what extent construction site managers need to possess the following smart metering technologies knowledge, skills and competences.” (Options in terms of relevance were: Very Low, Low, Average, High, Very High).

1. *Knowledge of a wide range of gas, heat, water, and electricity smart metering technologies and systems.*
2. *Knowledge of the environmental impact of gas, heat, water, electricity smart metering systems.*
3. *Knowledge of the IT infrastructure related to the recoding and storage of transmitted data.*
4. *Knowledge of the network infrastructure and the Internet of Things systems that cover the wide range of “smart” devices (sensors, actuators, meters etc).*
5. *Knowledge of the device interconnectivity among smart devices and smart metering systems.*
6. *Knowledge of technical issues related to the installation of smart metering technologies in new buildings (e.g. topics such as where to place antennas etc).*

7. *Knowledge of technical issues related to the retrofitting of smart metering technologies in existing buildings.*
8. *Construction site management and supervision skills regarding smart metering systems (e.g. checking processes, time planning and prioritization of site works).*
9. *Coordination of site staff, employed in works that include smart metering.*
10. *Preparing designs, drawings and reports on site works that include smart metering.*
11. *Digital skills on incorporating smart metering technologies in*
 1. *automated home infrastructures.*
12. *Technical skills on incorporating smart metering technologies in automated home infrastructures.*
13. *Customer consultation skills on the selection of the most suitable smart metering solutions.*
14. *Customer consultation skills on the use and impact (environmental, economic) of smart metering systems.*
15. *Knowledge of the European legislation framework for the installation of smart metering technologies in buildings.*
16. *Knowledge of the national legislation framework for the installation of smart metering technologies in buildings.*
17. *Knowledge of the health and safety issues associated with site works that include smart metering technologies and services.*

The overall rankings for the smart metering knowledge, skills and competences needed by site managers are shown in table 3. These are ranked in order of importance based on the combined numbers of respondents who marked each one as High or Very High, expressed as a percentage. Where there are equal rankings, the number of respondents who marked each one as Average have been used as a 'positive'. Where rankings are equal with others, these are shown with the = sign. Full details of each country's percentage responses can be found in Appendix A.

Those marked High/Very High with a percentage of over 50% are the most important (shaded green); those with a percentage between 30% & 49% are important (shaded amber); and those with 29% or less are least important (shaded red).

Table 3. Skills and competences needed by site managers. Source: Cosmet Project

Table 3	High/Very High	Average	Low/Very Low	Ranking
8. Construction site management and supervision skills regarding smart metering systems (e.g. checking processes, time planning and prioritization of site works).	57%	32%	11%	1
17. Knowledge of the health and safety issues associated with site works that include smart metering technologies and services.	55%	25%	20%	2
9. Coordination of site staff, employed in works that include smart metering	54%	27%	19%	3
13. Customer consultation skills on the selection of the most suitable smart metering solutions.	49%	27%	24%	4
6. Knowledge of technical issues related to the installation of smart metering technologies in new buildings (e.g. topics such as where to place antennas etc).	47%	32%	21%	5
10. Preparing designs, drawings and reports on site works that include smart metering.	46%	31%	23%	6
7. Knowledge of technical issues related to the retrofitting of smart metering technologies in existing buildings.	45%	35%	20%	7
5. Knowledge of the device interconnectivity among smart devices and smart metering systems.	42%	32%	26%	8
1. Knowledge of a wide range of gas, heat, water, and electricity smart metering technologies and systems.	40%	40%	20%	9
16. Knowledge of the national legislation framework for the installation of smart metering technologies in buildings.	39%	30%	31%	10
11. Digital skills on incorporating smart metering technologies in automated home infrastructures.	36%	33%	31%	11
12. Technical skills on incorporating smart metering technologies in automated home infrastructures.	35%	38%	27%	12
15. Knowledge of the European legislation framework for the installation of smart metering technologies in buildings.	35%	29%	36%	13
4. Knowledge of the network infrastructure and the Internet of Things systems that cover the wide range of “smart” devices (sensors, actuators, meters etc).	33%	38%	29%	14
14. Customer consultation skills on the use and impact (environmental, economic) of smart metering systems.	33%	34%	33%	15
2. Knowledge of the environmental impact of gas, heat, water, electricity smart metering systems.	32%	41%	27%	16
3. Knowledge of the IT infrastructure related to the recoding and storage of transmitted data.	29%	43%	28%	17

5. Research results (VET Provider research)

5.1 Research sample

A total of 77 individuals responded to the survey. (The question asked: “What is your area of expertise regarding vocational education and training (VET) provision for the construction sector?” and could select more than one answer. They could also choose to not answer the question):

It can be seen that 66% of respondents had expertise in VET provision for construction; 40% had expertise in building installation; and 39% had expertise in the energy and water sectors.

5.2. Research results

Respondents were asked the following questions:

1. *How relevant to the role of site managers is training in smart metering technologies in your country? (Select one answer)*
2. *What are the most needed skills/knowledge site managers need to acquire via training? (Select 3 most important)*
3. *What skill sets would site managers need for managing smart metering technologies? (Select all that apply)*
4. *Who should have the biggest role in providing training to site managers on smart metering technologies and services? (Select one answer).*
5. *How much training time do site management trainees need in order to improve their knowledge/skills in smart metering? (Select one answer)*
6. *What is the best way to improve the site manager’s knowledge and skills in smart metering? (Select one answer)*

The results for each question are shown, expressed as a percentage, in the tables below (Key: DE = Germany; GR = Greece; LT = Lithuania; PL = Poland; ES = Spain; UK = United Kingdom.) Where rankings are equal with others, these are shown with the = sign.

The results for question 1: “How relevant to the role of site managers is training in smart metering technologies in your country?” are shown in table 5.

Table 5. Relevant to the role of site managers is training in smart metering technologies. Source: Cosmet Project

	DE	GR	LT	PL	ES	UK	Overall
Very relevant	44%	33%	70%	60%	43%	50%	49%
Moderately relevant	17%	33%	0%	30%	36%	38%	26%
Not very relevant	39%	22%	30%	0%	14%	13%	21%
Not at all relevant	0%	11%	0%	0%	7%	0%	3%

A summary of the results for question 2: “What are the most needed skills/knowledge site managers need to acquire via training?” is shown in table 6.

Table 6. Most needed skills/knowledge site managers need. Source: Cosmet Project

	Percentage	Ranking
Technical skills (e.g. incorporating smart metering technologies in automated home infrastructures)	71%	1
Managerial skills (e.g. site supervision skills such as checking processes, prioritization of site works)	68%	2
Digital knowledge and skills (e.g. IT infrastructure interconnectivity, programming skills)	52%	3
Environmental knowledge (e.g. knowledge of the environmental impact of gas, heat, water, electricity smart metering systems)	42%	4
Public and customer consultation skills on the use and impact of smart metering systems	21%	5

The percentage results for question 3: “What skill sets would site managers need for managing smart metering technologies?” are shown on a country by country basis and overall in table 7. Those with an overall percentage of over 50% are the most important (shaded green); those with a percentage between 30% & 49% are important (shaded amber); and those with 29% or less are least important (shaded red).

Table 7. Percentage results for question 3. Source: Cosmet Project

	DE	GR	LT	PL	ES	UK	All
Installation	56%	33%	100%	60%	64%	44%	58%
Managing	22%	56%	60%	70%	50%	69%	52%
Maintenance	72%	33%	80%	40%	29%	50%	52%
Inspecting	50%	89%	50%	40%	31%	50%	48%
Reporting	50%	67%	30%	30%	43%	31%	42%
Commissioning	72%	22%	0%	10%	36%	56%	39%
Consulting	44%	44%	20%	20%	29%	38%	34%
Design	0%	33%	0%	40%	79%	19%	27%

The results for question 4: “Who should have the biggest role in providing training to site managers on smart metering technologies and services?” are shown in table 8.

Table 8. Percentage results for question 4. Source: Cosmet Project

	DE	GR	LT	PL	ES	UK	All
VET providers for the construction industry	61%	33%	100%	60%	64%	44%	60%
VET providers for the energy/water industry	22%	33%	0%	10%	7%	44%	21%
Construction industry associations	17%	22%	0%	20%	29%	6%	16%
Environmental agencies	0%	11%	0%	0%	0%	0%	1%

The results for question 5: “How much training time do site management trainees need in order to improve their knowledge/skills in smart metering?” are shown in table 9.

Table 9. Percentage results for question 5. Source: Cosmet Project

	DE	GR	LT	PL	ES	UK	All
Less than 20 hours per year	22%	44%	0%	50%	43%	69%	39%
More than 20 hours per year	61%	56%	100%	40%	57%	31%	56%

The results for question 6: “What is the best way to improve the site manager’s knowledge and skills in smart metering?” are shown in table 10.

Table 10. Percentage results for question 6. Source: Cosmet Project

	DE	GR	LT	PL	ES	UK	All
In-house training within construction companies	50%	11%	10%	60%	50%	31%	38%
VET provision for the construction industry	33%	44%	50%	20%	36%	50%	39%
Apprenticeships for site managers	11%	44%	40%	10%	14%	6%	18%

6. Conclusions

The 17 smart metering technologies knowledge, skills and competences from the industry/stakeholder survey can be grouped into the 5 headings used in the VET Provider survey as follows: **1)** Digital knowledge and skills (knowledge 3, 4, 5 and 11); **2)** Managerial skills (8, 9 and 17); **3)** Technical skills (6, 7, 10 and 12); **4)** Environmental knowledge (1, 2, 15 and 16); **5)** Public and customer consultation skills (13 and 14).

By using these groupings and taking the Average, High and Very High scores from the industry/stakeholder survey, the ranking in table 13 can be seen. This shows that industry and VET Providers broadly agree on the importance of each group of knowledge, skills and competences.

Table 11. Importance of each group of knowledge, skills and competences. Source: Cosmet Project

	Average/High/ Very High	Percentage of total	Ranking Industry	Ranking VET
Managerial skills	221	83%	1	2
Technical skills	278	77%	2	1
Digital knowledge and skills	253	72%	3	3
Environmental knowledge	254	71%	4=	4
Public and customer consultation skills	125	71%	4=	5

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Project-based learning based on a national pilot project for the data quality control and standardization of maternal and child information applied to Biomedical Engineering University teaching

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Abstract

Project-based learning is a useful technique for acquiring practical and real competencies in subjects related to new technologies. In the Master in Biomedical Engineering of the Universitat Politècnica de València, we applied a project-based learning strategy in the new subject “Data Quality and Interoperability” (DQI) introduced in the 2016-17 course. The main learning goal of the DQI subject is to use and exchange biomedical data based on its quality control and use of adequate exchange technologies, ensuring a reliable data exploitation and research. The project-based learning strategy consisted in guiding the theory and, principally, the practice of the subject through the replication of some of the tasks developed in a National pilot technological project by the Spanish Ministry of Health, Social Services and Equality, envisaged to the quality control and standardization of maternal and child information: the Maternal-Child-Information (MCI) project. The real use case was developed as an innovation project by the UPV, one of its Spin-Off, and two National hospitals. In addition, the subject is taught in English as the main language. In this article we present the newly developed learning contents for the DQI subject and we describe the project-based learning strategy based on the replication of the work developed in the MCI project.

Keywords: *project-based learning, biomedical engineering, university teaching, data quality, semantic interoperability.*

Introduction

The 2016-17 course was the first in which the subject Data Quality and Interoperability (DQI) took place in the Master in Biomedical Engineering of the Universitat Politècnica de València

(UPV). The main overall learning goal of the DQI subject (taught in English) is that the student is able to use, manage and exchange biomedical data by means of its data quality (DQ) assurance and the use of standards and methodologies for semantic and structural interoperability. To our knowledge, this is a pioneering subject offering a training in biomedical DQ, and including the concept of data interoperability. Training in DQ is vital for a reliable use of the data, especially for statistical analysis and modelling and for decision-making based on them. Inadequate data acquisition processes can lead to incomplete, inconsistent, or biased data, as well as to undesirable data variability effects, problems that may lead to suboptimal and poorly generalizable models, or require additional efforts to correct them. This is particularly important in the biomedical field, where information or knowledge extracted from data with quality problems can have direct repercussions on the patient, research studies, or public health decisions.

In this sense, several international Universities have incorporated DQ syllabus into their Programs, including a specialized DQ program at the Massachusetts Institute of Technology, and others included specific interoperability matters in their health IT programs. However, we did not find evidence of specialized courses in the specific problem of biomedical DQ nor complementing it with the interoperability matter.

Training in DQ is generally related to the learning of methods of DQ problems characterization, their evaluation and measurement, and the DQ assurance and control. Based on the extense experience of the authors of this work in DQ (Sáez, et al, 2012, 2016; García de León et al, 2015), we considered that the learning of these methods may result too abstract, or away from the student, if learned only theoretically or with specific, closed examples. A practical use of these DQ methods, based on a real project running through all the stages involved with DQ, since data creation to data reuse, using real, tangible data, may result a useful approach for the student to acquire practical and real competencies of the learned DQ methods and concepts.

The DQI subject coincided in time with the development of a real project envisaged to DQ and interoperability, on which the key learning outcomes of the subject were practically developed and applied. Specifically, coordinated by the Spin-off of the UPV VeraTech for Health, in partnership with the UPV, the Hospital Virgen del Castillo de Yecla, and the Hospital 12 de Octubre in Madrid, we developed the so-called "Pilot project to improve quality of information in perinatal care based on good practices of the National Health System, identified within the framework of the strategy of care for childbirth and reproductive health" commissioned by the Spanish Ministry of Health, Social Services and Equality (MSSSI), from now on the Maternal-Child-Information (MCI) project. The objective of this project was the creation of a national repository of maternal and child data, ensuring its DQ through DQ assessment methodologies, and its interoperability through medical information standards, with the ultimate aims of reliably evaluating healthcare

practices and providing reliable data for population research. In this manner, we decided to develop as a teaching innovation a project-based learning strategy (Blumenfeld et al., 1991), relying on the closeness of the teaching staff to the development of this National project, and supported by the direct application of all the learning outcomes of the subject.

The general objective of this innovation was to establish the contents of the new DQI subject supported by a project-based learning strategy based on the MCI project. Section 2 describes the defined learning outcomes. Section 3 describes the reference MCI project. Section 4 describes the project-based learning strategy showing the subject contents and how these have been linked to the real tasks developed in the MCI project. Next, section 5 discusses what we have achieved at this stage. Finally, section 6 concludes this work.

1. Learning outcomes of the new DQI subject

The first step in developing the new subject was to establish the union between the two main topics: DQ and interoperability, while maintaining the relationship with the general objective of the student to be able to use and exchange data optimally and reliably. Both sub-objectives justify by their selves the need for an adequate DQ and interoperability. However, two factors led us to organize the subject into two main blocks. First, in biomedical data reuse projects (such as in the MCI project), we often find as a first step the standardization and normalization of data, both to unify different formats and concepts of data from different origins and to establish an information standard that avoids ambiguities when analyzing the data. Second, we find as a second step the DQ assurance, although in some stages it relates to the first standardization and normalization processes. On the other hand, we find that there are specialized DQ and interoperability methods and strategies. Therefore, the first block of the subject would be related to interoperability goals, while the second block to DQ goals, what permitted aligning the syllabus of the subject with the real MCI project development. We must note that in the MCI project, the separation between the two blocks was not so abrupt, having some convergent stages. In spite of this, organizing the subject in this manner would allow the student to discover by herself in which points of the stage of interoperability it would be advisable to have applied some DQ methods. Thus, we define the following learning outcomes:

- **Block 1: Interoperability**

LO 1.1) Identify the needs for interoperability in healthcare environments and current approaches to address it, as well as the requirements for semantic interoperability at the national and international levels.

LO 1.2) Identify the different medical ontologies and terminologies and their application domains. Apply the definition of subsets of terms and terminological links.

LO 1.3) Apply interoperability techniques in real scenarios. Identify the advantages of interoperable systems in relation to the limitations of non-interoperable ones.

- **Block 2: Data quality**

LO 2.1) Identify the different types of DQ problems, modelling them as DQ dimensions, and their consequences in statistical modelling or reuse.

LO 2.2) Detect and measure specific quality problems in data repositories.

LO 2.3) Establish and implement DQ control and improvement processes.

Starting from these learning outcomes, the next step was to design a teaching content that fits them, but also, given the expected project-based learning strategy, to make this content traceable to the stages of development of the real MCI project.

2. The Maternal-Child-Information project

The MCI project (Sáez et al, 2017) started from two main motivations: the evaluation of National maternal and child health strategies and the provision of a standardized and DQ assured data repository for population research, with a major focus on breastfeeding, one of the major determinants of maternal and child health. The common feature of these two motivations is their dependence on data and information. First, the evaluation of health strategies requires the monitoring of healthcare practices, and this evaluation is calculated using indicators based on healthcare data. Second, the data repository of maternal and child population research originates from the same healthcare data, which is collected in a way that facilitates their usability in research. In both cases, it is crucial (1) to share information from the different hospitals involved in the health strategy, and (2) to ensure the quality of the information to be available. This led to the creation of the project in which interoperability and data standardization methodologies were applied to ensure (1) and DQ assessment methodologies to ensure (2). As described above, these two axis are in line with the principal learning outcomes blocks of the subject.

The project was divided into the following work packages (WPs) and tasks, which in practice were developed in parallel, and from which we will draw the contents of the project-based learning strategy in the next section.

- **WPI: Standardization and Interoperability**

T1.1) Definition of maternal and child information models in the ISO 13606 health information standard, identifying the main data structures and selecting and grouping relevant elements for the domain.

T1.2) "Mapping" of the ISO 13606 information models to the source databases (linking and transforming structures and concepts of the source data to the standardized model).

- **WP2: Data quality**

T2.1) Definition of the "dimensions" of DQ to be evaluated (DQ dimensions consist on measurable attributes related to simple aspects or constructs of DQ).

T2.2) Compilation and formalization of data validation rules and knowledge of the maternal and child domain that supports the measurements of some of DQ dimensions.

T2.3) Assessment of the DQ of the maternal and child data provided to the project by the participating hospitals.

- **WP3: Definition of indicators of good healthcare practices**

T3.1) Formal and operational definition of healthcare practice indicators to be evaluated based on literature reviews.

T3.2) Mapping of the indicators to the standardized data for their automatic calculation.

Replicating a reasonable subset of the project results would be the expected basis outcome for the student training plan. Hence, the project results included (1) two ISO 13606 clinical models for an interoperable perinatal health report and an infant-feeding model up to two years; (2) a data repository containing the standardized data for their reuse and exchange between hospitals, compiled using ExistDB, an open source database which can be freely used by the students; (3) a set of seven DQ dimensions and their methods including the knowledge and rules necessary for their calculation; (4) a detailed report was generated with the results of the DQ analysis of the data from the two participating hospitals; and (5) a total of 127 good practice indicators grouped into six categories (from gestation to postpartum follow-up at a community health centers), based on national and international recommendations (Euro-Peristat, WHO, UNICEF, MSSSI), and their link with the standardized models to allow their automated measurement based on XQuery programs. Finally, as a pilot project, certain objectives were left out of the project, some of which we decided to be initially studied along the project-based learning contents.

3. Project-based learning in the DQI subject

The learning outcomes of the DQI subject were defined to allow the students obtaining knowledge and competences in the fields of biomedical data interoperability and DQ assessment. To reach these outcomes, a set of classroom theory (CT) and computer practice (CP) contents were defined. Subsequently, these contents were linked with the tasks carried out during the project development, leading to the defined project-based learning strategy.

3.1. Subject contents

The DQI subject contents were organized in a set of nine CT sessions, and five CP sessions, with a three-hour duration each, covering the defined learning outcomes (Table 1). CT sessions include time for masterclass and time for the students to present some work related to that theme, encouraging debate and critical and scientific spirit. Emphasis is placed on real

examples or cases so that students identify the actions or critical elements that have led to success or failure in each case. The CP are performed in laboratories focused on the analysis of the quality of biomedical databases in different real problems and use of tools for their interoperability.

The Interoperability block firstly addressed an introduction to the needs for interoperability in healthcare environments, defining interoperability according to official organizations, and overviewing different standards. The second CT session focused on describing the main EHR standards and their clinical information models. Next, the third CT session addressed an introduction to the most common medical ontologies and terminologies, and then focused on the terminological binding of clinical information models and terminologies. The last CT session allowed students to review literature on cutting-edge research works about interoperability of DSS systems and EHR systems. On the other hand, the first CP session aimed to create a normalized clinical information model for data in the MCI project data, while mapping the perinatal data base to that model. In the second CP session, the students used the normalized perinatal records to feed a healthcare monitoring system, while discussing the benefits and limitations of this interoperability approach within the further DQ processes to improve the accuracy of the monitoring system.

The DQ block covered in its CT sessions, first, a general introduction to the problematic of DQ, providing different point of views in the literature and the definition basic concepts. In this session, students are required to read by their selves some seminar information on DQ and use it to characterize real examples. Next, three sessions describe thoroughly a set of eight DQ dimensions: completeness, contextualization, consistency, uniqueness, correctness, timeliness, temporal variability, and multi-source variability. These were supported by examples of real problems and were put into practice in the next two CP sessions. Particularly students developed a DQ assessment framework in the R open source programming language, which was incrementally completed during the CP sessions. The last session covered the most common DQ methodologies of standards, where the student was required to write a report of their application on a real problem.

Table 1 Contents of the DQI subject by block. CT: classroom theory, CP: computer practice

<i>Block 1: Interoperability</i>	<i>Block 2: Data Quality</i>
CT 1.1) Introduction to interoperability	CT 2.1) Introduction to data quality
CT 1.2) Health information standards	CT 2.2) Data quality dimensions (x3)
CT 1.3) Clinical ontologies and terminologies	CP 2.1) Creation of a basic DQ assessment platform in R
CP 1.1) Normalization of electronic health records	CP 2.2) Assessment of data validation and consistency rules
CT 1.4) Interoperability of DSS systems and EHR systems	CP 2.3) Advanced DQ assessment and data curation
CP 1.2) Monitoring healthcare indicators on standardized data	CT 2.3) DQ methodologies and standards

3.2. Mapping of subject contents with the Maternal-Child-Information Project

Figure 1 shows the outline of the MCI project, linking the project WPs to the corresponding learning blocks of the DQI subject. We must note that although the real project counted with datasets from two hospitals, in the DQI subject we focused to the data from the Hospital Virgen del Castillo, given its higher value to the contents of the subject. The development of the project tasks followed a workflow where, in general, WPs were carried out in parallel, but being interconnected in order to achieve the expected results. This workflow organization led us to organize the project-based learning strategy along the two main blocks, leaving some independency to their contents, but also justifying the need of putting together efforts in interoperability and DQ tasks in real data reuse projects. Particularly, the project WP3 provided the main data reuse purpose for the maternal child data: monitoring healthcare best practice indicators, where standardized data permits an standard monitoring independent of the source and benchmark between centers, and the assessment of DQ ensures the reliability of the indicators.

Figure 1 is supported by Table 2, which relates the tasks of the MCI project and the contents of the subject as described above, as a tool employed for defining an adequate organization of the project-based learning strategy with respect to the real project. If we observe by CT and CP groups, we can see that the relationship is approximately diagonal along the WP1 and WP2. This reflects the adequate workflow of the subject along its two main blocks in relation with the dependencies of the tasks of the original project. We observe that the subject contents related to tasks in WP3 are somehow isolated in the workflow. This is related to the transversal nature of WP3, which requires and is related to developments from WP1 and WP2. This was not a problem for the dynamic of the subject, since the interoperability requirements in WP3 to link the operational definition of the healthcare indicators were addressed in the interoperability block, and the DQ requirements to evaluate the effect of DQ on the indicators, were addressed separately in the DQ block.

We must note that the CT 2.3 contents are not shown in Table 2. The use of standard methodologies for DQ control (besides DQ dimensions) was not addressed in the pilot MCI project. However, given the importance of that topic in real DQ projects, we took the opportunity to teach that topic, while allow the students to present a work applying one of these methodologies to the MCI project.

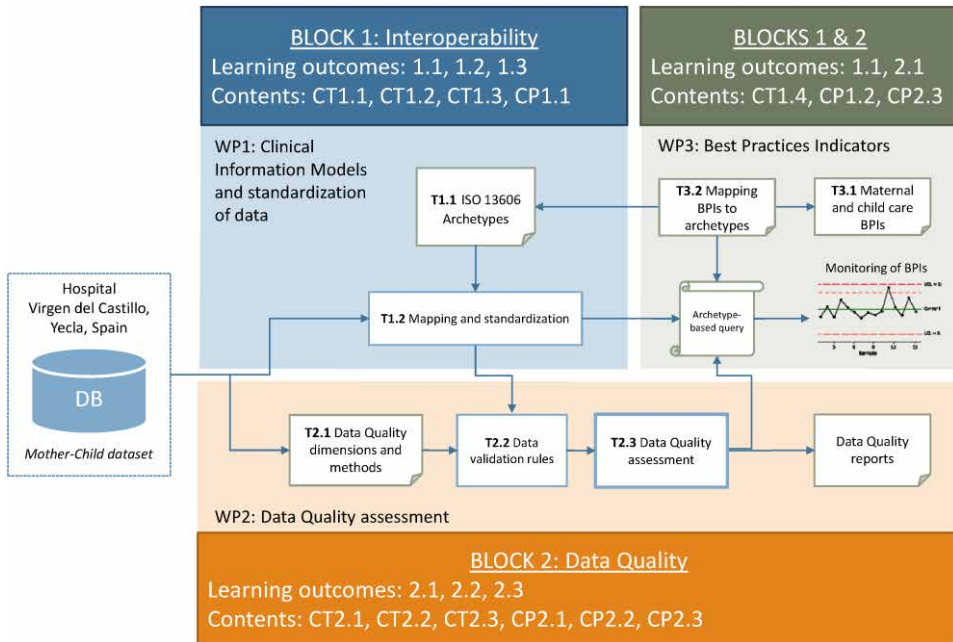


Figure 1 Project outline assigned to learning blocks

Table 2 Relationship between tasks of the real project and the contents of the DQI subject. Codes make reference to those tasks and content sessions described in the text.

			Tasks of the Maternal-Child Information project						
			WP1		WP2			WP3	
			T1.1	T1.2	T2.1	T2.2	T2.3	T3.1	T3.2
Contents of the DQI subject	Classroom Theory	CT1.1	x	x					
		CT1.2	x	x					
		CT1.3	x	x					
		CT1.4		x					x
		CT2.1			x				
		CT2.2			x	x	x		
	Computer Practice	CP1.1	x	x					
		CP1.2						x	x
		CP2.1			x	x	x		
		CP2.2				x	x		
CP2.3						x	x	x	

Additionally, to make closer this project-based learning experience to the real project, and specially supporting the final aim of the project: the standardized and reliable monitoring of maternal and child care best practices, we included in the syllabus a seminar taught by an expert in that topic who led the WP3 in the project.

4. Discussion

This project-based learning course counted with the benefit that the subject teachers were active participants in the real project on which it was based. Given the closeness of the defined learning outcomes and contents to real practical skills in the corresponding interoperability and DQ fields, we were able to link these contents to the tasks carried out in the MCI project described above. Particularly, the CP sessions aimed to replicate to some degree these tasks, while the CT sessions were supported by the real examples of the project development. The 2016-17 course has been the first introducing the DQI subject. Students showed to be satisfied with this subject, specially counting with the handicap of being taught in English, a foreign language, however, from the teachers' perspective there is room for improvement. Particularly, we consider that both blocks could be better linked, as both can take benefit of each other in their learning process, e.g., data validation rules can be included to some degree in the standard data models, or the degree of data standardization is a key factor for prospective DQ. On the other hand, in the next course we will focus in establishing evaluation rubrics for the specific project-based learning syllabus, as well as in studying the effect of the subject in the student awareness and skills in interoperability and DQ.

5. Conclusions

The DQI subject has been introduced in the 2016-17 course. To achieve the defined learning outcomes it has applied a project-based learning strategy based on the MCI project, a real National project where the learning outcomes of the subject were mostly covered, demonstrating the real practical use of the competencies to be acquired. In this first work we have focused in the development of the new subject itself, its learning outcomes and contents, with the framework of the project-based learning strategy. The subject continues being part of the syllabus of the Master in Biomedical Engineering of the Universitat Politècnica de València. Further studies will include improving the subject evaluation and studying the learning effect on the students.

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European Educational Program for Energy Professionals in Nearly Zero Energy Buildings (NZEB). The case of Universitat Politécnica de València

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Abstract

The 2016-17 H2020 work program in “Secure, Clean and Efficient Energy” considers moderating the growth of energy demand as the basis for a sustainable and affordable energy transition. One of the main energy demanding subsector is buildings, which accounts for 40% of final energy consumption, offering a high potential for energy efficiency improvement and savings on energy bills. In this regard, Nearly Zero Energy Buildings (NZEB) concept represents an important opportunity for construction sector and citizens. NZEB’s approach aims reducing building energy demand to its minimum, generating the necessary energy with renewable sources either in situ or in the nearby area.

This paper presents the implementation of “Meeting Energy Professional Skills (MEnS)” Project in Spain, an H2020 initiative based on upgrading energy professional skills in NZEB. MEnS project, funded under the “Construction Skills” call, uses a novel educational framework to train 1168 professionals around Europe to leverage the new building energy transition.

This work describes the educational implementation of MEnS and analyses the participation results at each of the participant countries, including the Spanish course which was carried out at the Universitat Politècnica de València.

Keywords: *Innovation in Education, Qualifications, NZEB, H2020 European project.*

Resumen

El programa de trabajo H2020 2016-17 sobre "Energía Segura, Limpia y Eficiente" considera moderar el crecimiento de la demanda de energía como

base para una transición energética sostenible y asequible. Uno de los principales sectores demandantes de energía es el de los edificios, que representa el 40% del consumo final de energía, ofreciendo un gran potencial de mejora basada en la eficiencia energética y el ahorro económico en la facturación. En este sentido, el concepto de Edificios de Mínimo Consumo (NZEB) representa una oportunidad para el sector de la construcción y la sociedad en general. El edificio NZEB tiene como objetivo reducir la demanda energética del edificio a su mínimo, generando la energía necesaria con fuentes renovables in situ o en el entorno cercano.

Este artículo presenta los resultados del proyecto "Meeting Energy Professional Skills (MEoS)" en España, una iniciativa del programa H2020 que promueve actualizar las capacidades y competencias de profesionales en materia de eficiencia energética y energías renovables. El proyecto tiene como objetivo formar a profesionales para abordar el nuevo reto de convertir los edificios existentes y nuevos en NZEB. El proyecto MEoS, financiado por la convocatoria "Skills Construction", utiliza un marco educativo novedoso para capacitar a 1168 profesionales de toda Europa con el fin de promover una transición energética en este sector.

Este trabajo describe esta iniciativa educativa y analiza los resultados de participación en cada uno de los países participantes, incluido el de España, el cual se llevó a cabo en la Universitat Politècnica de València.

Palabras clave: *Innovación en la educación, Qualificaciones, Proyecto europeo del H2020.*

Introduction

The European Commission has focused and promoted the need to improve the energy performance of EU's building stock since the early 2000's. Nowadays, buildings account for almost 40% of the total primary energy consumption in EU. This situation has influenced the adoption of the 2020 and 2030's energy efficiency targets. The targets consist on reducing energy consumption, increasing the use of renewable energies, and reducing Greenhouse gases emissions (GHG) (European Commission, 2008) by 20% in 2020. EU strategy for 2030 is even more ambitious than previous one, it aims for 40%, 27% and 27%, respectively (European Commission, 2013). The introduction of the notion of Nearly Zero Energy Buildings (NZEB) (European Union, 2002) into the Recast of the Energy Performance Building Directive in 2010 was an important step toward these targets (European Union, 2010). NZEB considers the need of reducing buildings energy requirements to minimum standards and integrate renewable energies so as to fulfil this demand (Hamdy, 2010). The directive obliges all new buildings to be NZEB from 2020 and public building from 2018.

However, there are many challenges ahead to support this European transition. On the one hand, construction industry needs to be able to deliver NZEB renovations using innovative technologies and products; while on the other hand, there is a need for qualified and upskilled professionals (architects, engineers, building managers, etc) capable to respond to these challenges effectively.

Along these lines, Smart Grids and Distributed Generation based on renewable sources is one of the pillars in this energy transition within the building sector (Marszal, 2011). The role of electrical engineers in the design, construction and retrofit of NZEBs is crucial (Kurnitski, 2011) and it means that this knowledge should be transferred and integrated in the construction sector (Schimschar, 2011) (Pacheco-Torgal, 2013).

Responding to this, an innovative, international and multilevel educational experience has been made available to European energy professionals under the Meeting of Energy Skills (MEoS) Horizon 2020 project, which will last until August 2017. The specific challenge addressed by MEoS is to upgrade the NZEB skills for professionals involved in the construction sector, including electrical and electronic engineers and related disciplines.

The following section provides a general overview on the MEoS's educational framework and the description of the main activities constituting its structure. Section 2 describes the evaluation method of MEoS's courses and Section 3 shows the results of the evaluation across Europe. Finally, conclusions are included in Section 4.

1. The educational Framework of MEoS

MEoS's educational experience was designed into three main activities. They are organised to tackle three different educational processes, thus constituting a solid and complete training agenda. These three main pillars are:

- An EQF level 7 educational programme for building professionals, organized in 10 European Universities, with a common structure and learning outcomes. Each course is rewarded with a total of 10 accredited ECTS by all institutions.
- A unique training experience, named "Front Meeting of Skills (FMS)", based on experiences from real case studies, which aims to become an open lab for integrated design towards NZEB solutions in housing stock, a think tank of discussion and interactions between involved actors.
- An E-learning platform, an interactive space portal that promotes distant learning and encourages real debate of stakeholders in the drive to adopt NZEB in transforming the current building stock.

Activities are independent but interlinked with each other, so they should be viewed as parts of an overall programme. Thus, participants were encouraged to join all three activities.

MEoS project began analysing actual NZEB situation in Europe and identifying main training gaps. A research was carried out in all participating EU countries to obtain general

information about current situation of NZEB, the available education and training opportunities and the existing training barriers.

Next, based on the market research, it was defined and organised the training experience, which was structured in three main pillars: EQF Level 7 Education Program, Front Meeting of Skills (FMS) and the E-learning Platform.

1.1. EQF Level 7 Education Program

This is the main pillar of MENs's educational framework. It was delivered in 10 EU countries during three course editions. Each edition targeted building professionals, finally reaching a total of 1168 participants around Europe. This program has the purpose of training building professionals in Nearly Zero Energy Building strategies and technologies according to the European's EPBD (Sartori, 2012) (Risholt, 2013) (Janssen, 2013). As a reflection of the demanding work, participants were awarded with 10 ECTS credits once they passed the final exam.

All participating Universities agreed on a training structure of the program, including common topics to be tackled during the course, plus an additional module with national particularities based on their national challenges. Educational programmes at Universities were accredited by their competent offices so the courses could award professionals with standardised ECTS credits.

The common structure consisted on 6 Units:

1. NZEB description and policies
2. Energy performance of building envelope
3. Building services for NZEB
4. Integration of renewable energy generation
5. Energy investment evaluation
6. Building energy modelling

In addition to the common structure, each university included in their academic programme a didactical unit representing the national and regional context within their countries.

Training courses aimed to raise the knowledge and skills of professional experts in Nearly Zero Energy Building aspects, while at the same time, recognizing and accrediting the knowledge and qualifications acquired throughout Europe. In this regard, initially all universities accredited their courses and then, the effectiveness of the learning process was jointly assessed across the different participant universities.

Universities carried out an accreditation process within their organisations to recognise their MENs training up-skilling courses with 10 ECTS (Table 1). This allowed course participants to be awarded with ECTS credits once they passed the course.

Table 1. Accreditation Process

Country	Institution	Course title	Accreditation Date
SPAIN (ES)	Universitat Politècnica de València / Institute for Energy Engineering (IE-UPV)	Professional Energy Skills in NZEB	Sept. 2015
IRELAND (IR)	Dublin School of Architecture	Professional Energy Skills in NZEB	Dec. 2015
ROMANIA (RO)	Technical University of Cluj-Napoca	Professional Energy Skills in NZEB | <i>Tehnici de analiza energetica si practici de implementare a cladirilor cu consum de energie aproape zero (NZEB)</i>	Jul. 2015
GREECE (EL)	Aristotle University of Thessaloniki / Power Systems Laboratory	Nearly-Zero Energy Buildings - Design and Conversion	Nov. 2015
CYPRUS (CY)	University of Cyprus	Building Integrated Photovoltaics (BIPV) - Towards nearly zero energy buildings (NZEB)	Dec. 2015
FYR OF MACEDONIA (MK)	Ss. Cyril and Methodius University in Skopje	Professional Energy Skills in NZEB | <i>Тренинг курс за згради со енергија близу до нула (NZEB) за дипломирани инженери и архитекти</i>	Oct. 2015
UNITED KINGDOM (GB)	Brunel University London	Nearly Zero Energy Building Retrofit	Nov. 2015
BELGIUM (BE)	Université libre de Bruxelles	Meeting of Energy Professional Skills towards NZEB	Feb. 2016
GERMANY (DE)	Universitaet Kassel	Nearly Zero Energy Buildings | <i>Niedrigstenergiegebäude-Standard für bestehende Wohngebäude</i>	Dec. 2015
DENMARK (DK)	Aarhus University	Professional Energy Skills in NZEB	Oct. 2015

Source: Peñalvo-López, E. (2017)

Delivery of the training courses was also left upon each University to decide. Some organisations adopted a blended method of face-to-face and distance learning, while others relied mostly on traditional in-class approach. Also, regarding to the number of teaching hours associated to each ECTS credit, the accreditation process revealed different workload per ECTS. Table 2 shows the course mode used in the different countries and the number of training hours associated to them.

Table 2. Training Modes

Country	Mode of study	Course Mode	Number of training hours	ECTS Credits
SPAIN (ES)	Full Time	Face-to-face	100	10
IRELAND (IR)	Part Time	Semi-online	45 contact (face + online lecture + webinar), 155 self directed. 200 total.	10
ROMANIA (RO)	Part Time	Face-to-face	100	10
GREECE (EL)	Full Time	Face-to-face	50+50 (distant)	10
CYPRUS (CY)	Full Time	Face-to-face and provide lectures/notes on the web.	-	10
FYR OF MACEDONIA (MK)	Full Time	Face to face with blended learning	250	12
UNITED KINGDOM (GB)	Part Time	Face-to-face/Online/Coursework	200	10 (20 UK credits)
BELGIUM (BE)	Full Time	Face-to-face	120	10
GERMANY (DE)	Part Time	Face-to-face/Online/Coursework	300	10
DENMARK (DK)	Full Time	Face-to-face + online lessons and materials + practical NZEB projects (exam projects)	120	10

Source: Peñalvo-López, E. (2017)

At the end of each course edition, a formal assessment was arranged to evaluate whether the participants met the desired learning outcomes. Each university decided the most appropriate evaluation method for their academic programme, such as an exam and/or a final project, to assess learning results.

Furthermore, the effectiveness of each educational program was also evaluated in the final day of the training course by means of a common questionnaire developed among all partners (universities and market players). This allowed collecting participants' comments and assessment of the courses for improving next edition. Results of this analysis are the objective of the next section.

1.2. Front Meeting of Skills (FMS)

Front Meeting of Skills is the action providing the international approach to the educational framework. It is a novel education and training activity carried out across four different countries UK, Cyprus, Belgium and Germany with the participation of professionals from all around Europe. The FMS is structured as 3-4 days intensive course with specific learning outcomes and ECTS awarding. The training consists on activities addressed to professionals of the building sector, mainly engineers, and architects. Main objective is built upon certain case studies, which the participants are requested to study and then propose measures and strategies in order to transform them into NZEB buildings.

FMS training activity was a short-duration training courses, focused on hands-on and case-study analysis (Pacheco-Torgal, 2014). In fact, the strategy of the FMS was creating a learning experience with international interaction and discussion on a series of shining case studies on NZEB retrofit.

1.3. E-learning Platform

The third and last pillar of MENs' educational framework is the e-learning platform, which resides inside the project's official portal.

The platform is designed to be a virtual innovation park promoting distance learning throughout a series of webinars and a NZEB repository, together with a connection database among stakeholders. By encouraging the high number of participants from the national courses and the FMSs to enrol in the platform, the goal is to gradually build a community of professionals that will even learn from each other, a type of informal learning procedure.

MENs platform is conceptualized to work together with the well-established Build Up web portal (Pacheco-Torgal, 2014). It does not just contain information and best practices from the national courses and the FMS. The long-term aim is to become a place where European professionals and stakeholders meet and learn about case studies, indicators, innovative technologies and policies towards NZEB transformation of the building stock. Eventually, the interaction of the platform with the other two pillars is expected to contribute to removing the barriers challenging the smooth transition toward NZEB.

Moreover, MENs's platform is the main instrument for communication and dissemination purposes. Apart from including all communication outputs (e.g. videos, webinars, interviews, etc), it acts as a liaison with the project social media (facebook, twitter,etc).

2. Evaluation and Results of MENs Courses

As mentioned in previous section, three editions of the accredited NZEB 10 ECTS courses were offered by each of the 10 participant universities. Thus, a total of 30 NZEB courses were offered during 2016 and 2017 across Europe, training 1168 professionals in NZEB design and renewable energy integration along 5527 training hours. Participant countries

were Spain, Greece, Cyprus, Romania, FYR of Macedonia, United Kingdom, Ireland, Belgium, Denmark, and Germany, by means of their universities (see Table 3).

Table 3. Universities participating in MEnS's Project

Country	University	Website
SPAIN (ES)	Universitat Politècnica de València / Institute for Energy Engineering (IIE-UPV)	www.cfp.upv.es
IRELAND (IR)	Dublin Institute of Technology	www.dit.ie/architecture/mens/
ROMANIA (RO)	Technical University of Cluj-Napoca	users.utcluj.ro/~lcmn
GREECE (EL)	Aristotle University of Thessaloniki / Electrical and Computer Engineering Department (ECE-AUTH)	www.power.ee.auth.gr
CYPRUS (CY)	University of Cyprus	www.pvtechnology.ucy.ac.cy
FYR OF MACEDONIA (MK)	Ss. Cyril and Methodius University in Skopje / Faculty of Electrical Engineering and Information Technologies	www.mens-nzeb.eu
UNITED KINGDOM (GB)	Brunel University London	www.brunel.ac.uk/energy-futures/themes/resource-efficient-future-cities
BELGIUM (BE)	Université Libre de Bruxelles	http://atm.ulb.ac.be and also http://formcont.ulb.ac.be
GERMANY (DE)	Universität Kassel	www.zub-kassel.de/weiterbildung
DENMARK (DK)	EC Network /Aarhus University	www.ecnetwork.dk , http://ase.au.dk/

Source: Own development

During this section, it is presented the participation results per university. Figures below show the aggregated data of the three MEnS editions carried out at the different universities. Over the duration of the project a total of 1168 building professional were upskilled across the 10th universities (see Fig. 1). Main course demand was in observed in Romania, Greece, FYR of Macedonia and Spain, while countries like Denmark or Belgium didn't have as many professionals interested in upskilling their NZEB capabilities. This is mainly because unemployment is relatively low in these countries and currently the construction sector is very busy. Moreover an optimum number of participants of 10 - 15 persons would also be considered recommended to base the courses on a participatory approach.

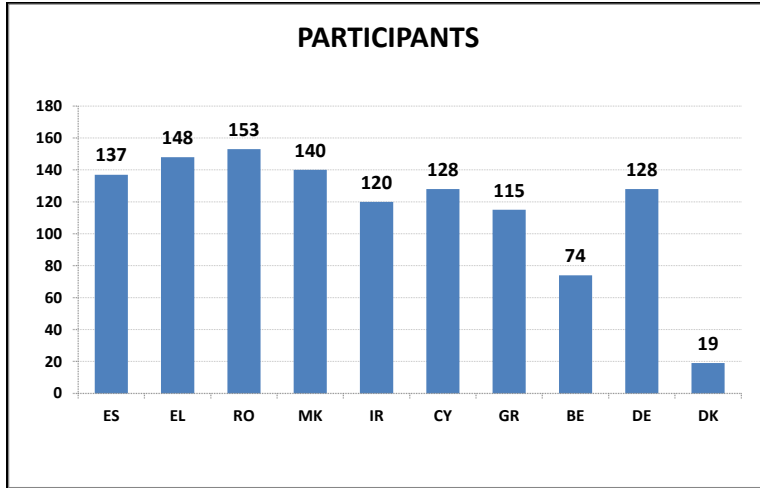


Figure 1. Number of participants per country at the three editions

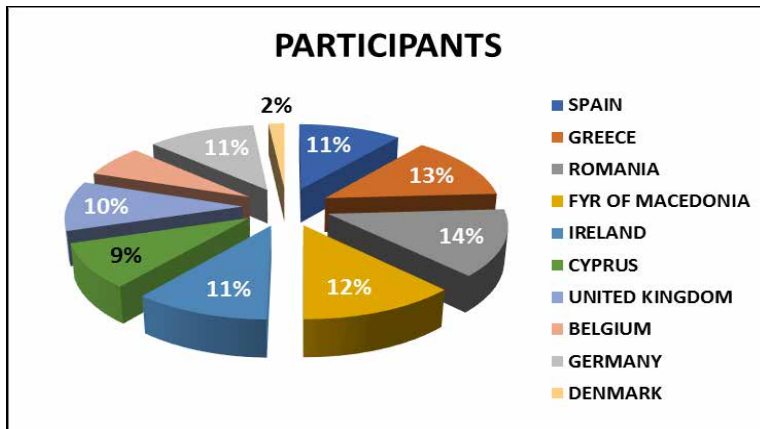


Figure 2. Percentage of participants per country

Regarding the professions of the participants, results show that main interest was identified within architectural and engineering disciplines, mainly Electrical and Civil/Structure engineers. Nevertheless, other professionals related to the construction sector, such as building and facility managers have also started to pay attention to the Nearly Zero Energy Building concept and the benefits associated to minimising energy consumption and increasing the contribution of renewable energy sources.

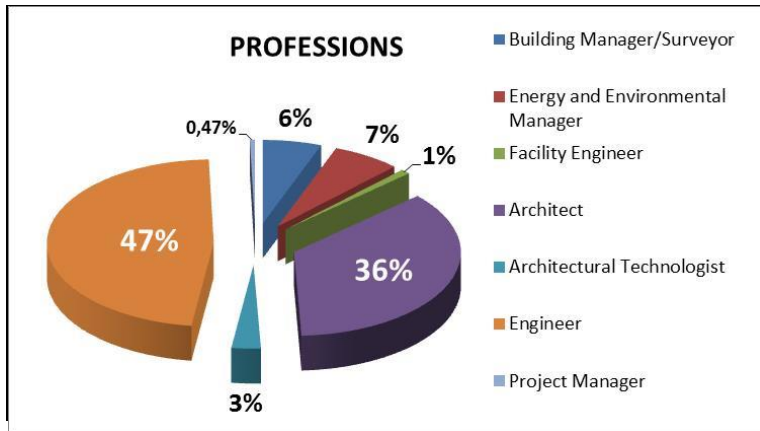


Figure 3. Type of professions in MEnS courses

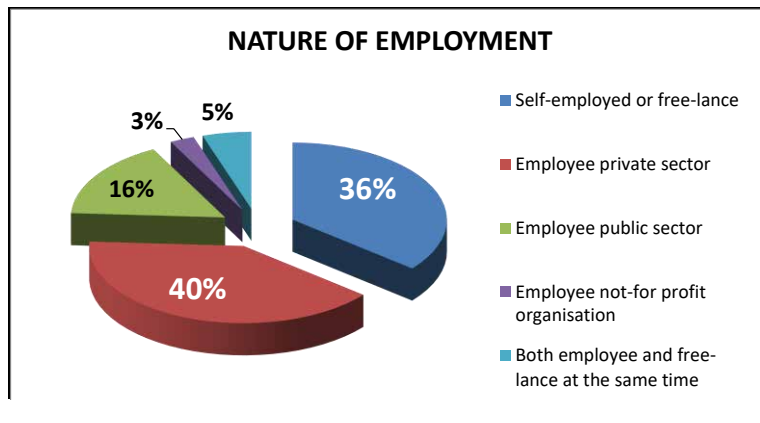


Figure 4. Nature of employment of participants

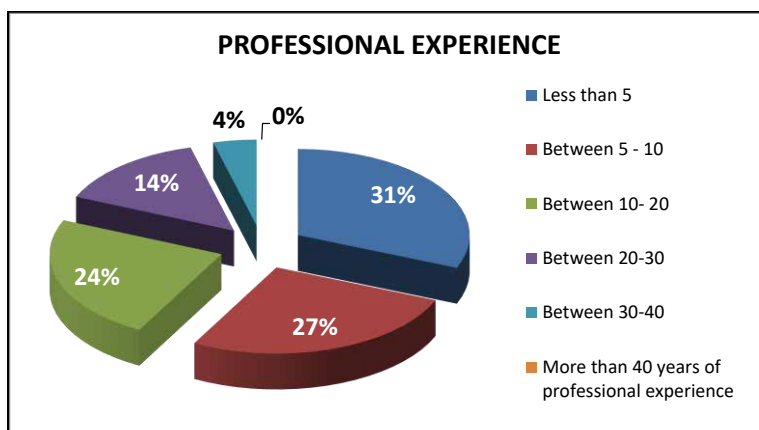


Figure 5. Professional experience of participants

Analysing the nature of the employment, the professional experience and unemployment rate, it was observed that the majority of the participants were employed by the private sector or self-employed/freelance with less than 10 years of experience. This is because one of the specific objectives of MEnS project was to focus on the unemployed community, upskilling their NZEB competences so they could have a better chance to find a job. In fact an unemployment rate of 34% was calculated among the 1168 trained professionals.

As shown in figure 6, higher unemployment rate was identified in Spain, where 91 participants were actively searching for a job. Other countries with significant percentage of unemployed professionals participating in the courses were Cyprus and United Kingdom, mainly because participants were graduate students finalising their post-graduate programmes. On the counterpart, courses organised in Germany, Ireland and Romania included experienced professionals actively involved in the market.

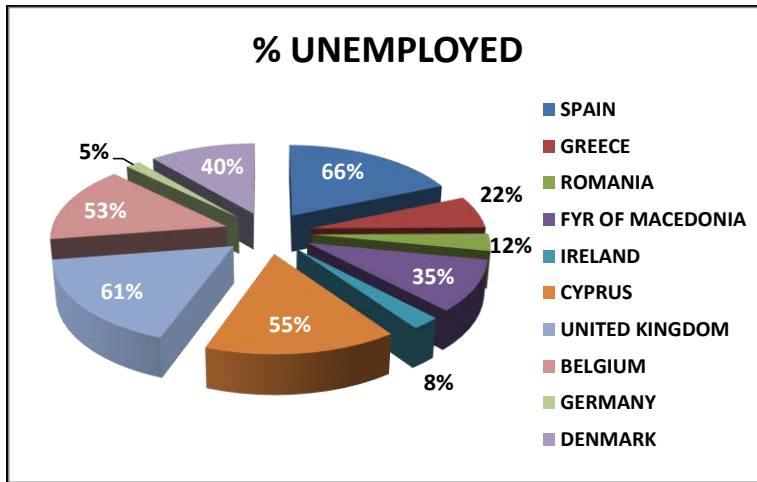


Figure 6. Percentage of unemployed professionals in each country

Another important target within MEnS project was increasing the capabilities of women in NZEB disciplines. In this regard, an important effort was made to involve women participation in the courses. As observed in figure 7, a total of 543 female building professionals were trained, mainly in Greece, FYR of Macedonia, Germany and Spain, which represented a percentage of 55%, 55%, 52%, and 47%, respectively.

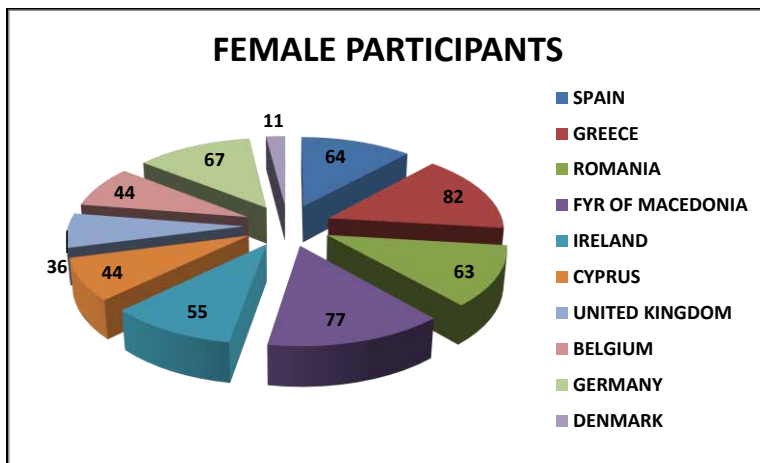


Figure 7. Female participants in each country

3. Conclusions

This paper presents a novel educational program on Nearly Zero Energy Buildings (NZEB) carried out within MEnS H2020 project (www.mens-nzeb.eu), which is based on three main activities: an EQF Level 7 Educational Program of 10 ECTS, a 3-4 days course based on hands-on and case analysis approach, and an e-learning platform promoting distance learning throughout a series of webinars and NZEB repository.

The paper focuses on the participation results obtained within the first educational experience: the EQF Level 7 Educational Program in Nearly Zero Energy Buildings. This educational program aimed upgrading NZEB skills and qualifications of European energy and building professionals with bachelor degree, while enhancing the participation of women and unemployed professionals.

As a result, 1168 building professionals were trained along 5527 hours, mainly architects and engineers with less than 10 years of experience. The specific target of enhancing the participation of women and unemployed professionals looking for new professional opportunities received a significant interest within the professional community and was widely tackled during the project.

4. Acknowledgments

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Empowering women participation in Europe's energy transition through the deployment of Nearly Zero Energy Buildings

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Abstract

In 2010 the Recast of the Energy Performance Building Directive (EPBD) introduced the requirement for all Member States to include the concept of Nearly Zero Energy Buildings (NZEB) in their national plans. Intermediate milestones were defined focused on increasing energy efficiency in new buildings. These aimed to encourage new buildings after 31 December 2020 and new buildings occupied and owned by public authorities after 31 December 2018 to be nearly zero energy.

However, this challenge requires upgrading building professional skills in NZEB concepts and strategies, thus guaranteeing the maximum impact on NZEB deployment around Europe. This is the objective of MEnS (“Meeting Energy Professional Skills”), a H2020 project focused on providing high quality upskilling and education to architects, engineers, and building professionals, so the construction industry is capable of delivering NZEB renovations with innovative technologies.

In this context, women professional, especially those who are mums, are very conscious of sustainable development as the future for their children. However, their participation in construction industry is not very notorious. The role of women in the NZEB industry indicates that female participation in the building industry is still low. The need to rebalance this gender gap is highlighted in this work, through the identification of female programs and schemes.

In addition, the results of women participation in MEnS project is analysed, which has created and implemented a new education and training program training 1200 building managers (engineers, architects) in NZEB design and construction, out of which 50% were women.

This paper describes the participation of women in this educational program and analyses initial conclusions and lessons learnt derived from this initiative in 10 European countries including Spain.

Keywords: *Training with accreditation for building managers, architects and engineers; NZEB; women in building environment; employability; educational integrated approach; H2020 European project.*

Resumen

En 2010 la refundición de la Directiva sobre eficiencia energética en edificios (EPBD) introdujo el requisito para todos los Estados Miembros de incluir el concepto de edificios de energía casi nulo (NZEB) en sus planes nacionales, cuyo objetivo es aumentar significativamente la eficiencia energética en los nuevos edificios. Dentro de la directiva se expone como objetivo para los Estados Miembros que todos los edificios de nueva construcción sean NZEB a partir del 31 de diciembre de 2020, reduciéndose al 2018 los edificios ocupados por administraciones públicas.

Sin embargo, este desafío requiere mejorar las habilidades profesionales en conceptos y estrategias NZEB, garantizando así el máximo impacto en el despliegue de NZEB en toda Europa. Este es el objetivo de MEnS ("Meeting Energy Professional Skills"), un proyecto H2020 enfocado a proveer una educación de alta calidad a arquitectos, ingenieros y profesionales de la construcción, con el fin de que la industria de la construcción pueda llevar a cabo renovaciones NZEB con tecnologías innovadoras.

Dentro de este contexto, las mujeres profesionales, especialmente aquellas que son madres, están muy concienciadas con la sostenibilidad en el futuro de sus hijos. Sin embargo, su participación en la industria de la construcción no es muy notoria. El papel de las mujeres en la industria NZEB indica que la participación femenina en el sector de la construcción sigue siendo baja. La necesidad de reducir esta brecha de género se destaca en este trabajo, a través de la identificación de programas y esquemas de apoyo a la igualdad.

Además, se analizan los resultados de la participación de las mujeres en el proyecto MEnS, donde se ha creado e implementado un nuevo programa de educación y capacitación a 1200 profesionales de la construcción (ingenieros, arquitectos) en el diseño NZEB, de las cuales el 50% eran mujeres

Este artículo describe la participación de las mujeres en este programa educativo y analiza los resultados iniciales y las lecciones aprendidas de esta iniciativa que se ha llevado a cabo en 10 países europeos, incluyendo España.

Palabras clave: *Capacitación con acreditación para profesionales de la construcción, arquitectos e ingenieros; NZEB; las mujeres en el sector de la*

construcción; empleabilidad; programa educativo; Proyecto europeo del H2020.

Introduction

From a historical perspective, female presence in Architecture and Engineering studies has rapidly evolved in the Spanish Universities and marketplace since 60's to the 90's. Women presence has increased from 2% in 1969 to 29% in 2013 (Sánchez de Madariaga, 2014). Despite the fact that today the majority of university alumni are women and they finish their studies with better average grades than their male counterparts, there are certain disciplines that are still resistant to female participation. Such is the case of engineering and some experimental sciences where less than 30% are women.

Female presence in Engineering in Spain is still one of the lowest feminine representations within the Spanish Higher Education. At the University level, in the 2003/04 edition, only 28.1% of the students in the Spanish technical curricula were females, however statistical tendency shows an increment in the last five years, almost 33% of graduates are women. Although female presence in engineering careers is approximately one third, the rate of abandonment before graduation is higher among men than among women.

Distribution of women among different technical fields is also evident, agronomic engineering are close to parity, forestry is slightly over 31%, while architecture and building engineering is rapidly increasing up to 60 and 37%, respectively, which denotes the interest of women in the building sector. In the majority of the remaining technical schools the percentage of women among new students lies somewhere between 23 and 30%, except for computer sciences, which has an extremely low participation of women (11%) (Sánchez de Madariaga, 2014).

Regarding university researchers/professors, from 2003 to 2013 the situation of this group shows a slow increase in the participation of women in the different professional categories of university professors. Women among Grade A professors, equivalent to Catedráticas de Universidad, has increased from 5.6% in 2003 to 11.95% in 2013, while in Grade B positions the increment is less significant, only 2 points for the decade, from 25.20% to 27.7% (Baldassarri, 2007).

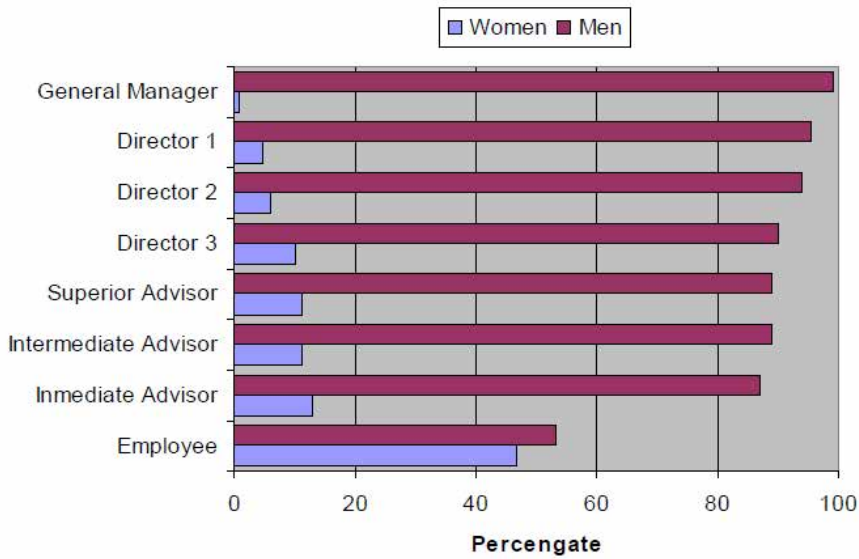


Figure 1. Male and female employment in companies in Spain. Source: [1, 2]

In the labour market, there is a rate of unemployment of approximately 7% in the case of males and of a 29% in the case of female engineers (Sánchez de Madariaga, 2014) (Baldassarri, 2007). Among the employed, the presence of men is significantly higher in Universities and especially in companies. Oddly, there are more women than men dedicated to research activities in non-profit private institutions. In 2012, 89% of employed women work in the services sector, in contrast with the 8% in industry and 2% in agriculture. Thus, it becomes evident that industry and business is still a male world. This situation occurs at all levels, but it is in the highest professional scales where the female presence decays becomes alarming. Female percentage in Executive Manager job positions is always below the 10%, while it is 0.9% in the General Manager category, as shown in Figure 1.

Despite the differences in men and women employment, many Spanish universities are showing a positive trend, promoting “girl’s day” and other initiatives to enhance the participation of women in technical degrees. Similarly, private organisations are slowly incorporating new gender equality policies, such as “Gender Equality Plans in the workplace” (Baldassarri, 2007) (INE, 2015).

1. Existing activities and schemes for the promotion of female engineers and building professionals

Many of the activities, schemes and organizations in Spain for the promotion of females in the engineering and building industry are international. Next, it is provided the national and international organisations accessible for Spanish women engineers.

- **MUCIT – Asociación de Mujeres Científicas y Técnicas (Association for Scientific and Technical Woman).** It is a regional association raising awareness and encouraging open debate on topics relating women, science and technology, persuading society that is not a problem specific to women but regards the whole humanity (MUCIT, 2016).
- **AMIT - Asociación de Mujeres Investigadoras y Tecnólogas (Association for Woman in Research and Technology).** It is a non-profit and inclusive association aiming to be the voice and support network for all researchers and university in order to achieve the full participation of women in research and science (AMIT, 2001)].
- **IEEE Women in Engineering (WIE) - Spain.** It is an affinity group within the IEEE, the largest professional organization in the world with over 300,000 members. WIE Spain is the Spanish Chapter, responsible for organizing and coordinating the activities of WIE in Spain (WiSET, 2015). IEEE – Women in Engineering IEEE Women in Engineering (WIE) is the largest international professional organization to promote women engineers and scientists and inspire girls around the world to follow their academic interests to a career in engineering. They are active on a global level, but do have local activities in Spain as well (WIE-Spain, 2015) (IEEE Women, 2015).
- **WiSET – Women in Science, Engineering and Technology.** The main aim of the WiSET network is to widen the participation women in science, technology, engineering, maths and the built environment. They have developed and delivered a wide range of innovative projects, and activities based on gender and occupational segregation at all levels of education and employment (WiSET, 2015).
- **Women in Engineering Society.** The Women in Engineering initiative aims to redress the gender imbalance of the discipline. Raising the profile of talented female engineers and widening the general understanding of engineering through events are key targets of the programme (University of Sheffield, 2015).
- **IET Women’s Network.** The IET Women's Network is set up in order to engage with the under-represented groups within engineering and technology, that women engineers are, and support them throughout their career (IET, 2015).
- **Athena Swan Charter.** ECU’s Athena SWAN Charter was established in 2005 to encourage the enhancing of the careers of women in science, technology, engineering,

maths and medicine (STEMM) employment in higher education and research (Athena Swan Charter, 2015).

2. European Initiative in NZEB – MEnS H2020 Project

The European Commission identified and promoted the need to focus on improving energy performance of E.U.'s building stock in 2000, as a mean of reaching 2020 and 2030 energy efficiency targets. Following this, in 2010 it was published a Recast of the Energy Performance Building Directive introducing the concept of Nearly Zero Energy Buildings (NZEB) into the E.U. legislation, which obliges all new buildings to be NZEB from 2020 and public building from 2018 (EUR-Lex, 2010) (Spanish Ministry of Development, 2014). Responding to this challenge, construction industry needs to be able to deliver renovations leading to new NZEBs, using innovative technologies. To do so, it is also important that training actors effectively provide high quality upskilling and education to architects, engineers and building professionals.

In the above context, a series of different Horizon 2020 projects were promoted under the "Construction Skills" funding scheme. One of these projects is Meeting of Energy Skills (MEnS), which will run until August 2017 (MENS, 2017) (Peñalvo-López, 2017).

Main challenges of MEnS are:

- increasing the knowledge and skills of at least 1200 building managers (engineers, architects) in NZEB design and construction, out of which 50% would be women or unemployed.
- creating and implementing a new education and training program for such professionals in 10 countries, under the European Qualifications Framework provisions and based on desired and common learning outcomes of Level 7.
- creating and implementing an innovative, interdisciplinary education and training program with an integrated approach, focusing on real case studies
- accrediting courses using the formal procedure in each country and assign ECTS credits.
- enhancing and support the development of a professional network in Europe specifically focused on retrofitting of housing stocks towards NZEB.
- providing working opportunities to unemployed professionals, by bringing them closer to possible employers and improving their qualifications, at a percentage of 30% of those attending.
- continuing the education and training courses for at least 5 years after the end of the project based on concrete sustainability plans agreed by University partners.

These specific challenges are addressed by upgrading and upskilling building professionals throughout a novel and accredited educational programme, based on three main training experiences:

- a) An EQF level 7 educational program for building professionals organized in 10 European Universities with a common structure, learning outcomes and accredited with a total of 10 ECTS. This educational program is structured in three editions in order to continuously improve it based on trainers and trainees feedback.

- b) A unique training experience, termed “Front Meeting of Skills (FMS)”, based on experiences from real case studies, which aims to become an open lab for integrated design towards NZEB solutions in housing stock, a think tank of discussion and interactions between involved actors.
- c) An e-learning platform, in the form of an interactive space portal that promotes distant learning and encourages real debate of stakeholders in the drive to adopt NZEB in transforming the current building stock.

Summarising, MEnS is a H2020 European project conceived to enhance NZEB skills of building managers, such as engineers and architects, through a series of accredited training activities developed by 10 universities and 3 market players. In addition, MEnS pays special attention to the integration of female professionals in the construction market by upskilling their capabilities in NZEB.

3. Female participation in NZEB courses across Europe

The EQF level 7 educational programme involved the organisation of 3 editions of the academic courses per university. Along these 3 editions, the 10 participant universities have trained a total of 1162 building professionals during 5407 training hours.

Female presence was very meaningful in all editions; a total of 540 trainees were women, which represented a 46% of total building professionals involved in the long training courses offered by the universities (Figure 2).

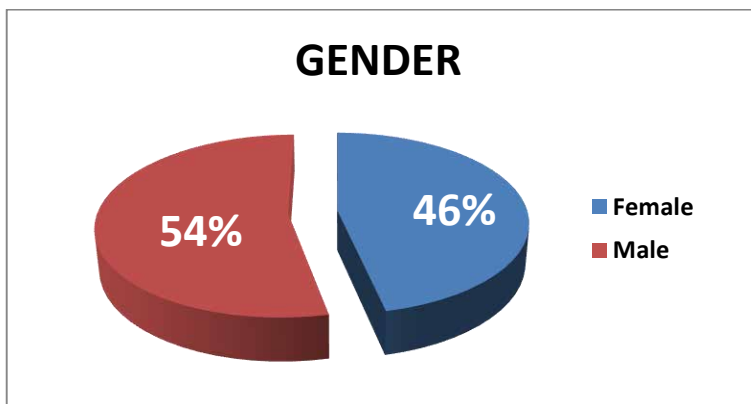


Figure 2. Male and female participation in MEnS training courses.

Main women participation was observed in the courses carried out at the Université Libre de Bruxelles (ULB) in Belgium, being 59% of total participants. Nevertheless, Aristotle University of Thessaloniki in Greece was the University training more female professionals, concretely 82 out of 148 participants (55%). Followed universities with female participation over 50% in the courses included Ss. Cyril and Methodius University in Skopje (FYR of

Macedonia) with 77 out of 140 and Universität Kassel (Germany) with 67 out of 128, corresponding to 55% and 52%, respectively.

Lowest women participation was observed at Brunel University London (United Kingdom) and EC Network in collaboration with Aarhus University (Denmark), which registered just 36 out of 115 (31%) and 8 out of 19 (42%) participants, respectively (see Figure 3 & 4).

In the case of Spain, Universitat Politècnica de València throughout the Institute for Energy Engineering trained a total of 64 women out of 137 professionals, which represented an involvement of 46% total female building professionals (see Table 1).

Table 1. Number of participants per university

Country	University	Course Participants	Number of women	% female
SPAIN (ES)	Universitat Politècnica de València / Institute for Energy Engineering (IIE-UPV)	137	64	47 %
IRELAND (IR)	Dublin School of Architecture	120	55	46 %
ROMANIA (RO)	Technical University of Cluj-Napoca	153	63	41 %
GREECE (EL)	Aristotle University of Thessaloniki / Power Systems Laboratory	148	82	55 %
CYPRUS (CY)	University of Cyprus	128	44	34 %
FYR OF MACEDONIA (MK)	Ss. Cyril and Methodius University in Skopje	140	77	55 %
UNITED KINGDOM (GB)	Brunel University London	115	36	31 %
BELGIUM (BE)	Université libre de Bruxelles	74	44	59 %
GERMANY (DE)	Universitaet Kassel	128	67	52 %
DENMARK (DK)	Aarhus University	19	8	42 %

Source: Peñalvo-López, E. (2017)

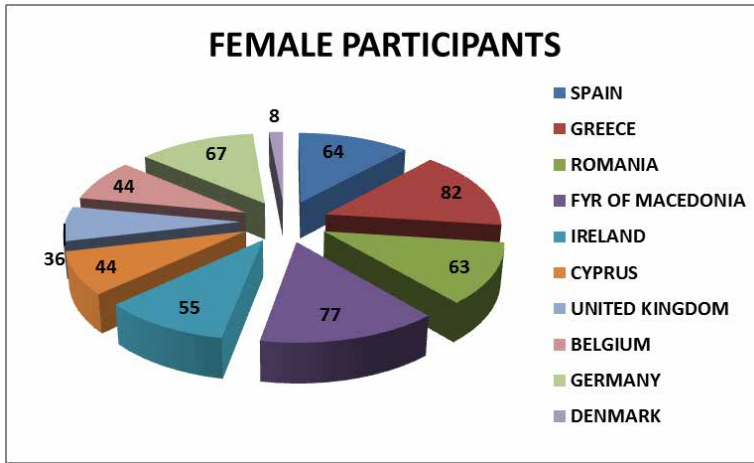


Figure 3. Number of male and female participants per country.

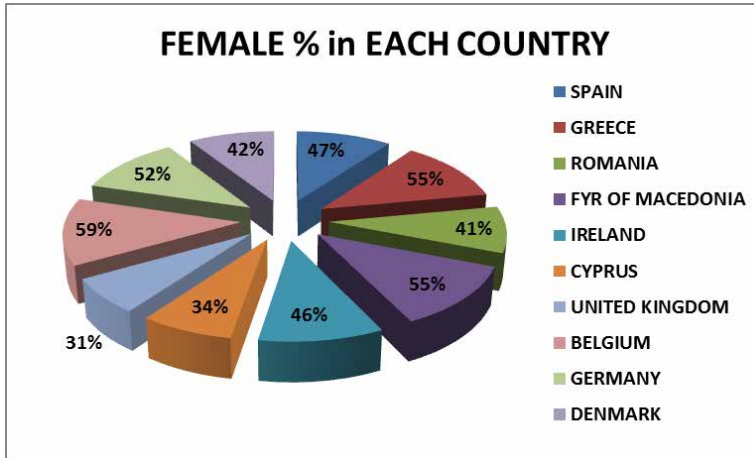


Figure 4. Percentage of participation of female building professionals per country.

4. Conclusions

Women participation in engineering and architect disciplines is rapidly increasing, which denotes the interest of female professionals in the building sector. However, it still lacks women visibility in high professional positions within the organisations, such as executive management position or research institute directors. In this regard, there exists many different organisation supporting and promoting women contribution to engineering and technology areas through association and networking.

MEoS, Meeting of Energy Skills is a H2020 European project aiming to upskill building professionals in NZEB concept, design and strategies, specially promoting female participation in the different academic experiences. Response of women professionals in the construction sector was very positive in the 10 ECTS educational activity; 540 female building professionals out of 1162 participants were upskilled along 5407 training hours. Main female participation was accounted at the Aristotle University of Thessaloniki (Greece), Ss. Cyril and Methodius University in Skopje (FYR of Macedonia) and Universität Kassel (Germany) with 82 out of 148 (55%), 77 out of 140 (55%), and 67 out of 128 (52%), respectively. In the case of Universitat Politècnica de València, the Institute for Energy Engineering trained a total of 64 female building professionals out of 137, which represented an involvement of 46% total participants.

5. Acknowledgments

This initiative responds to a common effort between 10 European universities and 3 market players, funded by the “Meeting of Energy Skills (MEoS)” Horizon 2020 project (Ref. 649773). The work was completed by the *Institute for Energy Engineering* located at the *Universitat Politècnica de València*. The authors deeply thanks the *Universitat Politècnica de Valencia* and all the organizations involved in this projects for their support and, specially, to the European Commission for their funding provision.

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Using computer applications for training and assessing the generic competence “effective communication”

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Abstract

The new study programs at the Universitat Politècnica de València include the assessment of a set of generic (transversal) and specific competences. These competences are to be assessed in order to certify their development and achievement in the students. The assessment of generic competences is relatively new and still demands the development of new activities, tools and procedures that allows assessing the achieved degree of development by students.

In this context, after the completion of two innovative education projects to assess the degree of achievement of two generic competences in the last years, it was observed the need to introduce mechanisms to improve the utility of assessment instruments. This paper presents the introduction of computer applications for training and improving the understanding of the “effective communication” competence by students. The developed approach is being applied in during this academic year with the purpose of analyzing its impact and its further development and implementation in other courses.

Keywords: *Higher Education, effective communication, generic competence, computer applications.*

Introduction

González and Wagenaar (2003) indicate that “*specific competences are those skills related to the specific domain of knowledge while generic or transversal competences are those skills related to personal development that do not depend on a thematic or specific scope but they appear in all the domains of the professional and academic activity*”. Generic competences include, for example, the capability to learn, the capability to communicate, the capability of decision-making, etc.

In the design of the new study programs at the Universitat Politècnica de València (UPV), thirteen generic competences were selected to be assessed in the curricula of all the official programs (both undergraduate and graduate studies). These thirteen competences include (UPV, 2017): effective communication, critical thinking, design and project, team work and

leadership, time planning and management, etc. Once the generic competences were introduced in the programs, the main issue was to develop a systematic procedure to assess the progress and learning outcomes of the students. This is a key step because instructors are experts in assessing specific competencies however they need new tools and procedures to assess the degree of achievement of generic competences due to their different nature and lack of expertise in their assessment. In order to address this challenge, different proposals have been developed at Universities. In this line, the UPV developed a institutional project called “UPV transversal competences” for addressing the overall project definition and execution of the assessment of generic competences in the different degrees provided.

At the operational level, in coherence with the general UPV institutional project, different innovative educational research projects have been developed at UPV to define, propose and implement tools and instruments for guiding the assessment of generic competences. Two of these projects were developed by the authors of the present work who conform the Idomei Educational Innovation Group (EICE) at UPV. These two projects were “Assessment and follow-up of the UPV competence “effective communication” in master degree” during the academic year 2014-1015 (Verdecho et al., 2015) and “Assessment of the transversal UPV competence “analysis and problem solving” in master students” during the academic year 2015-2016 (Verdecho et al., 2017). Similar approaches had been developed to solve this issue by other authors, instructors and Universities such as the works developed by Jonsson and Svingby (2007), Villa and Poblete (2007), AQSUC (2009), Blanco et al. (2009), García-García et al. (2009), Rodríguez-Gómez (2009), Ibarra (2010), Alsina (2013) and Sonseca et al. (2015).

The objective of the two previous innovative educational research projects was the development of assessment tools for assessing generic competences at master level so that students knew the assessment indicators of the competences and could focus their efforts on their development and improvement. After the completion of the two projects, it was observed the absence of mechanisms to improve the tool utility. Then, the objectives of the new project were to enhance the student’s understanding of effective communication and aid to collect evidences in quality and number. In order to achieve these objectives, it was proposed to implement mechanisms for these tools using software applications. In addition, it was defined another important objective: assigning students an active role in the assessment process. For that purpose, it was necessary to engage students by using participatory procedures (self-assesment, peer-assessment and/or co-assessment procedures) in order to increase their motivation and performance (Dochy et al., 1999).

This paper is structured as follows. In the next section, the methodology developed to deploy the research project is presented. Then, the following sections show the specific phases of the methodology: learning outcomes of the competence, redefinition of indicators, assessment procedures, decomposition of indicators to assess the competence, design of

learning activities, implementation of the assessment tools and, pilot applications and feedback. Finally, conclusions of the paper are exposed.

1. Methodology

Figure 1 shows the different phases of the developed methodology in the educational innovation project. The methodology comprises seven phases (Fig. 1):

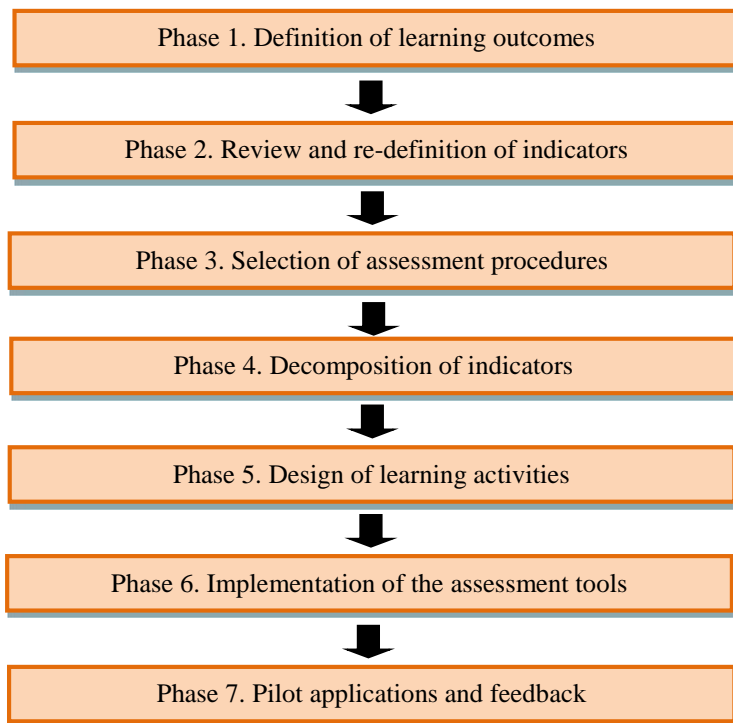


Figure 1. Methodology of seven phases

2. Definition of learning outcomes

Villa and Poblete (2007) define oral communication competence as “*expressing with clarity and opportunity the ideas, knowledge and feelings by using words, adapting them to the characteristics of the situation and the audience to achieve its understanding and adhesion*”. Thus, this competence comprises different types of skills:

- Communication of ideas, approaches and solutions.
- Use of projection tools and graphical resources
- Knowledge of the audience

In order to develop this competence, the student should have a certain degree of self-confidence and self-esteem as well as being able to adapt to the environment in order to communicate effectively with the audience.

In the “UPV transversal competences” institutional project, different learning outcomes for every transversal competence were defined depending on the academic year of the studies. Three levels were established. The first level comprises the first and second year of the degree. The second level comprises the third and fourth year of the degree. Finally, the third level corresponds to master/graduate studies. Thus, the three levels correspond to three levels of increasing requirements on the development of the transversal competence as the degree of development of the generic competence has to increase when moving to a higher level of study. Then, three levels of domain for every transversal competence were defined. The learning outcome for the oral communication competence at master level (level III) is *“to be persuasive in the discourse, adapting the message and the means to the characteristics of the situation and the audience in presentations of long duration, with possible debate”* (Bravo et al., 2015).

3. Review and re-definition of indicators

As a result of the project “Assessment and follow-up of the UPV competence ‘effective communication’ in master degree” during the academic year 2014-1015, an assessment tool was developed to assess the degree of development of oral communication in students as shown in Verdecho et al. (2015). The indicators defined in this tool and the learning outcome in section 3 were taken as input of the new project. The indicators of the tool were reviewed and re-defined for adapting the tool to the new requirements of the new project.

4. Selection of assessment procedures

In order to provide a participatory role to students in the assessment process, it was necessary to introduce active assessment procedures in the project. The main idea was firstly to train students in the understanding of the oral communication competence and then, assess how well they perform in applying that knowledge into practice. The project will be based on two active assessment procedures:

- Self-assessment to train the students in the comprehension of the oral communication competence
- Co-assessment: peer and instructor jointly assess oral communication of students in class.

5. Decomposition of indicators

In this project, students have to perform co-assessment activities. The indicators to use in the assessment should comply with being meaningful, clear, concise and, easy to understand and assess. Thus, all the indicators were decomposed further and collected into one questionnaire. The questionnaire is structured in four parts: material (six questions), exposition (six questions), non verbal communication (five questions) and time (one question). Every question has three (mutually exclusive) answers. Also, an explanation of the question and

answers is provided for its easy understanding by students. Fig. 2 shows an excerpt of the questionnaire showing one indicator/question, answers and corresponding explanation for the Part 1 (Material) of the questionnaire.

<p>PART 1: MATERIAL</p> <p><i>Part 1 comprises a set of questions regarding oral presentation support material (usually a Powerpoint presentation).</i></p> <p>1 The presentation, as it is structured, aids to the audience not to get lost.</p> <p>1.1 No</p> <p>1.2 Initially, the presentation shows an outline with the sections. However, during the presentation, the audience does not know the specific section treated.</p> <p>1.3 Yes</p> <div style="border: 1px solid black; padding: 5px;"><p>Explanation: The material in the presentation must be structured to facilitate and support the oral discourse. The structure is shown by an initial outline that organizes the content in parts as well as the identification of each slide to the part to which it belongs (part bookmark).</p><p>The possible answers are:</p><ul style="list-style-type: none">- NO (if the material does not present initial outline and part bookmark);- INITIALLY THE PRESENTATION SHOWS AN OUTLINE WITH THE SECTIONS. HOWEVER, DURING THE PRESENTATION, THE AUDIENCE DOES NOT KNOW THE SPECIFIC SECTION TREATED (the material has initial outline but the rest of slides do not have part bookmark);- YES (the material presents initial outline and part bookmark in each slide).</div>

Figure 2. Questionnaire excerpt

6. Design of learning activities for formative assessment of the competence

In order to develop the oral communication competence through a formative assessment, students have to perform three consecutive activities (Fig. 3): 1. Theoretical understanding of the competence, 2. Practical understanding of the competence; and 3. Practical and real application of the competence. The figure shows the three activities as well as what is the objective of each activity and how is to be reached.

6.1. Theoretical understanding of the Competence

In the first place, instructors explain the fundamentals of the oral communication competence in class. For that purpose, they have developed a tool composed of a competence description and the questionnaire (see section 6) to assess the different indicators of the competence. This tool is available in the e-learning platform for students. Instructors explain the tool in class in order to clarify any doubt (if necessary).

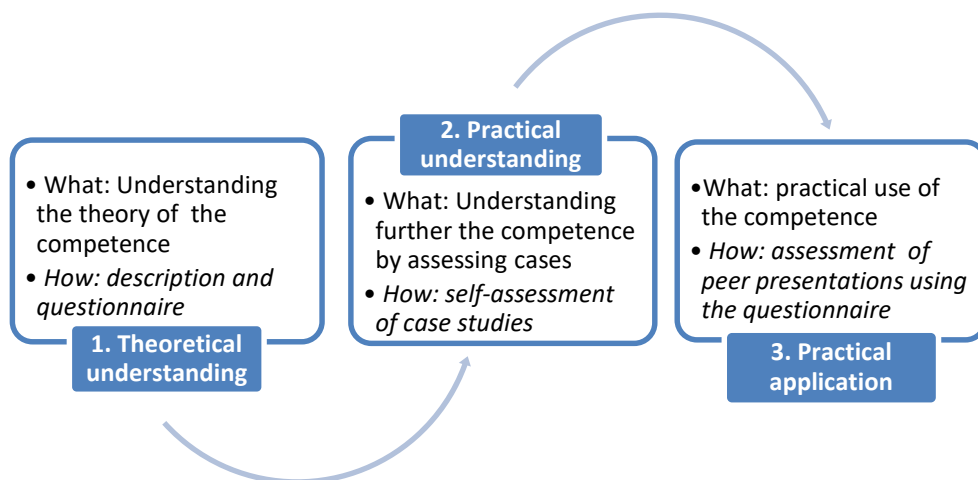


Figure 3. Formative assessment of the competence

6.2. Practical understanding of the Competence

In the second place, instructors have developed a set of cases of oral presentations developed in video technology. Thus, students can visualize the videos (one video per case), and then, complete a questionnaire to assess each oral presentation by themselves. After completing the self-assessment of the oral presentations, they can check the valid response of the questionnaire and compare their results. If they are not sure of some responses, they can visualize the videos and fill-in the questionnaires as many times as they need. The idea is to support their formative assessment.

6.3. Practical real application of the competence

In the third place, once the students have gained a deeper understanding of the oral communication competence scope, assessment indicators and have taken it into practice assessing oral presentation cases; they are ready to assess real-time oral presentations. The oral presentations are performed by their peers in class. In fact, this activity is composed of two subactivities in the co-assessment: performing oral presentations and peer assessment. This means that each student will have to perform an oral presentation in class and this presentation will be assessed by both students and instructor by using the questionnaire.

1. The instructor assessment will provide the mark for the student presenting the oral exposition. For that purpose, the whole questionnaire will be used.
2. The peer assessment is used to assess the own knowledge acquisition of the student assessing the competence and it is estimated by comparing his/her assessment to the instructor's assessment. In this case, the peer assessment will be done only using some questions of the questionnaire.

7. Implementing the assessment tools

In order to implement the different tools at UPV, different UPV technologies have been used.

7.1. Theoretical understanding of the Competence

For this activity, a document was developed describing the fundamentals of the competence and showing the complete questionnaire with the possible answers and explanations. This document was uploaded to the UPV platform PoliformaT of all the courses involved so that all the students have access to it.

7.2. Practical understanding of the Competence

For this activity, three practical cases were developed. Each case is an example of presentation covering the items to assess in the questionnaire in a different manner in order to represent variety of types of presentations. The videos were developed using the technology Polimedia at the UPV. Each video has associated a list of questions of the questionnaire to be self-assessed by students. The video and the questionnaire are uploaded in PoliformaT in all the courses involved in the project. The students, after watching a video, respond to the questionnaire implemented in Poliformat. When the questionnaire is completed, they obtain the correct response. Then, they can watch the video again and review their responses in order to understand further how the competence is assessed.

7.3. Practical real application of the competence

After the competence self-assessment, students must assess real presentations performed by their peers at class. In each course, each student must present an oral presentation regarding a specific topic at class. Instructor is in charge of assessing the presentation for obtaining the mark and at the same time peers are in charge of assessing the presentation for assessing their own knowledge of the competence. Each student is assigned to assess only a set of presentations and also using a set of questions so that students do not have to assess the whole questionnaire. It is better considered to assess only some questions in order to focus the available time during the presentation in some specific questions. All the questionnaires completed (instructor and peer questionnaires) are filled in using Poliformat so that the collection the responses is automated and easy to compute.

8. Pilot application and feedback

The project has been applied to three master courses belonging to the Higher Technical School of Industrial Engineering at UPV (Table 1).

Table 1. Application of the project in three master courses

Course	Course Type	Degree
PMS	Core	Master in Advanced Engineering Production, Logistics and Supply Chain (MAEPLSC)
PPEED	Elective	MAEPLSC
SIE	Elective	Master in Industrial Engineering

After collecting the data, the analysis of results indicate an increasing interest in the satisfaction of students (see satisfaction survey results coming from students in Table 2):

Table 2. Overall student satisfaction survey results in the three courses

Course	Overall student satisfaction 2015-2016	Overall student satisfaction 2016-2017	Satisfaction Increase (%)
PMS	9.22	9.08	-1.51%
PPEED	8	8.89	10%
SIE	5.42	7.5	38.37%

Results showed a positive feedback of the experience. It can be observed in Table 2 that the two courses with higher potential to increase the mark (PPEED and SIE), both have increased considerably the satisfaction of students while the course with high results (PMS) (9.22 out of 10 in the academic year 2015-2016) has maintained the results (insignificant difference). In addition, some aspects are recommended to be considered before transferring this experience to other courses. These aspects are concluded in a SWOT (Strengths, Weaknesses, Opportunities, and Threats) matrix (Table 3):

Table 3. SWOT analysis of the innovation project

<i>Strengths</i>	<i>Weaknesses:</i>
<ul style="list-style-type: none"> - Previous joint experience of the members in Innovation Projects - Members teach the same course - Easy transfer to other degrees 	<ul style="list-style-type: none"> - Software applications are not dedicated so that data analysis is not automated.
<i>Opportunities</i>	<i>Threats:</i>
<ul style="list-style-type: none"> - Motivation of students increase when attractive environment is provided. - Developing more resources (videos, presentations, apps, etc.) to guide students. - Distinguish the limits between level of acquisition of the competence (undergraduate and graduate) for instructors and students. 	<ul style="list-style-type: none"> - The experience is to be performed in a moment of the semester when the student is not overloaded to increase motivation. - In expositions with more that 30 students, the session may be too long. With higher size groups, it is better to perform more than one session.

9. Conclusions

The assessment of generic competences is gaining attention in the literature. Multiple tools have been developed in the last years, the vast majority paper-based tools. However, tools implemented in software applications can aid to pursue higher objectives such as collecting evidences in quality and number and increasing student motivation.

This paper has presented the methodology developed to achieve these objectives. In order to collect evidences in quality and number, an easy to use and automated questionnaire implemented in Poliformat was developed to self-assess and co-assess the comprehension and application of the competence. To increase student’s motivation it was considered necessary to involve students in the assessment process: applying self-assessment of the competence knowledge in the case studies assessment and using peer-assessment as a way to obtain their own mark. Results obtained show a positive feedback coming from student satisfaction surveys in all three courses involved. In addition, a SWOT analysis is developed to improve some aspects for future implementations.

10. Acknowledgements

This work has been developed within the research project called “Use of software applications for training and assessing the UPV transversal competence “effective communication” in bachelor and master” (Ref. PIME-A16-16) funded by the Vice-Rectorate for Studies, Quality and Accreditation at Universitat Politècnica de València.

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Assessment of “Structural Concrete” of Civil Engineering Degree of Universitat Politècnica de València. Specific and cross curricular competences

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Abstract

The purpose of this work is to assess if the learning outcomes of “Structural Concrete” subject are well determined and if the methodology to reach them and to evaluate them, is adequate. Thus, it is analyzed if the didactic programming of the subject is in line with the theory of Constructive Alignment. The subject is part of the third course of Civil Engineering degree at Universitat Politècnica de València.

The specific competences that are worked on in the subject are:

- Conceive, design, construct and maintain structures of reinforced concrete based on the knowledge of the fundamentals aspects of the structural behavior.
- Analyze and understand how the characteristics of structures influence their behavior. Apply the knowledge about the structures mechanics to design them according to the existing regulations and using analytical and numerical calculation methods.

The cross curricular competences that are worked on in the subject are

- Analysis and resolution of problems.
- Planning and management of time.

Students will acquire previous competences by means of evaluation of predefined learning outcomes.

Keywords: *Assessment, civil engineering, structural concrete, competences.*

Introduction

The subject under analysis is "Structural Concrete". It is taught in 3rd course of the degree of Civil Engineering at the Universitat Politècnica de València from September to December. It consists of 6 ECTS, whose distribution is 3 ECTS of classroom theory, 1.4 ECTS of practical tasks and projects in the room, 1.6 ECTS of practical tasks performed using computer in a specialized room and practical tasks in structural laboratory. Following the guidelines stated by the Royal Decree 1393/2007, which establishes the organization of the official university studies, and the ECTS user guide, 2015 published by the Education Ministry, Universitat Politècnica de València has implemented the European credits, the ECTS as the standardized way to assess the learning outcomes and the amount of work done by the student to comply with the goals of the subject programme.

The main aim to achieve in this subject is to provide our students with the learning tools so as to design and check concrete reinforced structures. Particularly, the learning outcomes our students ought to reach are: determine design forces (LO-1), determine conditions to assure structure durability (LO-2), calculate sectional forces and prestressing loss forces in isostatic structures (LO-3), design the prestressing of an isostatic beam (LO-4), calculate one-dimensional elements in ultimate limit state (LO-5), design the reinforcements arrangement (LO-6), check cracking and deflection requirements (LO-7).

The aforementioned learning outcomes will be evaluated in order to determine if competences of the subject have been achieved because teaching process is based on competences. The basic and general competences of the subject are:

- Learn in a self-sufficient way new knowledge and techniques related to civil engineering.
- Understand and use technical language typical of engineering, specifically of civil engineering.
- Qualify scientifically and technically for the practice of the civil engineering with knowledge of the functions of consulting, analysis, design, calculation, design, construction, maintenance, conservation and exploitation.

Specific competences which are the ones linked to the more particular and definite aspects of this scientific field are:

- Conceive, design, construct and maintain structures of reinforced concrete based on the knowledge of the fundamentals aspects of the structural behavior.
- Analyze and understand how the characteristics of structures influence their behavior. Apply the knowledge about the structures mechanics to design them according to the existing regulations and using analytical and numerical calculation methods.

This subject also works on the so-called key-competences. These core or key competences are those which are key and fundamental and also transferable to a wide variety contexts

throughout life. According to the UPV key-competences project, 2015 they are characterized to be transferable, integrating, interdependent, multifunctional and assessable. One of the ways of assessing the key competences is, according to the UPV institutional project, by assigning different core competences to different subjects. “Structural Concrete” subject has been selected to assess the “Analysis and resolution of problems” and “Time management and planning” key competences.

1. Methodology

The methodology that has been implemented last year, from September to December, is the following one. This subject is evaluated by a wide variety of ways although the exam marks determine most of the final mark. It is assessed through three theoretical exams which are related to the theory foundations of the subject.

It is to say that these fundamentals are highly relevant to this area. Moreover, lessons are divided into theory and practice. First of all, professors introduce some theory exposition. Afterwards, learners perform two different required kinds of practical tasks.

On the one hand, students will apply theory to practice by doing some problem-solving activities after the theory explanations. This way, teachers are exclusively devoted to monitor, guide and solve doubts of the students at any point of their different learning processes.

Apart from this, learners will carry out five practical computer activities in which they will also have the support of teachers. All of them are assessed with a 7.5% of the global mark. Moreover, there are also planned four practical tasks that will be done in the structural laboratory. Only the last one is assessed because the previous ones have been designed to teach our students how to deal with real testing and analysing concrete elements. Once they have had the opportunity to learn the essential knowledge about the issues is when they are evaluated with a task that summarizes the cases previously studied. Furthermore, as we are conscious about the deep and profound level of knowledge that is required to perform to the highest standard in actual working cases, we decided not to assess these practical skills and abilities in a remarkable percentage. Only a 2.5% of the final mark can be achieved by this task. We wanted to be sure that the whole learning process was perfectly aligned before giving more punctuation to this very specific part of the subject.

Besides, regarding the theoretical subject part, this will be assessed by three written exams along the course from which represent 90% of the final mark. Nonetheless, we are aware of the new advances in legislation, educative research and recommendations from the Council of Europe, 2014 that have stated that educative systems have to evolve to a more pragmatist and real-life direction. We have taken this into account regarding the planning and the designing of the activities, trying to bring to life the contents and competences but it is true that we have not fostered them enough in terms of assessment. We will analyse and reflect on this in the conclusion and improvement measures section.

Otherwise, the way we have proceed is based on well-founded educative theories such as the following ones. We have taken into account the Constructivism education theory as a paradigm for our teaching-learning process. Our students' role in learning is active and they are engaged and involved in constructing the learning. We have followed one of the most important guides in this theory which is the fact that the new information has to be linked to prior knowledge to be meaningful for students and a long-lasting learning. Our contents have been connected with our learners' previous knowledge and then a scaffolding (a term which was coined by Jerome Bruner) process begins. All parts in the subject have been designed to foster this approach since listening to the lecture actively is also part of it because not only constructing the information on the practical part is constructivism, as it is commonly thought. It is necessary for the scientific degrees to value this approach appropriately as Slezak, 2014, states.

Besides, we went beyond constructivism to take advantage of the social constructivism theory too. As the theory states, individual's learning takes place because of peer's interaction or student-teacher interaction. This is due to the psychological dimensions that this social interaction and feedback have on learning development (Palincsar, 1998). This is the main pedagogical reason why we have focused the practical tasks on pair work and on a constant professor monitoring. What it is more, an instructional strategy grounded in social constructivism is computer-supported collaborative learning (CSCL) (Stahl ,2006). This strategy gives students opportunities to practice 21st-century skills in communication, knowledge sharing, critical thinking and use of relevant technologies found in the workplace. This is now an area of active research and we have based our practices on it. It is the perfect mixing between constructivism, social constructivism and the use of the new information and communication technologies (ICT), where our pupils are building learning by interaction, ideas socialization and through the use of a computer as a learning tool and the teacher as a guide.

2. Assessment

As it has states previously, the assessment of this area is subjected to a written exams and case-method approach. Our students will acquire the theoretical knowledge they will need to success in the exams and in the practice task. The exams have a weight in the final mark of 90%, and the practical task a 10%. These exams allow to evaluate all learning outcomes mentioned in section 1.

In order to obtain the final mark, the following expression is used:

$$\text{Final mark} = 0.9 \cdot E + 0.075 \cdot PC + 0.025 \cdot PL$$

Where:

E: Average mark of the three exams. 30% of the marks corresponds to theoretical questions and 70% to problems resolution

PC: Average mark of the computer practical tasks

PC: Average mark of the laboratory practical tasks

As it can be seen, problem resolution (in written exams and in practical tasks) plays an important role in the assessment of this subject. This implies that the theory is inextricably linked to the pragmatic side. This is the reason why it is extremely important our student's class attendance. If they come to class, they will be able to have the sufficient basis to get over the practice part, and in addition to this, they will have the opportunity of being monitored all the time. The minimum class attendance percentage established is 85%. This is a way of fostering class attendance and in the end, this will be positive for them and for the society because they will be able to perform to the highest standard in their working environments in the near future.

Now we will briefly describe the practical tasks they will be carrying out along the course and the learning outcomes that evaluates each one (learning outcomes are shown in section 1). The five computer practical tasks (**II-I5**) works on these aspects: combination of loads (session 1, it evaluates LO-1), instability (session 2, it evaluates LO-1), prestressing design (session 3, it evaluates LO-3 and LO-4), ultimate state design (session 4 and 5, it evaluates LO-3, LO-5, LO-6). Each practice is taken at the end of the session and it is corrected. The mark of the computer practical tasks is the mean of each one. Regarding laboratory practical tasks (**L1-L4**), only the last session out of four is evaluated (it evaluates LO-2, LO-3, LO-5, LO-6, LO-7). Previous these sessions, students can see in live and analyze how a tie fails under tension (it works LO-2, LO-7), a beam fails under bending (it works LO-3, LO-5, LO-6) and a beam fails under shear (it works LO-3, LO-5, LO-6).

As we have stated before, this subject has been chosen as an area to control the acquisition of two of the so called key competences: analysis and resolution of problems and time management and planning.

In the key competence "analysis and resolution of problems" students must develop own strategies to solve problems effectively and efficiently by means of reflection and experience. So as to evaluate it objectively we have stated different achievement indicators, which are the following:

- Transform a complex problem into an easier one using structural reasons.
- Contrast information sources and handle rigorous data.
- Use the most appropriate methodology, based on your experience, to solve the problem efficiently and justifiably.
- Choose an optimal solution through justified criteria

Taking into account these indicators, this key competence has been assessed thanks to written exams and the practical tasks.

Regarding “time management and planning”, students must be aware that “time is a limited period in which we have to accomplish our actions. Being able to plan and manage time will enable our students to carry out all the academic, personal and professional activities”. The achievement indicators to evaluate are:

- Determining the different phases of the project, integrating the individual and group activities in order to reach the aim.
- Assigning time to the individual and group work activities to reach the project aim and to comply with the planning.
- Assessing the planning and the individual and group project results.

Considering these indicators, this key competence has been evaluated by analysing what percentage of the task students were able to finish in two practical tasks.

3. Results

In this section, we have displayed our students’ final marks regarding the three written exams and all practical tasks (Figure 1). These marks are useful to check if general and specific competences and “analysis and resolution of problems” key competence have been achieved. In the Figure 2 just the marks regarding practical tasks are displayed. It can be seen that around 45% of students that completed the course, did not achieved the competences. This percentage is even higher if we only consider the marks of the three written exams. However, the marks regarding practical tasks are far better as it is shown in Figure 3 and 4.

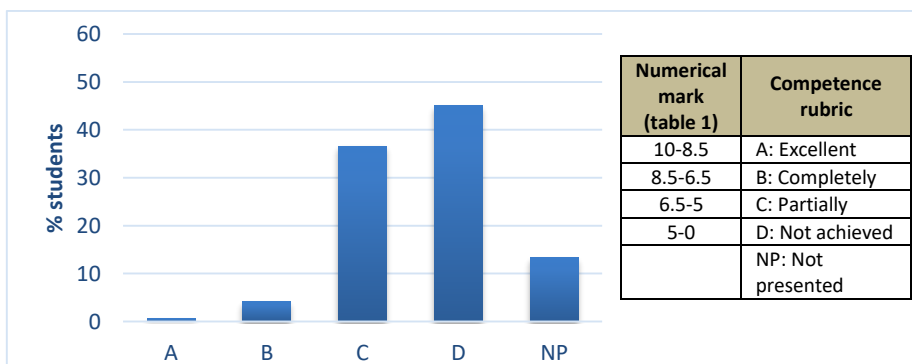


Figure 1. Students’ qualifications (total marks)

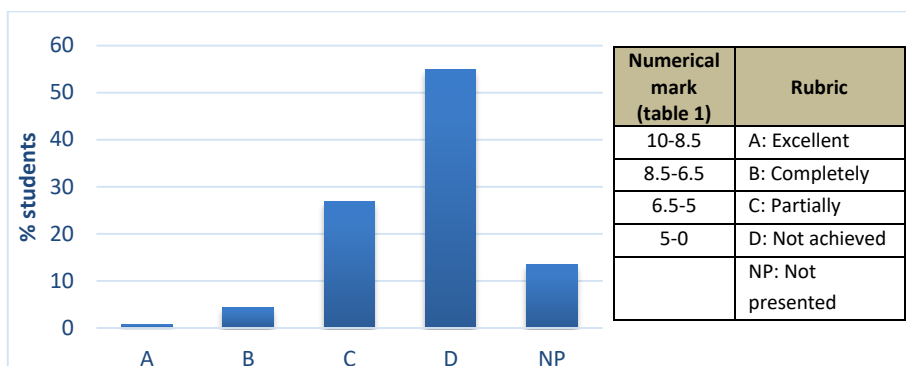


Figure 2. Students' qualifications regarding written exams

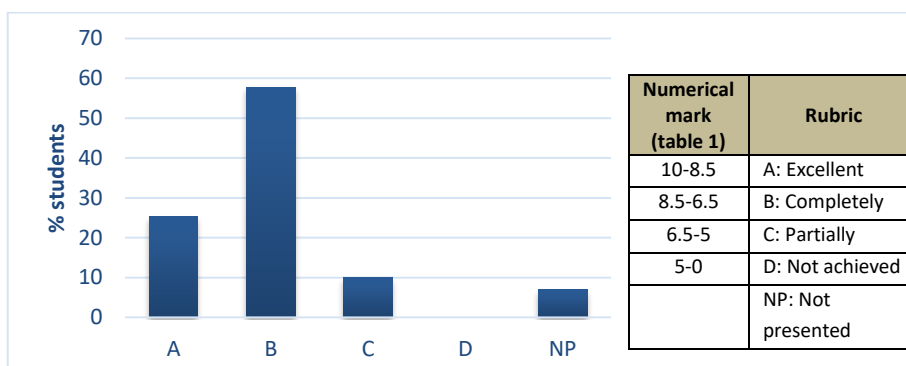


Figure 3. Students' qualifications regarding practical tasks

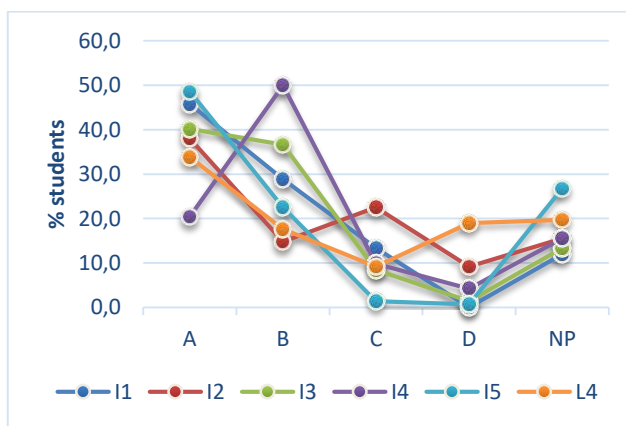


Figure 4. Marks in each practical task

For the evaluation of the key competence “time management and planning”, a computer practical task I3 and the laboratory task L4 have been used. In them it has been emphasized to the students they try to plan and manage properly the time of the practice before beginning. Tasks have been divided into parts (6 in practice I3 and 3 in practice L4) and the parts completed by students have been counted. Subsequently, the results have been transformed to base 10, the mean has been made and the note has been discretized according to the criterion of Figures 1-4. The results are shown in Figure 5. It shows a decreasing tendency because most of the students have an "A" mark, that is, they have achieved to plan and manage their available time to perform the practical tasks correctly. The rest have a mark of "B" and almost none has obtained a lower mark. In general, it can be concluded that students have acquired this key competence.

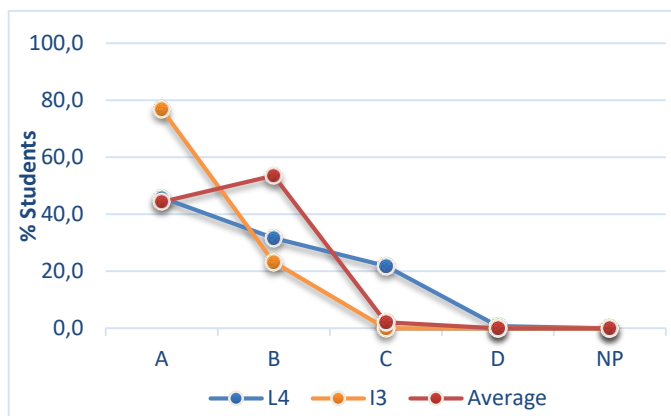


Figure 5. Assessment of key competence “time management and planning”

4. Conclusions and improvement measures

Finally, in order to summarize this communication, we will enumerate the main conclusions and the improvement measures we have drawn after having analyzed and reflected on all the information and data we have shown.

- Taking this into account, and reflecting on the new guidelines suggested by the European Commission in terms of education and training, improvement measures need to be taken. For instance, a good example is the European Commission communication: "Rethinking education: investing in skills for better socio-economic outcomes", which encouraged the European Union (EU) countries and all the educative institutions to aim their education policies at a more pragmatist and real-life direction. For this reason, and after reflecting carefully on our teaching process, it is necessary to suggest some changes on the teaching methods used

because this will enable us to adapt our requirements to our students and social and European needs in a better way.

- We have thought about this new pragmatical European requirements in relation to our programming and they are clearly balanced in terms of competences and practical contents.
- On the contrary, it is necessary to admit that we have not achieved the Construction Alignment theory completely and it is a part of this rethinking education process. This theory states that the teaching and learning activities, and also the assessment assignments, have to be directly addressed to the intended learning outcomes using different and innovative ways of achieving them (Biggs, 2011). It is to say that we have succeeded in terms of the alignment among learning activities, assessment tasks and learning outcomes. Although the evaluation approach has a significant number of innovative treats such as the computer-supported collaborative learning (CSCL) and the structural laboratory tasks, we have not given to them the sufficient importance as regards to the mark percentage.
- The results in terms of the number of students that have passed the subject are not satisfactory. On the other hand, results as regards to the number of learners that have succeeded on the computer and laboratory tasks are positive. This difference can happen because of students are used to work and solve tasks in pairs and with the help of the teacher, so they are able to success in a social context of mutual collaboration. On the contrary, when doing the exam, they are on their own, and maybe there are some concepts that they have not acquired totally. This could explain these results. So as to improve this, a reflecting portfolio of each practice should be introduced where students could explain and be aware of their weaker points and work specifically and individually on them.
- All learning outcomes are evaluated and, consequently, competences too.
- Students have acquired the key competence “time management and planning”, satisfactorily.

We will take all of this into account when planning next year so as to assure that the subject learning-process will go better and to analyse if the improvement measures suggested can do a great deal to obtain a better result.

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Evaluation of learning outcomes of the subject: “Non-linear and Time-dependent Analysis of Concrete Structures” - Master in Concrete Engineering at the Universitat Politècnica de València

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Abstract

This communication shows in detail the evaluation procedure and the results of the "Non-linear and Time-dependent analysis of Concrete Structures" subject, of the master in Concrete Engineering at the Universitat Politècnica de València. It is a subject of 5 ECTS, whose distribution is established as follows: 2.5 ECTS of classroom theory, 2.5 ECTS of practical activities. The methodology applied is based on master class technique for the theory and application of the case method for the practical part of the subject. The evaluation is continuous by assessing practical works and class attendance. At the end of the course, the student should be able to analyze the non-linear behavior of simple structures of reinforced concrete (load capacity and deformability).

As the number of students is small, a more individualized and guided methodology can be used. During the semester, each student prepares a portfolio where he or she will incorporate the results developed during the practical activities of the subject. These activities can range from short and simple tasks to extensive and complex works typical of last courses and doctoral theses. They are developed by groups, formed in a particular way with the aim of maximizing learning.

Apart from showing the assessment and the results of the specific competences of the subject, it is presented the methodology used to evaluate the cross curricular competence of Planning and Time Management, as well as the results.

Keywords: *Assessment, master, individualized, competences, cross curricular competence.*

Introduction

The subject under consideration is "Non-linear and Time-dependent analysis of Concrete Structures". It is taught in the master in Concrete Engineering at the Universitat Politècnica de València from September to December. It consists of 5 ECTS, whose distribution is 2.5 ECTS of classroom theory and 2.5 ECTS of practical tasks and projects.

Following the guidelines stated by the Royal Decree 1393/2007, which establishes the organization of the official university studies, and the ECTS user guide, 2015 published by the Education Ministry, this Polytechnic university has implemented the European credits, the ECTS as the standardized way to assess the learning outcomes and the amount of work done by the student to comply with the goals of the subject programme.

In order for our department to innovate and to adapt our teaching-learning practice to the European Higher Education Area (known as the "Bologna process"), we have been carrying out throughout the years a methodology and an assessment that will enable us to meet the education needs.

Let us now briefly mention what is the subject about. The main aim to achieve in this course is to provide our students with the advanced learning tools so as to analyze and design concrete reinforced structures. Particularly, the specific objectives our students ought to reach are: knowing, discerning and interpreting the different causes of non-linear and differing behaviour in concrete structures; knowing the mechanic materials behaviour; being aware of the non-linear behaviour due to geometry; knowing the non-linear and differing concrete structures' fundamentals and models; applying the non-linear and differing models to the concrete structures calculation and assessing the behaviour of structures in service and in ultimate state.

We will move on to the next point which is related to the general and specific key competences. First of all, it is to say that we will be referring to the Verification memory of Master in Concrete Engineering of Universitat Politècnica de Valencia, of the degree with regards to the basic, general and specific competences. This is our main reference because it does not exist any ministerial law since this master does not allow students to any standardized profession. According to this, these are the different competences our students will be dealing with:

With regard to the basic and general competences, these are related to both life and personal skills and contents related to the field of knowledge under consideration: concrete structures. Specifically, these are the basic and general competences:

- That our students will achieve the learning abilities that will allow them to continue studying in a more independent, self-reliant and autonomous way.
- That our learners acquire the knowledge and skills that will allow them to have a profound comprehension regarding the aspects related to the concrete engineering and the practical appliance of the already mentioned knowledge.

On the other hand, the specific competences are linked to the more particular and definite aspects of this scientific field.

- To discern and applying the forces transmission mechanism in the concrete structures.
- To develop and contrasting sectional and structural numerical models that reproduce the structural behaviour of the concrete under solicitation of complex forces, considering the different non-linear causes.

In summary, if students' success the general learning outcomes are the following ones: students will be able to understand the non-linear and differing behaviour causes with regard to concrete structures. They will also apply different calculating methods to analyze the non-linear and differing behaviour in continuous beams and reinforced concrete columns.

What it is more, this subject also works on the so-called key-competences. This core competences are those which are key and fundamental and also transferable to a wide variety of personal, social, academic and working contexts throughout life. According to the UPV key-competences project, 2015 they are characterized to be transferable, integrating, interdependent, multifunctional and assessable. One of the ways of assessing the key competences is, according to the UPV institutional project, by assigning different core competences to different subjects. The basic principle that it assumes is monitoring the student's progress through the selected areas. These areas have been denominated "points of control".

It is to say that this subject has been selected to assess the "Time management and planning" key competence. This point will be extended to in section number 3.

1. Methodology

The applied methodology is based on different principles regarding the theory or the practice part. In relation to the theoretical part we are mainly using the exposition technique which is more teacher-centered but essential to give our learners the necessary theory foundations to success in the practical demands. For this reason, we combine this approach with a student centered-model to work in the practice part of the subject. This way, they are learning throughout a case method approach.

This subject is not evaluated neither by tests nor exams. It is assessed through group work projects biweekly. Lessons are divided into theory and practice. First, the professor introduces the theory and then students have some activities and problem-solving tasks to do. There are some sessions that are exclusively devoted to work in the classroom with the continuous tutoring and guidance of the subject educators and even of their peers. This way, they are able to ask their doubts and they are guided by the teachers in any moment while they complete the activities and projects.

As we have already mentioned, it is a subject taught in the master in concrete engineering. This lead us to an important and distinguishing aspect: a great variety of students can attend

to this master from different degrees such as Civil Engineering, Architecture or Technical Architecture.

This point has shown us that in everyday practice the most prepared students from the calculation perspective are the ones that help better other group mates, establishing the concepts clearly whereas the others are learning from them. This is due to the complexity in terms of calculations and structural theory that this subject is full of. In spite of this fact, the official marks have stated that all students pass the subject with an average mark of notable qualifications. This implies that the already mentioned methodology is suitable to overcome the difficulties of the students with less calculation training, being helped by the others. This way, we are demonstrating that teamworking and not only teaching but also peer monitoring are greater learning tools than individual work.

This methodology that we have implemented has been focused on following some of the most important educative theories. For instance, the scaffolding method stated by Wood, 1976, which implies fostering teamwork and provide our students with all the resources and monitoring they need to complete the task, step by step, until they are able to do it in an autonomous way, becoming independent learners. Although this theory originally was thought to children, evidence has shown that it is totally valid and recommendable to be used with any kind of learners. According to (Jarvis, 1995) states that "Bruner has outlined a set of principles that educators of adults should be aware of because they form part of the theoretical perspectives of teaching". What it is more, our methodology covers 2 out of the 3 stages of development that Bruner states: enactive, iconic and symbolic.

In the iconic stage, in which it is very important to present a number of different visual aids to students to supplement the teaching material, we include images, videos, charts and graphs, and also a visit to the laboratory to see an experiment. This laboratory visit could be linked to the previous stage, the enactive, in which the learners are supposed to learn by experimenting and manipulating objects. We should rethink this laboratory lesson in order to give our students a more active role in it, but we are aware of the difficulty of this due to the high cost of the experiment, so it is possible that a kind of simulation could improve this aspect.

Moreover, after this previous work students are able to work abstractly with mathematical symbols that explain what they have previously seen in images and in an actual way.

Besides, we should not forget the predecessor of Bruner's theory, Lev Vygotski, whose learning paradigm, the constructivism, is guiding the European framework and our regular basis. Thanks to it, our students construct their own knowledge by solving task-based problems that they will encounter in their real life when they work.

Moreover, we have based our methodology on the Europe Strategy ET2020, 2009 too, which is the general legal framework we try to put into practice specially in one of its main aims:

the promotion and fostering of creativity and innovation, including the entrepreneurship competence in all the education and training levels.

2. Assessment

As we have mentioned before, the assessment of this area is subjected to a case-method approach. That is to say, our students will acquire the theoretical knowledge they will need to success in the practice task, and these practical activities are the ones to be marked. This implies that the theory is inextricably linked to the pragmatic side. This is the reason why it is extremely important our student's class attendance. If they come to class, they will be able to have the sufficient basis to get over the practice part, and in addition to this, they will have the opportunity of being monitored all the time. The more they attend to lessons, the better results they will obtain.

Thinking about what it is best for them, and drawing this conclusion, improvement measures have been implemented. For this reason, class attendance is highly rewarded from 0 to 0,75 that it is added to the final mark depending on percentage of attendance. The minimum percentage established is 85%. This is a way of fostering class attendance and in the end, this will be positive for them and for the society because they will be able to perform to the highest standard in their working environments in the near future.

Now we will briefly describe the practical tasks they will be carrying out along the course. The first one is about the concrete differing behaviour: shrinkage and creep. Then, the next task is about calculating deflections in a reinforced concrete structure. They will have to do a comparative analysis with different methods.

Task number 3 is about analysing second order effects in a cantilever column.

Next practice is about plastic analysis as regard to the ultimate rotations method.

In task number 5 learners will have to make a differing analysis of concrete structures.

Finally, they will be able to analyze global and local second order effects in framed structures.

Besides, they will have to carry out a comparative analysis among different methods.

In order to obtain the final mark, the following expression is used:

$$\text{Mark} = \text{Mean mark of group tasks} + \alpha, \text{ where } \alpha \text{ is } (\% \text{ attendance} - 85\%) * 0.05 \geq 0$$

These activities have been designed bearing in mind another important theory in education, Bloom's Taxonomy (Blom, 1956). It is used to classify learning aims into complexity levels, from the first one which is about knowledge to the last one, the evaluation. This means that our activities have been designed from the easiest aspects to the more difficult ones, having our students to thrive on to progress on each activity and on the whole subject. It is also a good way to determine our student's learning outcomes.

As we have stated before, this subject has been chosen as an area to control the acquisition of one of the key competences: time management and planning.

Now we will explain what this core competence is about: "time is a limited period in which we have to accomplish our actions. Being able to plan and manage time will enable our

students to carry out all the academic, personal and professional activities. This plan implies setting goals, making decisions, assume responsibilities, coordination, reflexion and evaluation”.

Taking this into account, this is the evaluation criteria we have assessed:

-Planning and managing temporarily individual and group projects.

So as to evaluate it objectively we have stated different achievement indicators, which are the following ones:

- Determining the different phases of the project, integrating the individual and group activities in order to reach the aim.
- Assigning time to the individual and group work activities to reach the project aim and to comply with the planning.
- Assessing the planning and the individual and group project results.

To obtain this valuable information we have asked our students for their personal experiences (time that the spent doing the tasks). As they are the ones who have first-hand information results will be true to life. We will explain this onto the next point, which is about results and learning outcomes.

3. Results

Here we have displayed (Table 1) our students' marks regarding the six different tasks they have been working on. As it can be seen, marks are quite high and remarkable.

Table 1. Students' marks regarding the six tasks

GROUP TASKS							CLASS ATTENDANCE		MARK	FINAL MARK
T1	T2	T3	T4	T5	T6	MEAN	%	α		
10,0	9,0	7,5	4,0	7,0	10,0	7,92	85	0	7,92	7,9
10,0	9,5	10,0	9,5	10,0	7,5	9,42	96	0,55	9,97	10
7,5	5,0	10,0	5,0	10,0	7,5	7,50	100	0,75	8,25	8,3
7,5	8,0	10,0	5,0	10,0	9,5	8,33	100	0,75	9,08	9,1
10,0	8,0	10,0	9,0	7,0	9,0	8,83	100	0,75	9,58	9,6
10,0	9,0	7,5	4,0	7,0	10,0	7,92	96	0,55	8,47	8,5
10,0	8,0	10,0	9,0	7,0	9,0	8,83	96	0,55	9,38	9,4
10,0	9,5	10,0	9,5	10,0	7,5	9,42	100	0,75	10	10
7,5	8,0	10,0	5,0	10,0	9,5	8,33	100	0,75	9,08	9,1
7,5	8,0	10,0	5,0	10,0	9,5	8,33	92	0,35	8,68	8,7
7,5	5,0	10,0	5,0	10,0	7,5	7,50	100	0,75	8,25	8,3
10,0	9,0	7,5	4,0	7,0	10,0	7,92	96	0,55	8,47	8,5
10,0	8,0	10,0	9,0	7,0	9,0	8,83	92	0,35	9,18	9,2
10,0	9,5	10,0	9,5	10,0	7,5	9,42	96	0,55	9,97	10
7,5	5,0	10,0	5,0	10,0	7,5	7,50	100	0,75	8,25	8,3
10,0	8,0	10,0	9,0	7,0	9,0	8,83	96	0,55	9,38	9,4
10,0	9,0	7,5	4,0	7,0	10,0	7,92	92	0,35	8,27	8,3

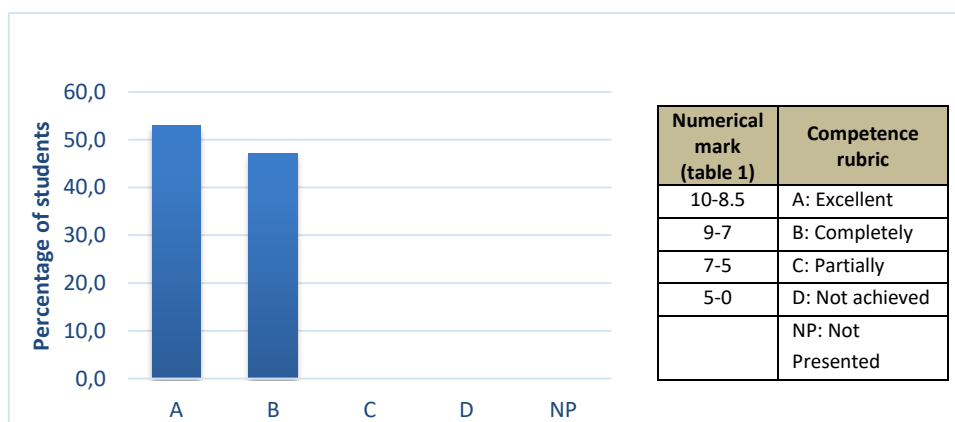


Figure 1. Students' qualification regarding specific competences (section 1)

Students' groups measured the time they spend carrying out the different tasks and projects. Some groups did not inform about the time they spent so we are basing our data taking into account 4 groups of students. With the information, we have we can say that the average regarding the amount of time students spent along the course is approximately 60 hours. We state that 50 hours of total work corresponds to an excellent time planning and management, therefore, up to 50 hours the qualification is A. B is to hand over tasks in time (without delays). C or D is to deliver tasks with delays, depending on the frequency and magnitude of delays respectively.

Table 2. Students' marks regarding time management and planning competence

Group	Amount of time devoted to tasks (h)						Sum of each group (h)	Mark
	P1	P2	P3	P4	P5	P6		
1	9,00	11,20	7,30	5,50	2,50	5,67	41,17	A
2	18,50	23,50	7,00	16,00	6,50	15,00	86,50	B
3	8,50	20,00	7,75	20,58	4,42	7,33	68,58	B
4	12,00	8,50	7,75	4,35	6,85	6,25	45,70	A
Mean of each task (h)	12,00	15,80	7,45	11,61	5,07	8,56	60,49	

Where: A: Competence has been achieved in an excellent way
B: Competence has been achieved completely
C: Competence has been achieved partially
D: Competence not achieved

4. Conclusions

As it can be contrasted with Table 1 and Figure 1, this methodology and assessing method has brought good results. This implies that the learning teaching-process has been adapted to the student's different needs and has appeal to all of them since marks have been pretty successful.

After having reflected thoroughly on these results, we can draw some important conclusions:

- Deadline tasks are achievable, which inform us that we ought to continue working this aspect in this way.
- Working in teams and developing cross-curricular competences such as time management has brought about a positive change in our student's learning outcomes.
- It seems that our students have not devoted less time to the subject as if they would have had an exam to pass, so they are not learning less that if they would have been taught with a more traditional evaluation system. Besides, they have not spent their time only memorizing but fostering practical skills and abilities.
- As it is promoted by the current European guidelines a long-lasting learning is a goal to achieve. When learning is closely related to problem-solving tasks and real-life

situations learning is acquired. This is what we have implemented with our assessment method.

- Peers help does free our student's from suffering anxiety, a student problem related to exams. This way, they have helped each other to achieve common goals, reaching agreements, developing actual projects and learning without any kind of pressure.
- A continuous assessment appears to be a proper evaluation system since allows our students to know their stronger and weaker points in every moment and this enables them to know how to improve and to be more motivated and conscious about their teaching-learning process.

Of course, improvement measures will be proposed such as conducting a research or a survey in which our students will be able to express themselves and their opinions about the methodology and assessing method. Last but not least, we hope that other departments could be inspired by this practice and we shall endeavour to improve the next year's learning-teaching process.

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Engagement as a Key Mediator Variable in User Generated Content on Social Media Platforms

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Abstract

The tourism sector has often been associated with new technologies, and more specifically with social media. The objective of this study is to analyse the interaction between tourist satisfaction, tourist engagement, and user generated content on social media, especially on Twitter. We propose a model based on these three related variables. The context of the model is tourist related events and locations, and consists of three hypotheses which are supported by the literature. To test our model we conducted our studies in two independent settings the “Marina d’Or”, which is a popular tourist destination close to Castellon, Spain, and the “Fira d’Onda” festival, which is held in the town of Onda, in the Valencian Community, Spain. These were analysed using structural equation modelling. Additionally, we validated our model by analysing the messages published on the popular microblog platform Twitter, during the same period. We determined that the strongest influence on User Generated Content comes from the the tourist engagement as a mediator variable. Besides, we found that getting an engagement of tourists to the destination is an effective way to generate positive content in social media. The study makes a novel contribution to the literature - the proposed model is innovative, in particular due to the introduction of engagement as a mediator variable, and the incorporation of an analysis of social media content into the model validation.

Keywords: *User generated Contents, Engagement, Satisfaction, Social Media and Tourism.*

Introduction

Social media platforms such as Facebook, Twitter, YouTube, and numerous others have begun to revolutionize the state of marketing, advertising, and promotions (Hanna, Rohm & Crittenden, 2011). These social platforms continue to play an increasingly influential role in the social and economic aspects of the tourism industry. In the new social media-driven business model defined by customer connectivity and interactivity (Hanna, Rohm & Crittenden, 2011). Individuals use these platforms to search, find, and read about tourist locations and events, and have a higher degree of trust in the content than in conventional marketing material (Zeng & Gerritsen, 2014). For this reason, the amount of digital information available to individuals is ever-increasing (Khan, Mohammad & Thakare, 2015). However, there is a lack of empirical data to describe and explain the role of social networks in the context of online travel information search (Xiang & Gretzel, 2010). Interactive digital media has catapulted company and consumer contact from the traditional Web 1.0 model to the highly interactive Web 2.0 world (Hanna, Rohm & Crittenden, 2011). Therefore, most marketers are using social media to develop loyal fans (68%) and gain marketplace intelligence (66%) (Stelzner, 2014). Additionally, there has been little background study that determines the participation of consumers in the exchanges and the possible impacts of such participation on other consumer behaviours (Bigné et al., 2013).

The objective of this study is to analyse the interaction between satisfaction, engagement, and user generated content on social media, in relation to a specific tourist event. We propose a model based on three related variables: engagement, satisfaction and user generated contents. The context of the model is tourist related events and locations, and consists of three hypotheses which are supported by the literature.

1. Social media platform: Twitter

As a micro blogging and social networking website, Twitter has become very popular and has grown rapidly (Khan, Mohammad & Thakare, 2015). With the continued rise of social media as a communication platform, the ability to construct unsolicited public opinion polls has become a possibility for researchers though parsing of massive text-based datasets (Cody et al, 2016)

In Twitter a tweet is a textbased post and only has 140 characters, which is approximately the length of a typical newspaper headline and subhead (Khan, Mohammad & Thakare, 2015). The short messages are very easy and convenient to both sender and reader to share things of interest and communicate their thoughts anywhere and anytime in the world (Khan, Mohammad & Thakare, 2015). In this way, online social networks enable people to easily connect and maintain relationships with others independent of the individuals' locality (Jurgens, 2013).

Individuals post short messages (tweets) and may form asymmetric social relationships, known as following, where one individual monitors the tweets of another individual (Jurgens, 2013). A considerable amount of this information is in textual format, which can be broadly categorized into two main types: Facts and opinions (Khan, Mohammad & Thakare, 2015). And also there are differences between these categories, because facts indicate objective information whereas opinions can be subjective and indicate the sentiment of the author about an issue. Opinions can be about anything, e.g. a product, a service or a company (Khan, Mohammad & Thakare, 2015). Public opinion data can be used to determine public awareness, to predict outcomes of events, and to infer characteristics of human behaviors (Cody et al, 2016) thus, Twitter is an ideal source for spotting the information about societal interest and general people's opinions (Khan, Mohammad & Thakare, 2015). Although "conversations" can occur using Twitter, the medium is designed for oneway interactions where users "tweet" information to their contacts (Davenport et al, 2014). Therefore, a significant 90% of marketers said that social media is important to their businesses (Stelzner, 2014).

2. Hypotheses

As part of the services sector, tourism has inevitably been associated with the evolution of new technologies (Bigné, Aldás & Andreu, 2008). Tourists are changing the way in which they search, find, read and trust information, throughout the tourism sector (Zeng & Gerritsen, 2014). Anderson, Fornell and Mazvacheryl (2004) have investigated the long-term effects of customer satisfaction and concluded that satisfied consumers makes recommendations to others and therefore secures future income (Kobylanski, 2012). Therefore, it is argued that:

H1: Tourist satisfaction has a direct influence on user generated contents in Social Networks
Users of social networks that are subject to information influence are expected to show a greater need to acquire information and guidance from contacts with greater knowledge, which will facilitate their engagement in the user-generated contents of social networks (Chu & Kim, 2011). Therefore, it is proposed that:

H2: Tourist Engagement has a direct influence on user generated contents in Social networks
Laroche et al. (2012) revealed that social networking communities promote shared awareness, society's obligation, rites and traditions, trust, and customer loyalty. A year later, Brodie et al (2013) specified the reach of consumers in online participation suggesting that consumers with a good level of engagement present greater loyalty, empowerment, connection, emotional attachment, trust, and above all satisfaction. Based on these findings, it is argued that:

H3: Tourist satisfaction has a direct influence on Tourist Engagement.

3. Esearch method

We conducted our studies in two independent settings (1) the Marina d'Or, which is a popular tourist destination close to Castellon, Spain, and (2) the "Fira d'Onda" festival, which is held in the town of Onda, in the Valencian Community, Spain. Both studies were conducted over one week (Easter 2016 in the case of Marina d'Or, and in the final week of October 2016 for the Fira d'Onda festival). In each case we conducted a questionnaire based survey which we analysed using structural equation models (SEM), and simultaneously collected and analysed conversations related to the event/destination which were being published on the Twitter social network. Our aim is to determine the extent to which Twitter can be used to complement traditional public opinion surveys, ideally as a dashboard indicator accompanied by solicited feedback. (Cody et al, 2016)

Regarding the survey, we collected a total of 282 valid questionnaires from visitors to Marina d'Or, and 215 at the Fira d'Onda. The participants were presented with a set of questions related to each of the variables being analysed. Participants were asked to express their opinions by indicating their position on each question on a scale anchored at 1 (completely disagree) to 5 (completely agree). In order to design these questions properly, we followed the approach of several authors who have proven the goodness of the scales used in previous researches. Concretely, for satisfaction: Echtner and Ritchie, 1991; Baloglu and McCleary, 1999; Bloemer and Odekerken-Schröder, 2002; Gallarza et al., 2002; Kim and Richardson, 2003; Beerli and Martín, 2004. For engagement: Nunnally and Bernstein, 1994, Spratt, Czellar & Spangenberg, 2009. And for user generated contents: Zeithaml et al, 1996, Bloemer and Odekerken-Schröder, 2002.

During the same periods, we monitored the conversations taking place on Twitter by downloading and analysing the relevant tweets. These were identified by selecting those which included the hashtags #marinador and #firadonda, along with a number of related search terms. The datasets were converted into a network using the NodeXL Social Network Analysis software. Then, the Clauset-Newman-Moore algorithm (Clauset et al, 2004) was applied to identify different clusters of users in the network who are strongly connected (i.e., those who mention, reply to, or re-tweet each other's messages). This process highlighted the most important users, their level of influence, and how closely the users were connected to one another.

We then conducted a semantic analysis on the conversations that could be identified as visitors, rather than organisations who were promoting the destination, focussing in particular on the polarity of opinion expressed in the conversation threads.

4. Results and Analysis

The analysis of the data obtained in the questionnaires was carried out using the EQS 6.3 program. From the measurement of the variables (satisfaction, engagement and user-generated contents) and the number of items used for each scale, as well as the references used, the instrument was validated by first contrasting the model with a confirmatory factor analysis structural equation.

4.1. Figure

Our results demonstrated in both studies that there is a strong relationship between the variables, especially between engagement and user generated contents, as is illustrated graphically in Figure 1.

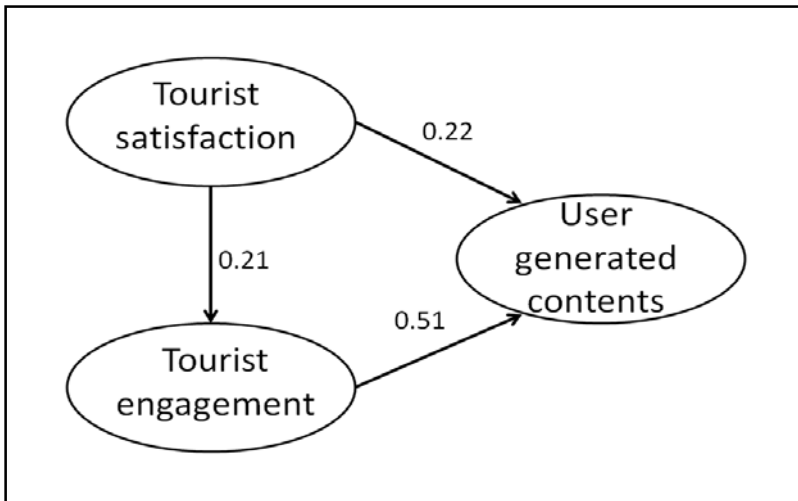


Figure 1. Relationships between the Variables

After processing and filtering the Twitter datasets as described above, we analysed 105 tweets written by Marina d'Dor visitors, and 298 from Fira d'Onda visitors. Of those from which a polarity could be discerned, 95% of the Marina d'Dor, and 98% of the Fira d'Onda messages could be classified as positive, thus reinforcing the findings of hypotheses H1 and H2, i.e., that visitors' satisfaction and engagement did in fact result in positive feedback being posted online, at least on the Twitter platform.

5. Conclusions

In this paper we have proposed a model based on three related variables: engagement, satisfaction and user generated contents. We have tested our model in the context of two tourist related events and locations, examining information gleaned from both surveys and conversations taking place on social media platforms. We have seen that the best way to generate a strong relationship is from the tourist engagement thought user generated content. Furthermore, we found that getting an engagement of tourists to the destination is an effective way to generate positive content in social media

The study makes a specific contribution to the literature - the model is innovative especially with the introduction of engagement as a mediator variable, in addition to incorporating an analysis of social media content into the model validation.

Additionally, the part investigated with Twitter gives us a greater vision of the results obtained. Building a large-scale social network for millions of users with bidirectional following relationships is a time-intensive and potentially infeasible process due to the rate limits on accessing information from the Twitter (Jurgens, 2013). Although we acknowledge limitations to the current research, we believe that the current findings regarding reasons for SNS usage will prompt researchers to include such motivational types of variables in future SNS studies (Davenport et al, 2014). Although not only can tweets anticipate survey responses (Cody et al, 2016) is an important part to complement is study through surveys. The study of the role of social networks in marketing is an incipient area of investigation in tourism that must be thoroughly explored in order to understand the complex environment in which tourism firms and destinations operate (Zeng and Gerritsen 2014).

Finally, the study has some inherent limitations that open up new lines for future research. The first limitation is the scope of our sample, which is limited to a specific areas in one particular country. As such, the study can be replicated with samples in other regions, and even other countries, to provide a cross-cultural perspective (Kobylanski 2012).

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Integral Tutoring Model based on Design Thinking for Colombian SMEs

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Abstract

This article shows the systemic perspective applied to the development of products and services, through the application of the Design Thinking Theory using an accompaniment model called Integral Design Tutoring Model (IDTM). The IDTM proposes to delimit the factors that influence the decision making when tutoring a new engineering project, taking as a reference the innovation, the human-centered design and the sustainability of the design process in a sample of small and medium enterprises in Colombia. The experience developed from the *Universidad EAN* in Colombia at the hand of the Institute for Sustainable Entrepreneurship, through the projects of innovation and consultancies that have been developed with companies, has allowed to build and apply a methodology of strategic tutoring based on the knowledge and evolutionary development of an engineering project, using as a base the current productive model in Colombia. This article will show the importance of the implication between innovation and social design using the IDTM from a perspective in the social and productive innovation. The information obtained has allowed to obtain tangible and beneficial results for the companies that are involved, from the reflection and the usage of the design as the core idea in the application of strategic innovation in Colombian Micro, Small and Medium Enterprises (SMEs).

Keywords: *Design Thinking, Innovation, engineering projects, entrepreneurship.*

Introduction

This article shows the systemic perspective applied to the development of products and services, through the application of the Design Thinking Theory using an accompaniment model called Integral Design Tutoring Model (IDTM). The IDTM proposes to delimit the factors that influence the decision making when tutoring a new engineering project, taking as a reference the innovation, the human-centered design and the sustainability of the design process in a sample of small and medium enterprises in Colombia. The experience developed from the *Universidad EAN* in Colombia at the hand of the Institute for Sustainable Entrepreneurship, through the projects of innovation and consultancies that have been developed with companies, has allowed to build and apply a methodology of strategic tutoring based on the knowledge and evolutionary development of an engineering project, using as a base the current productive model in Colombia. This article will show the importance of the implication between innovation and social design using the IDTM from a perspective in the social and productive innovation. The information obtained has allowed to obtain tangible and beneficial results for the companies that are involved, from the reflection and the usage of the design as the core idea in the application of strategic innovation in Colombian Micro, Small and Medium Enterprises (SMEs).

1. Demographic, social and economic context in Colombia.

Up to 1990 population growth in Colombia had an increasing exponential behavior for the population between 0 and 14 years of age, which ensured for the following decade a significant productive population that would support the economic and social demands of the country, also called dependencies by young ages and advanced ages. According to the Ministry of Health and Social Protection, population growth during the period 1995-2020, predicts for Colombia an active participation of young population in the economy, which allows generating productive investments or increasing social investment in the improvement of education, health, as well as in the fight against poverty. In fact, it has been observed that since 2005, there has been a decrease in the dependence by young ages, generating greater availability of money for different uses: technology, tourism, real estate, and higher education, among others. This also means that by 2020, Colombia will have the highest percentage of adult population in its history and therefore, greater demands for this population.

In recent years, Colombia has become the third country with the best business environment in Latin America, a favorable scenario for business development, however, there are relevant factors to analyze. One of these is the low investment in R+D+I (Research, Development and Innovation), represented by 0.2% of the Gross Domestic Product (GDP) added to the typology of companies which make up the Colombian business sector, represented in a 96% by small and medium-sized enterprises (SMEs) (Velásquez, 2004).

The reports issued by the Ministry of Information Technology during the year 2016, indicate that there are three future technological challenges that 96% of the entrepreneurs in the country will have to overcome, which correspond precisely to the SMEs in Colombia. These three challenges focus on a number of specific objectives:

1. Remove the barriers that are perceived by entrepreneurs to connect themselves (cost, knowledge and advice)
2. Generate capabilities (web presence, social networks, digital content, office programs)
3. Promotion in the use of digital social networks to promote digital business.

With the constant changes that are presented in the business world at the level of technology, challenges for the financial systems of the countries are developing at a fast pace, while in traditional practices the technology used to adapt to the regulations of the countries; at this point, it is interesting to observe how regulations seek to adapt quickly to innovations and respond to market needs (Table 1).

Table 1. Classification according to the type of company in Colombia

Type of Company	Staff	Total assets in statutory monthly minimum wages
Medium	51-200	5.001-15.000
Small	11-50	501-5.000
Micro-enterprise	Up to 10	Less than 500

Source: Law 905 of 2004. Government of Colombia.

According to the global competitiveness report of the World Economic Forum in 2016, Colombia has been climbing positions in the ranking that scores the most innovative countries, since it reached the 90th position in 2010, by 2015 it was already in position 61, and it is expected that for 2017 it reaches position number 50. This report also explains that innovation: "... in an ecosystem where business, regulations and social norms promote connectivity, creativity, entrepreneurship, collaboration and adoption of the latest technologies to generate new ideas and offer products and business models that are new to the market ..." (World Economic Forum, 2016).

In order to achieve a sustainable development in Colombia, it is necessary for companies to establish innovation strategies that improve their products and services or allow them to create new ones to be more competitive within and out of the country. In this sense, it has been shown how some design methodologies have supported these innovation processes in companies around the world (Norman, 2002; Brown & Kätz, 2009).

2. Design Thinking applied to the enterprise

During the second half of the twentieth century and the beginning of the twenty first century, the concept of what is now understood as Design Thinking has been developing, an expression coined by the D-School¹ to define its project based methodology for teaching and research that has served to differentiate in some way from what was done in a conventional School of Design at an international level during those decades.

Brown & Kätz (2009) define Design Thinking as a process with 3 main phases: inspiration, ideation and implementation. Inspiration based on a problem or opportunity that requires several alternatives to find the best solution. Ideation, the part that uses the power of creativity to create, develop and prototype concepts and ideas. And finally implementation, when the project jumps from working table to the real world: the market.

This panorama motivated the development of the tutoring model presented in this article, and the interest in contributing to the Colombian business community with a new model to tutor SMEs in a comprehensive way so that they innovate strategically from Design Thinking methodologies and improve the development of their products and services.

The application of Design Thinking in companies was initially focused on product development, a task that was inherited from engineering and the interest in improving production processes, in some cases seeking to incorporate better materials or add value through new uses. A more extensive approach included the application of design in business management, social development and economic transformation.

This scenario has resulted in new dynamics, one of these is the economy based on creativity, developed by Florida (2002) who theorized with a creativity that could be understood from three basic premises:

1. Creativity is essential in humans who use it to live and work on a daily basis.
2. Creativity is not limited by technology or business models as it is multifaceted and multidimensional.
3. Creativity must be understood as a social process that can provide benefits within the companies.

This same creativity is the one that allows the creation of new companies from entrepreneurship, based on the development of new products and services that can be understood as a threat to the traditional companies and their outmoded or obsolete business models (Schumpeter, 1934).

There are innumerable examples that demonstrate that the application of Design Thinking in companies is a way to develop innovation, and it can be observed in three ways: the first one focused on the improvement or development of products and services, the second one on the optimization of the internal processes in the company, and the third one in the formulation

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of new business lines or even in the generation of new companies through entrepreneurship projects.

2.1 Adapting Design Thinking from the Latin American context.

The complexity and particularities of the different cultures in the countries that conform Latin America, together with the different social needs that each of them have, generate a gap between the real scenario from which some methodologies were created and the scenario in which they are applied, a situation that is not only seen in this model, but is a generalized symptom in many methodologies that are developed in first world countries and then incorporated in developing countries.

The model of integral tutoring based on the concept of Design Thinking that allowed to evaluate the innovation in the Colombian SMEs from theoretical models, among which we can highlight the one created by Buckland and Murillo (2014) who based on the Murray model, propose a series of additional variables to be taken into account when applying this method in Latin America. Their work makes a lot of sense considering the high percentage of SMEs in the Colombian business community and the high social impact that the activities of this type of companies have from the productive and manufacturing sectors.

The adaptation of the model by Buckland and Murillo (2014) proposes five vital variables to consider when evaluating or proposing a social innovation project especially for Latin America. These variables draw a path from the definition of the project to the questioning of how to make it sustainable and replicable in similar ecosystems or conditions (see Figure 1).

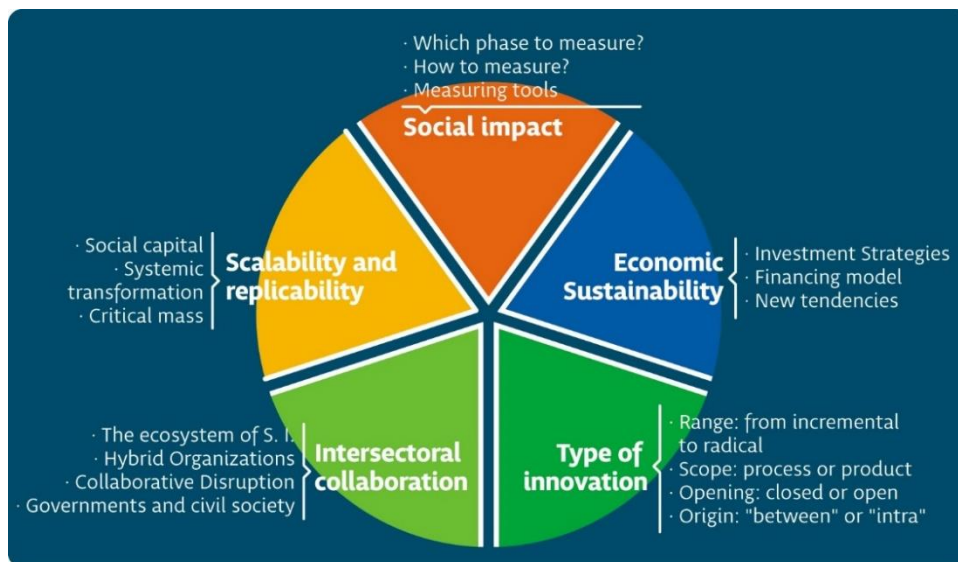


Figure 1: Variables in the application of the social innovation model for Latin America. Source: Buckland & Murillo (2014)

In reference to the applied variables, we can find:

- Social impact: Buckland and Murillo emphasize this variable from the Murray model because the objective of the social innovation model is to generate a systemic impact in the society where the methodologies are applied, in this way it is understood that any impact of this magnitude must be measured with some tool that is appropriate to the scenario that is under study so that it can be clearly demonstrated that the facilitation and intervention process has been worthwhile. This variable should be understood as the point at which the questions of how far the proposed initiative can achieve a true social transformation and how it solves the posed innovation challenge in terms of measurable and verifiable impact, are answered.
- Economic sustainability: this variable refers to the approach of a financing and survival strategy model that guarantees the long-term financial sustainability of the project. Many social projects start with resources from third-party donations without proposing medium-term self-financing strategies that condemn them to failure due to lack of resources. In other cases, the lack of transparency in the management of resources discourages the participation not only of large benefactors but also of ordinary people who can support through microcredit or strategies such as crowdfunding.
- Type of innovation: not all types of innovation are relevant to any need, each case is different and it is necessary to define the type of innovation that is intended to be developed, encompassing the initiative or project that has been proposed, in order to assist in the approach and development strategy of the project.
- Intersectoral collaboration: this variable refers to the definition of the different stakeholders who will come into contact with the initiative and the exchange of values or capital that they will have with the project. In many of the social innovation projects, the participation of public or governmental entities guarantees the impact and scope of the project, however, the involvement of the business ecosystem enhances the implementation of the different initiatives that are achieved with the development of the social innovation project.
- Scalability and replicability: this variable refers to the possibility of growth of the initiative in the context of origin, or in others with similar ecosystem conditions. The course of action of this variable consists in the vision of the project team with the ability to identify the characteristics that can be replicated in other scenarios or those that can allow the initiative to have a global growth starting from the local. Taking into account that the systemic change is the main objective, the challenge is to develop initiatives that can multiply.

3. Conclusions

The conclusions provided by the work that was carried out with the Design Thinking method applied to the SMEs in Colombia, allowed to define future aspects in the treatment and investigation of the information that was obtained from the scenario of Colombian companies:

- Currently, there are programs to promote innovation and creativity in companies that are powered by the Chambers of Commerce of each of the regions with own and government resources.
- Some entrepreneurs participate in awareness programs to generate an innovative culture, however, when they return to their companies, the paths or steps to apply the knowledge that was acquired are not clear, reason why a model linked to methodologies and tools that could facilitate this task would be very useful.
- 96% of the companies are categorized as micro, small or medium enterprises; their assets vary from less than 500 legal minimum wage, or SMLV (for its abbreviation in Spanish), between 501 and 5000 SMLV, and between 5001 and 15000 SMLV, respectively, so due to their size, they are not usually willing to invest in innovation since the perception of risk caused by the uncertainty that is generated in this type of process as a result of the lack of knowledge about the subject is too high.
- 80% of Colombian companies are family businesses, businesses that have been passed down from generation to generation and that show a strong resistance to change, especially when it comes to implementing new models and methods.
- Although there are experts who are acting as consultants in innovation for companies and organizations, their work has reached to the proposal of European and North American models that do not entirely fit the Colombian context and that in the majority of the cases remains in the formulation and dies in the implementation due to the lack of competencies of the profiles that must carry out this task.

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Integration of the ethical dimension in dentistry curricula

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Abstract

The inclusion of the ethical perspective in the curricula of professions related to healthcare is becoming more frequent, especially in the field of Medicine, Nursing, Pharmacy and Biology. In Dentistry similar advances have been developed although more limited. Aspects such as the situation of vulnerability of the patient, the possibility of rejecting a recommended treatment, the fairness of the service provided, the free competition among health professionals, the rise of non-traditional therapeutic treatments, etc., are common in public and private oral healthcare centers. We consider essential to redesign the curricula of the dentistry degree to include study subjects with an applied ethical focus. We propose a course design implemented for more than eight years at the Universitat Internacional de Catalunya structured in three main subjects that address the decision making process and its practical application to real situations, as well as methods to assess the acquisition of these competences. The contents focus on three separate domains with distinct parameters drawn from practical cases and their foundation, basic principles of general ethics and applied ethics. We conclude that the design presented achieves its objectives and provides future professionals with ethical competences especially useful in dental practice.

Keywords: ethics, dentistry, course design, educational competences.

Introduction

The analysis of ethical competences in university curricula begins to be frequent in all professional fields (Beigy et al., 2016). Moreover, there are areas where the ethical and moral dimensions of any action become essential, as it is the case of healthcare related fields. Thus, the incorporation in the curricula of ethic content has not been uncommon (Little et al., 2011), although it often is embedded in a cross-curricular model in various subjects. This model makes difficult to assess its value and outcome and, in fact, there is a risk to disappear and dilute the ethics curriculum within other contents, decreasing its singularity. At present, schools and faculties seem to gradually have gained in moral sensitivity, perhaps driven by current changes in social paradigms and advancing new technologies (Airth-Kindree & Kirkhorn, 2016).

Even so, there remain healthcare areas where the overall curricula did not seem to have undergone these model changes so radically. Probably because of the nature of the clinical act, which seems limited to very specific and localized actions upon the human body, e.g. dentistry, physiotherapy, podiatry, dietetics amongst others. In these cases, it the basic principles of traditional medicine may seem to address any type of ethical conflict which may arise. However, it is clear that this perspective is no longer sustainable (Rule & Veatch, 2004). Dentistry, a health profession inserted in a dual system of public-private health care providers, generates situations, scenarios and problems that students and new practitioners have seldom addressed during their training: confidentiality of a patient victim of abuse, justice in insolvent patients, poorly informed consent delivery or satisfactory medicine outputs (Ozar & David, 2002). In addition, the requests of new, over-informed patients owing to the accessible digital networks and Internet, together with a greater awareness of healthcare rights are forcing practitioners to acquire legal and communication skills that have hitherto been unnecessary. Furthermore, the advent of an established “medicine of desire” taking advantage of new aesthetic-driven technology, it is not strange the increasing requests for advice to address particular situations within the dentistry practice looking for more precise solutions (Plasschaert et al., 2005).

Usually, these scenarios were resolved by the competent professional association or Professional College, which remain the reference institutions for discussion and consultation. However, their assessment may fall short upon the growing sensitivity towards the patient’s views, a dimension that is not usually reflected in codes, laws or protocols. This dimension includes the patient concept of freedom to accept a specific treatment, his or her perspective of justice upon the assessment of the results, the idea of "good" when confronting a risky intervention, or the sense of dignity when he or she claims for his rights (Rule & Veatch, 2004).

These highly dynamic situations have generated a reaction with growing interest for the ethical dimension of dental procedures which do not aim at the clinical performance itself,

but focus on discovering the importance of the patient, not only as a patient who desires a result, but as an individual who the dentist seeks to aid. This paradigm shift makes necessary to include in the curriculum a series of specific theoretical concepts coupled with practical skills development to acquire the basic ethic assessment competency. These training require curricular and instructional design planning: it does not arise spontaneously, cannot be improvised and it may not be easily recognized within other areas of the curriculum. However, the clinical practice training may facilitate its integration and implementation as seen in other healthcare fields (Segarra & Gómez, 2014). We consider essential the design an inclusion of disciplines that provide tools to facilitate inquiry about ethical aspects of clinical practice and enhance their implementation (Sharp et al., 2005; Segarra & Gómez, 2014).

1. Description of the curriculum

Current ethics curriculum for the Dentistry Degree delivered at the Faculty of Dentistry of the Universitat Internacional de Catalunya (Barcelona, Spain) was initiated in its present configuration in the academic course 2009-2010. It is structured with three courses delivered along three semesters: General anthropology and General Ethics during the first and second semester of the first year and Applied Bioethics during the second semester of the second year (Table 1). The student effort equivalence based on the European Credit Transfer System (ECTS) is as follows: General Anthropology consists of 60 ECTS, General Ethics consists of 30 ECTS and Applied Bioethics consists of 60 ECTS. An ECTS credit is equivalent to 10 hours of class plus 15 to 20 hours of student work, approximately.

The first subject, General Anthropology deals with the basic features the human being and the human doing and seeks to establish a common language that facilitates dialogue to establish the fundamental principles related to life. The second subject, General Ethics, aims to establish a set of criteria to facilitate the critical analysis and capacity to assess routine, standardized everyday situations. Last, the third subject, Applied Bioethics, systematically develops the specific aspects of healthcare ethics and fosters the acquisition of the necessary skills for decision making.

This sequential structure of the ethics curriculum allows gradual introduction and integration of concepts of three separate domains with distinct parameters:

- a) A theoretical aspect, constituted by the contents of basic anthropology and ethics concepts developed out of different declarations, codes, reports, legislative bodies and philosophical studies common in Western culture. It especially includes the conceptual developments since the middle of XX century but without leaving out the large European tradition of previous centuries (MacIntyre, 1981; Jonsen & Toulmin, 1988; Beauchamp & Childress, 2013; ADA, 2016; Morales et al., 2016; CED, 2017)
- b) A practical aspect, which is delivered through the method of the case. These cases offer the students real-like situations and scenarios in routine practice and require reflection

and implementation of the most basic professional qualities, fundamentally prudence (Rule & Veatch, 2004; Macpherson et al., 2017b).

Table 1. Distribution of curricula content of Anthropology, Ethics and Bioethics subjects in the Dentistry curriculum (MC: master class, CM: case method)

GENERAL ANTHROPOLOGY Year I - Semester I 60 hours (36 MC + 24 CM)	GENERAL ETHICS Year I - Semester II 30 hours (15 MC + 15 CM)	APPLIED BIOETHICS Year II - Semester II 60 hours (24 MC + 36 CM)
Unit 1: Anthropology 1.1. Philosophical knowledge 1.2. Scientific knowledge 1.3. Other Models of Knowledge 1.4. Anthropological reductions Unit 2: Human life 2.1. Biological sciences and life 2.2. Life and its evolution 2.3. The genesis of the human being 2.4. Nature, culture and person Unit 3: Corporeality 3.1. Body and corporeality 3.2. Conceptions of the body 3.3. Phenomenology of the body Unit 4: The existential dynamics 4.1. The appetitive dynamics 4.2. The cognitive dynamics 4.3. Theoretical reason Unit 5: The notion of person 5.1. Historical tour of the term 5.2. The dignity of the person 5.3. Dignity and human rights Unit 6: Human freedom 6.1. Notion of freedom 6.2. Areas of freedom 6.3. The vital project of man Unit 7: The relational man 7.1. The dialogical structure 7.2. Interpersonal Relationships 7.3. Respect for diversity Unit 8: The technological world 8.1. Concept of technique 8.2. Historical development 8.3. Anthropological Perspective Unit 9: Vulnerability 9.1. Pain as a vital phenomenon 9.2. The cause of pain 9.3. The sense of pain 9.4. The essence of pain Unit 10: Death 10.1. Human Death 10.2. Attitudes of man facing death 10.3. Longing for living 10.4. Forms of evasion	Unit 1. Foundation of Ethics 1.1. The moral phenomenon 1.2. Meaning of 'ethics' and 'moral' 1.3. The basis of ethical criteria Unit 2. Human action 2.1. Underlying principles of acts 2.2. Ethical components of acts 2.3. Effects of acts 2.4. Cooperation in evil Unit 3. Moral Choice 3.1. The process of choosing 3.2. Degrees of freedom 3.3. Coordinates of freedom Unit 4. Law and rights 4.1. The discovery of natural law 4.2. Characteristics and contents 4.3. The moral dispositions 4.4. Human rights Unit 5. Human Conscience 5.1. Ethical or moral Conscience 5.2. Modalities of Conscience 5.3. Principles of action Unit 6. The virtues and values 6.1. The terms "value" and "virtue" 6.2. The fundamental virtues 6.3. Temperance and Strength 6.4. Justice and Prudence Unit 7. Ethics of social life 7.1. Fundamental principles 7.2. Distinction morality-legality 7.3. Racial/sexual discrimination 7.4. Physical integrity. The violence Unit 8. Ethics of friendship 8.1. The dignity of the person 8.2. Friendship as love-affection 8.3. Integration of affection and love Unit 9. Ethics and the media 9.1. The communication 9.2. Information 9.3. The lie as manipulation 9.4. Respect for privacy. Unit 10. Professional work 10.1. Professional relationships 10.2. Rationality of duty in work 10.3. Employers and employees	Unit 1. Origin and development 1.1. Definition of Bioethics 1.2. Brief historical overview 1.3. Models of foundations Unit 2. Foundations of Bioethics 2.1. Need for bioethics 2.2. Ethical Concepts of Bioethics 2.3. Dentist-patient relationships Unit 3. Ethical decisions 3.1. Analysis of moral decision 3.2. Decision-making process 3.3. Application to healthcare praxis Unit 4. Beginning of human life 4.1. Human sexuality 4.2. Procreation and Reproduction 4.3. Genetic manipulation 4.4. Embryo experimentation Unit 5. End of human life 5.1. Palliative care 5.2. Death diagnosis 5.3. Sedation and Distanasia 5.4. Euthanasia and Assisted Suicide Unit 6. Dental bioethics 6.1. Ethics and Medical Records 6.2. Informed Consent 6.3. Professional secrecy 6.4. Conscientious objection Unit 7. Legal bioethics 7.1. Legal responsibility 7.2. Ethics Committees 7.3. Limits on interventions 7.4. Ethical-deontological codes Unit 8. Research Ethics 8.1. Experimentation with humans 8.2. Experimentation with animals 8.3. Fraud in experimentation 8.4. Fraud in publication 8.5. Conflict of interest 8.4. Clinical Research Committees

Source: Universitat Internacional de Catalunya (2017)

c) A communication aspect. This domain aims to train the ability to critically assess the various moral situations. It is implemented in the classroom and requires dialogue and exchange of positions, with certain pedagogy ability to explain humanistic subjects in a rational and orderly manner avoiding stereotype emotions and responses (Zemel & Miguel, 2012).

All these three domains/features are present in each session along the delivery of the program of each subject throughout its respective semester. The program ends with a series of

assessments to evaluate the acquisition of content and skills. The assessment is carried out using diverse tools (Loike et al., 2013) including multiple-choice tests, oral exams, case resolution presentations (Macpherson et al., 2017a) and thematic questionnaires matching various levels of Bloom's and Fink's taxonomies of knowledge shown in Table 2 (Segarra & Gómez, 2014).

Table 2. Levels of Learning

Bloom's taxonomy of learning (hierarchical)	Fink's taxonomy of significant learning (non-hierarchical)
Evaluation (highest level)	Foundational knowledge
Synthesis	Application
Analysis	Integration
Application	Human Dimension
Comprehension	Caring
Knowledge (lowest level)	Learning how to learn

Source: Segarra, I & Gómez, M (2014)

2. Discussion and limitations

At present, the eight year cumulative implementation of the ethics curriculum structured in three semesters has gathered encouraging aspects as well as a variety of difficulties in the implementation.

Amongst the several aspects regarding the implementation of the ethics curriculum has contributed positively to its implementation and integration within the dental Degree (Macpherson, 2016; Morales et al., 2016). The sequence and initiation of the ethics curriculum in the first semester of year one and followed in year 2, has provided a relatively humanistic environment and context for the delivery and discussion of the topics of interest. Furthermore, since the initial training steps a healthcare outlook was generated which set the stage for subsequent years of the degree. This clearly has facilitated integrating the concept of person within the clinical practice in upper semesters of the degree providing a larger perspective of the patient with his or her multiple variables, circumstances and problems (Pandya et al., 2016)

Thus, consistency in personal and professional decisions has been fostered and validated in preliminary studies (Morales et al., 2016; Macpherson et al., 2017a). The initial theoretical reflection on moral concepts and the coherence with which the dilemmas are raised in both General Ethics and Applied Bioethics facilitates critical evaluation of the ethical questions in a larger perspective (Macpherson, 2016).

The integration in the curriculum has also fostered the ability and capacity for critical analysis and subsequent judgment of diverse situations (Macpherson et al., 2017a). This assessment

included quickness, also with legislative basis which showed a greater maturity in the trainees for professional exercise. This feature was also manifested in an enhanced capacity for dialogue among students, openness to understand diverse and distinct attitudes of individuals or communities, including patients, colleagues and institutions (Segarra & Gómez, 2014; Rezaee & Mosalanejad, 2015; Macpherson et al., 2017b).

In this sense, sensitivity to detect situations requiring attention and non-clinical solutions was enhanced. We suggest that the main reason for the increased ability to identify this kind of scenarios is due to the spiral approach to teaching and learning of the ethics curriculum. The presentation and subsequent reviews and insistence on the human factor in each intervention seems to raise a deeper awareness towards the patient's problems. This awareness also enhance the individual reflection on the proper way of acting and react upon the different situations presented. This was portrayed during the case study sessions along the academic year (Macpherson, 2016).

Nevertheless, the students' resistance to internalize moral problems and to overcome the tendency to superficial criticism are significant difficulties. Ethical thinking does not follow a mechanistic, automatic or protocol-based approach to problem solving unlike technical interventions. Thus, the internal rationalization of the conflict seeking depth away from a light approach becomes a barrier for many students to properly contextualize the solution without applying a mechanical protocol.

In addition, difficulties regarding the assessment and evaluation of knowledge acquisition are also present. First, the assessment of the narrative analysis elaborated by each student may incorporate possible biases in the evaluation, which could prevent an accurate and standardized comparison across the trainees of their acquired knowledge (Morales et al., 2016). Second, it is a challenge to achieve equitable participation of all students as well as to avoid their anonymity in large groups. Thus, efforts to create an environment that encourages participation should be a high priority amongst the faculty and teaching staff.

3. Conclusion

The ethical reflection in Dentistry is acquiring increasing importance, not only due to the diversity of problems that arise, but also because of the possibilities offered by the new technologies for patient self-information process. The moral dimension is essential to avoid falling into distorted views of current healthcare professions: defensive medicine, medicine of desire or mercantilism. The social repercussion of dentistry as a basic constituent of the dignity of all individuals demands from the practitioner a humanistic training beyond and additional to the technical disciplines. Moreover, we consider essential to include specific and cross-sectional approaches in their ethics training that may ensure the ethical dimension of their whole dental practice.

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Groundwater management conflicts: learning environmental and ethical responsibility

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Abstract

Groundwater management is a complicated issue because it must consider a wide range of different interests from environment sustainability to economic development. The objective of this work is to improve the environmental and ethical responsibility of students of the Bachelor Degree in Environmental Sciences. Two case studies are analyzed: 1) Tablas de Daimiel National Park (Castilla La Mancha, Spain) and 2) Alto Vinalopó (Comunidad Valenciana, Spain). To dynamize the case studies we used collaborative work tools integrated in a learning management system (LMS). This experience is part of an Educational Innovation and Improvement Project for the development and evaluation of the key transversal competence ethical, environmental and professional responsibility in the areas of engineering and life sciences through collaborative TICSs of the Universitat Politècnica de València

Keywords: *water management, key competences, environmental sciences, learning management systems, wiki, forum.*

Introduction

Competences in Education are instruments to adapt education to real work requirements. Education in modern societies provides the work force with the qualifications and skills to cope with the challenges of companies (CompAssess 2015). Transversal competences are skills related to personal development useful in multiple disciplinary areas (González and Wagenaar 2003). They respond to those competences that are key and transferable in relation to a wide variety of personal, social contexts, academics and work throughout the life. Transversal competences constitute a fundamental part of the student's professional and training profile (Universitat Politècnica de València 2015).

In the last years, the Universitat Politècnica de València (UPV) (Spain) has developed a new policy to accredit transversal competences in their student's curricula. In the UPV in total thirteen competences have been defined: 1. Understanding and integration; 2. Application and practical thought; 3. Analysis and resolution of problems; 4. Innovation, creativity and entrepreneurship; 5. Design and project; 6. Teamwork and Leadership; 7. Ethical, environmental and professional responsibility; 8. Effective communication; 9. Critical thinking; 10. Knowledge of contemporary problems; 11. Lifelong Learning; 12. Planning and time management; 13. Specific instruments. Moreover, rubrics to assess these competences have been defined. For instance, the rubric for the transversal competence "Ethical, environmental and professional responsibility" (Fernández March et al. 2017) includes a set of learning skills, such as: (1) to question reality and to be aware of the concepts and values from which it is built; (2) to critically analyze one's own and others' judgments about reality, and be aware of the consequences and implications of these; (3) to understand the need to assess the consequences of professional actions in terms of social, environmental and economic repercussions and to act accordingly; (4) to design, organize and implement specific professional actions that respect the social, economic and environmental environment; and (5) to coordinate and evaluate integral actions in the professional field, respecting the social, economic and environmental environment.

Teaching of ethical responsibility in higher education can be approached in different ways. On one hand, the introduction of a specific subject of ethics in the curriculum, and on the other hand introducing moral dilemmas of real cases in different subjects that are present in the current curricula. These dilemmas would be solved in the classroom through debates and deliberations. In engineering studies, the most common way is the second one, being able to find quite a number of cases such as those reported by (Herkert 2005; Simonson 2005; Bouville 2008; Bucciarelli 2008), (Giménez Carbó 2016) goes further in her Master's thesis and studies in depth the ethics in Civil Engineering, and how to introduce this competence in the studies of such Engineering. According to the author, the introduction of a specific subject of ethics in the curriculum should not be the solution because this means to deal with the

issue in isolation. What she proposes is to articulate an applied ethics based on Adela Cortina's model (Cortina 1996).

Environmental competence refers to learning about the environment. Environmental competence has been defined as 'people's ability to deal with their immediate surroundings in an effective and stimulating manner' (Steele 1980). It has different components: perceptual, cognitive, affective, behavioral, and personal. The perceptual component involves the ability to identify and prioritize the most relevant aspects of the environment. Cognition functions to organize the most important aspects related with the environment. The affective component refers to both positive and negative emotional responses to characteristics of the environment. The behavioral element includes the responses, strategies, and behaviors. All of these aspects are influenced by the individual motivations, personality characteristics, expectations, cognitive styles, coping strategies, past experience, etc. Environmental competence is required for effective human (and nonhuman) functioning. Humans begin to achieve environmental competence at birth, and it is an ongoing learning process throughout the life (Pedersen 1999). Most of it is learned informally, although it can be learned formally in the classroom (Robinson and Wolfson 1982). Field trips lend themselves particularly well to teaching environmental competence (Martin, Falk, and Balling 1981).

As with traditional learning, environmental competence is learned within an environmental context. In this case, the environment is both the subject matter and the milieu. Some programs have taught young students to design effective environments for classrooms and other. Risk identification needs correct tools to properly link causes and effects and these should be taught in our subjects. Topics that must be considered are, among others, the nature of the activity (e.g. natural park, wetlands, etc.), its surrounding environment (ecosystem components), the effectiveness of the safeguards and management systems put in place to minimize chance of failure of equipment and processes, where to set the limit of the system to be examined (Harding 1998).

In this paper, a practical experience to develop the "ethical, environmental and professional responsibility" in the subject "Groundwater management" is presented. The objective is to show the usefulness of two different collaborative work tools, forum and wiki, to dynamize the tasks that help to acquire and improve this key competence.

1. Groundwater management

Groundwater is an essential resource for all living beings and the environment on planet earth. It provides over 90 % of accessible freshwater on the planet (Diop 2008). Half of the world's drinking water and nearly half of irrigation water for agriculture come from groundwater.

However, historically, groundwater has been out of sight and thus underappreciated (Jakeman et al. 2016). At the begins, groundwater management was just concerned with how much water was stored in the aquifers and how much could be extracted. But contemporary groundwater management has moved beyond and today it is recognized that integrated, effective and efficient groundwater management has to involve different disciplines such as climate science, ecology, socioeconomics, environment, public policy and law, as well as hydrogeology (Jakeman et al. 2016). Jakeman et al. (Jakeman et al. 2016) define the “thinking beyond the aquifer” approach as that which considers also cross-sectoral issues. This approach must deal with multiple stakeholders and decision makers with competing goals.

This article explains the educational experience developed in a Bachelor Degree in Environmental Sciences to prepare future technicians to deal with this complex reality. The Bachelor Degree in Environmental Science Degree is taught in the UPV. The experience analyzed in this article is developed in the fourth academic year. The subject involved is “Groundwater management” an elective subject, taught in English. The last five years there has been 22 enrolled students as average, and 40% on average were Erasmus students.

Each year, students have to deal with real case studies to analyze groundwater management conflicts and to propose solutions. Educative innovation experiences have been already developed in previous years (Sebastiá-Frasquet et al. 2016). The present academic year 2016/17 a new experience has been developed supported by digital collaborative work tools. Next sections describe the case studies and the methodology applied in each one.

1.1. Case study 1: Tablas de Daimiel National Park

There is a common and false perception that groundwater and surface water are separate and disconnected resources. Fortunately, there is a growing awareness of the crucial connectedness of freshwater systems (Villholth and Giordano 2007). The Tablas de Daimiel National Park is a paradigmatic example of the devastating effects on surface ecosystems.

Las Tablas de Daimiel National Park (TDNP) is one of the most important semiarid wetlands of the Mediterranean area, located in central Spain. TDNP was declared as a Biosphere Reserve by UNESCO in 1981, and since 1982, is also listed under the Ramsar Convention. Mediterranean wetlands are highly dependent on groundwater dynamics because of the climate conditions in this area (Aguilera et al. 2013). TDNP used to be a discharge area for the Mancha Occidental aquifer, but the depletion of groundwater levels due to intensive pumping for irrigation all through the Mancha Plain caused an inversion of the hydraulic gradient. (Llamas and Martínez-Santos 2005) named the “silent revolution” the spectacular

increase in groundwater development for irrigation that took place during the last half of the XX century in most arid and semiarid countries. This development was carried out mostly by personal initiative of farmers searching greater benefits. These farmers have been frequently incentivized by soft loans or energy subsidies from governmental agriculture departments. (Lamas and Martínez-Santos 2005) describe this Silent Revolution as a market-driven phenomenon, moving from low-value crops to cash crops.

A series of corrective measures have been implemented in order to mitigate negative effects on the wetland, such as water transfers (diversion from the Tajo-Segura transfer), dams' construction inside TDNP, emergency wells and legal and administrative measures among others (Castaño-Castaño, Martínez-Santos, and Martínez-Alfaro 2008). However, these measures responded to emergency patch-ups, rather than measures based on a deep knowledge of the system, and, consequently, had limited efficiency (Sánchez-Carrillo and Álvarez-Cobelas 2010). Among the public policy measures that have been implemented in the area to address the conflict between agriculture and wetland protection, the most recent was the Special Plan for the Upper Guadiana (SPUG) approved in 2008. The objective of this Plan was to comply with the Water Framework Directive (de la Hera and Villarroya 2013).

1.1.1. Wiki

The Tablas de Daimiel National Park is an example of groundwater management conflicts with lots of scientific literature discussing them. Thus, students must do a complete literature review and compilation as a first step.

The instructor created a wiki in the learning management system of the UPV. This wiki initially just contained the document structure, meaning the title and subtitles of the main sections. Students worked in pairs to develop the contents of an assigned section. In a second round, each student's pair had to constructively criticize the provisional wiki contents. This allowed students to detect incomplete information or incoherencies. Then, the final wiki was built up in a collaborative effort and searching consensus.

1.2. Case study 2: Alto Vinalopó

In Spain, water users are grouped into water users' communities. These communities are basically formed by water irrigation communities and other water users such as councils.

The Alto Vinalopó General Users' Community is located in Villena (southeast Spain). This community manages the following resources: 24 surveys in the Júcar River Basin with a capacitance of approximately 23 Hm³; the effluent from the Villena Wastewater Treatment Plant; freshwater from the Vinalopó River and water diverted from the Júcar-Vinalopó

transfer. Thus, this users' Community is a perfect example of integrated water resources use, as they use surface water, groundwater, treated wastewater and even water from an inter-basin transfer.

Groundwater management conflicts in this region are exacerbated because the different development models between coastal and inland cities. While coastal cities have based their development in tourism, inner cities have focused on agriculture and to a less extent in industry. The tourism model of the coastal cities is based on a sun and beach product, with intensive urbanization processes for either second homes or renting, that poses a great pressure to all water resources, including coastal waters (Sebastiá and Rodilla 2013). This is the case of Benidorm city, for instance.

As had happened in many other places (Jakeman et al. 2016; Llamas and Martínez-Santos 2005) water rights were granted by state administration without a good knowledge of groundwater resources and their renewal rates. Those water rights, allowed the development of economic activities both in inner and coastal areas, thanks to the enormous inner aquifers potential. However, nowadays there are areas with an annual decrease in the piezometric level higher than 7 m (personal communication Alto Vinalopó General Users' Community).

1.2.1. Forum

As in the previous case, the students work started with a compilation of information from the study area. However, in this case there is not so much scientific literature, and sources of information were more varied (water monitoring networks, administration websites, etc.). This research work was complemented by a field visit to the Alto Vinalopó General Users' Community. During this visit the managers showed the infrastructure to the students and explained all issues related to the water management. Students had to take advantage of this visit also to get the answers to a list of complex question given by the teacher in advance. This questions were related to all cross-sectoral issues, bearing in mind the "thinking beyond the aquifer approach".

After the field visit, a forum conversation was opened in the learning management system of the UPV to answer the questions proposed by the instructor before. The questions were designed taking into account the different levels of acquisition of the transversal skill "ethical and environmental responsibility" (Fernández March et al. 2017), which were: 1) Level I: understand the need to assess the consequences of professional actions in social, environmental and economic impact, and act accordingly 2) Level II: design, organization and implementation of integrated actions friendly to the social, economic and environmental framework 3) Level III: coordinate and evaluate integrated actions in the professional field, respectful with the social, economic and environmental framework.

The instructor is the forum moderator. In addition to raising the baseline issues, she redirects the debate when necessary, asking for additional information, encouraging students to correct, or complete, incorrect information, and correcting it if necessary.

2. Results

Figures 1 and 2 show the appearance of both the wiki and the forum.

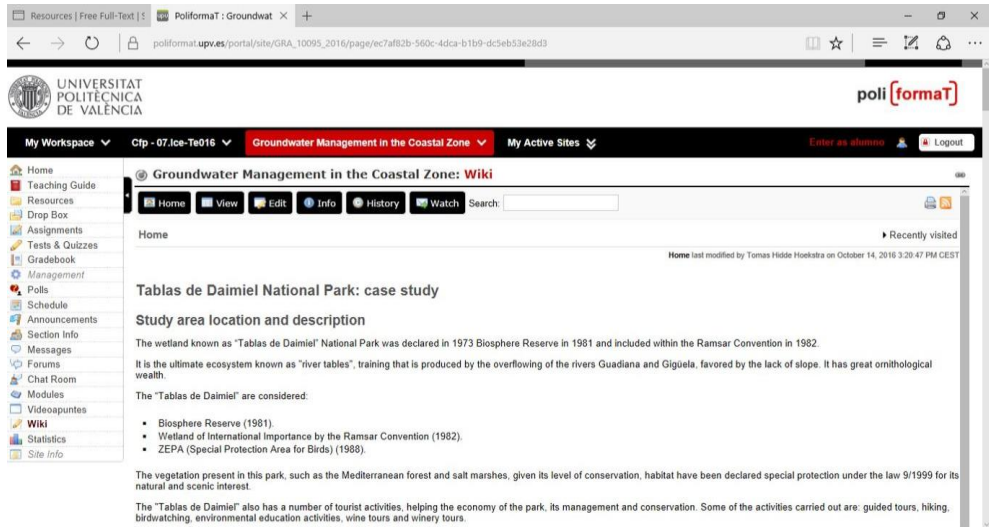


Figure 1. Wiki for the Tablas de Daimiel National Park case study

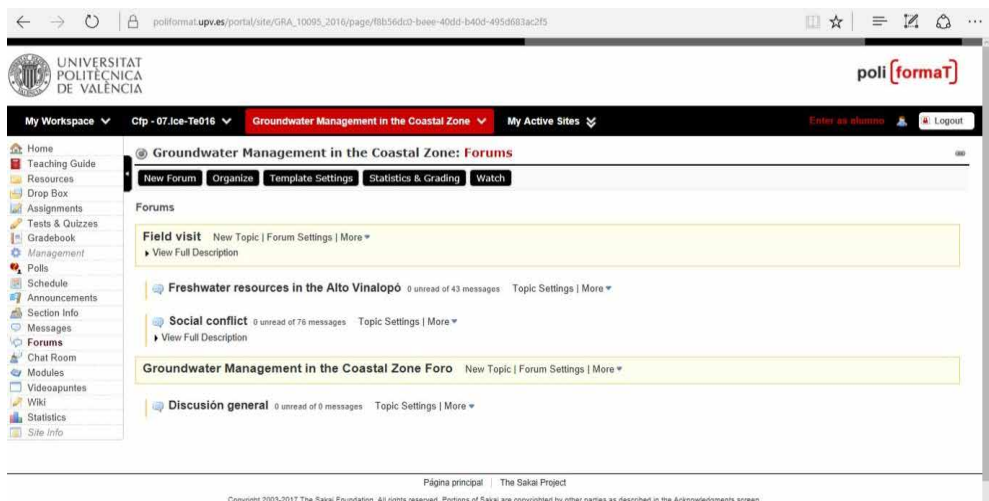


Figure 2. Forum for the Alto Vinalopó case study

The forum statistics show a total of 823 events carried out by the students and 185 by the instructor. The following actions are considered as an event: Create New Thread, Read Thread, Reply Thread, Grade Forum, Create New Thread, Review Thread, Delete Thread, Delete Thread, Delete Thread. Of all these events, the students only read threads of conversation, or answered a thread.

In the wiki, students worked in pairs, while the participation in the forum was individual. Then, the possibility to evaluate the ethical and environmental responsibility was more accurate with individual work. All students participated in the elaboration of wiki contents, however, as they worked in pairs this could be not completely true. In the forum a 16% of the students did not reply any thread, corresponding to 3 students, from 19 enrolled. So, the competence of these 3 students could not be assessed. The main cause argued by the students for not participating, was shyness.

Both tools, wiki and forum, proved to be useful for working the ethical and environmental responsibility. The approach with real case studies allowed the students to work with real situations and cope with complex problems. They had to do a great effort to be critical with management decisions taken by the administration and to comprehend the historical context. The collaborative creation of contents in both cases, helped the students to do a critical assessment of their colleagues' work. This is key for improving their competence and for being able to evaluate it. A proposal for improvement is a third phase in the creation of the wiki that allowed to evaluate the individual work. Wiki contents are only visible to students enrolled in the subject. To improve the quality of the contents it is proposed to increase the visibility of the wiki to a wider audience. It is believed that this would make the students work harder.

3. Conclusion

Water management is a real complex issue affected by very diverse cross-sectorial issues. It is crucial that future technicians develop a wide view of the context. However, this is not an easy task. Working with real case studies offers the students an opportunity to improve their ethical and environmental responsibility when dealing with water management. Collaborative work using information and communication technology (ICT) allows to work specially on their critical vision. However, due to the complexity of factors involved (history, economics, policy, agriculture, society, etc.) it is necessary to work in several case studies to cover all aspects.

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Competence Assessment in Audiovisual Communication Degree Projects

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Abstract

The implementation of the new Bachelor degree has introduced a series of reforms, among them, a change of the learning model. This new model is based on competences. Now there is the need for applying new teaching-learning methodologies in order to teach and assess these competences. This research shows, under the frame of The European Higher Education Area, how students are enabled to acquire and develop competences by carrying out a multidisciplinary digital project. At the same time, it devises an assessment, which may allow for evaluating these competences. To that end, a pilot experience was devised for students of Audiovisual Communication B.Soc.Sc. at the Higher Polytechnic School of Gandia, Spain. The aim was to lay out a transversal project between various subjects for implementing an interdisciplinary approach by coordinating curricular contents. Not only were methodological strategies for the teaching-learning model coordinated but the assessment of different subjects within one only project as well. This way the constructive alignment is improved. Regarding assessment, three levels were proposed: to evaluate knowledge students have acquired, to evaluate dynamic organization and to assess of a digital projects. The aim for students is focused on developing a complete and interdisciplinary project. Starting from the resources offered by each subject, the student receives a global view of the project and through the acquired knowledge, they are enabled to combine that input and present a finished digital project.

Keywords: *Audiovisual Communication, assessment, rubrics, digital projects.*

Introduction

Since the Bolonia Declaration¹, a series of changes have been produced in the higher education system that requires the implementation of new teaching methodologies. These methodologies are oriented towards evaluating the student's work and effort dynamics. The teacher acquires new roles in his teaching tasks for guiding the student in the learning process. With the teaching model that the European Higher Education Area (EHEA) raises and the generalised use of information and communication technologies (ICT), the teacher goes from being a knowledge transmitter to becoming an advisor and facilitator of her students' learning processes. We are talking about providing the needed resources and criteria for the student to know how to look for, find and select the information he needs for transforming it into knowledge. Furthermore, the teacher must fulfil study motivation, facilitation and incentive functions. He must favour the cooperation between students and offer a more personalised assistance. The ultimate aim is that the student builds, in an active and autonomous way, her own knowledge from the information that the teacher provides to her, an information that the student herself seeks and finds, helped by other classmates or following her own criterion. (Delgado et al. 2005:17).

For the application of these new methodologies, universities had to change their educational models into others centred in the student's learning, which means a change of paradigm in the educative field. This change tries to centre the objectives of the degrees and their subjects, not only on the mere accumulation of knowledge, but also on the professional skills and personal attitude that allow the graduates to occupy the place they should in the working world and, in general, in the society.

In this new model, the university must prepare students for the demands of a changing society, this way increasing their employability. Therefore, the student is expected to learn in a competency system. (Bartram & Roe, 2005), (Villa & Poblete, 2007). It is necessary to establish a teaching system that allows an all-round education for the students, and adapts to the needs of the society and the competitive labour market. This requires specific competency profiles that allow a constant learning.

The Tuning Educational Structures in Europe Project defines competency as "a dynamic combination of attributes, in relation to the knowledge, abilities, attitudes and responsibilities that describe the results of learning in an educational programme, or what students are able to prove at the end of an educational process."² (González, 2003:280). In this competencies system the learning responsibility falls on the student, who does not solely focus on acquiring knowledge, techniques, attitudes, procedures and values, but on applying them in an adequate manner.

1 Bolonia Declaration, 1999. Downloaded from <https://goo.gl/de9Kan> (Consulted on 12-06-2017)

2 Own translation.

As Legendre (2007:172) underlines, “what matters is not only the types of mobilised resources, but the way the individual combines them to respond to an objective, adapting himself to the demands as well as to the restrictions of the situation.”³ That is the reason it is vital that the student is able to work autonomously. He handles knowledge as well as assumes competencies, internalises them, is able to apply them taking into account any considered problem and its context. The student knows what processes to handle and apply depending on her previous experience, making it possible to entirely develop these competencies.

This contextual nature of the competency creates a conscious and reflexive learning process. As the students learn to mobilise and combine resources, they also learn to solve more and more complex situations. As a result, they will eventually become professionals with a high adaptability and problem solving skills, which is exactly what the current working world demands.

Another relevant question is the assessment of these competencies (Gullickson, 2007). The evaluation serves the student to be conscious about his development, to get feedback and to be certified when it comes to proof himself before his potential employers. Evaluating these competencies involves the observation of their whole elements. Tardif (2006) calls these elements “learning resources”, since process and resolution must be evaluated (Tardif, 2006). It corresponds to the teacher the assessment task, considering that he monitors the whole process and instructs the student to achieve her goals.

The evaluation of competencies is based on the queries on the different evidences we have within reach. With this information, it is possible to determine if the students have succeeded in the development of their competencies and the correspondent mastery.

It is this way that the teacher must link results with evidences. The result is a grade justified on the outcomes of the competencies learned. Rubrics are used to define indicators. These constitute a helpful source for the teacher, as well as for the student, to determine what are the concepts to work on (Montgomery, 2000), (Villa et al. 2011). Hence, we must consider three levels of assessment: the student assessment (the knowledge that the student has obtained), the solutions laid out in context (the student’s dynamic organisation), and the assessment the project in its whole, from its conception to its final implementation.

Our experience comes from the formerly commented premises: the education delimited in the EHEA, a learning system based on competencies, mobilisation of knowledge and its combination for problem solving; the contextual nature, the assessment through rubrics and, above all, the student’s autonomy in her development. With this research work, we expect to observe how students are able to acquire and develop competences when carrying out a

3 Idem.

multidisciplinary project, and hence to establish a coherent assessment of the aforementioned competencies.

1. Material and methodology

The Project-Based Learning (PBL) is the favoured teaching-learning method for this experience. With this methodology, the process is complete: students create a final product starting from their own ideas and finishing with their execution on praxis (Mettas & Constantinou, 2007). In this context, students pursue solutions to real problems, generating questions, debating answers, designing strategies, establishing conclusions, communicating ideas to each other... improving their own products and processes (Blumenfeld et al. 1991). This methodology forces the student to plan, create and evaluate a project from the development and application of the acquired skills, of their effective usage. The teachers offer the possibility to develop a final course work where all subjects are involved, a project where every subject contribute with independent competencies and assessment, yet interconnected when students face the challenge. The rubrics must serve as guidance for establishing evaluation criteria. The purpose of a transversal project is to progress in the interdisciplinary approach. It favours the coordination of the curricular content, and of the teaching-learning methodological strategies in each subject. All in a single project.

Regarding the student, the purpose of this task is centred in allowing her develop a complete, interdisciplinary product out of the resources each subject contributes. The student should understand the complete picture of the project, and from that, develop his competencies. Regarding the teacher, it is imperative to establish the value of the competencies assessment as a whole, in other words, to evaluate how the learning resources that their subject contributes help on developing the competencies.

1.1. Sample

In this research we consider a horizontal, interdisciplinary project, plus three subjects of the same knowledge area, multimedia, from the last academic course of the Audiovisual Communication B.Soc.Sc. (Higher Polytechnic School of Gandia, UPV): Video Game Workshop, Interactive Products Workshop and Graphic Multimedia Design Workshop. These subjects complement each other and share common topics that allow develop a project from start to end. As an example, creating a video game does not only require programming, but graphic elements and the design of its interactivity. Through this experience, students can put into use their multidisciplinary knowledge and combine them to create a complete project.

1.2. Description of the experience

Students are asked to create a final project, with a free topic and a professional nature. Participating in these projects is completely optional, due to the fact that the subjects involved are not mandatory neither. A student can decide if joining one, two or the three of these courses, and therefore we had to be understanding with their probable situation. However and regardless of the number of subjects they join, it is always possible for them to participate. It can occur that the student brings up a project where more than one subject intervene, or that the project is too ambitious and, because of its scope, it needs other students to participate, thus it is necessary to coordinate groups of students and subjects involved. This gives the opportunity to plan projects which functions are distributed between students, competencies can be developed, and the learning process is cooperative.

Each student can contribute with the knowledge they acquired throughout the course, specifically from the multimedia area, or from their accumulated bachelor years. This allows developing either an individual or a group project, both of interdisciplinary nature, that favours the resolution of problems in the closest to professional environments possible. Professionalism is reinforced because all of the teachers involved belong to the EPSGmedia group, a community of teachers and professionals with wide experience in the multimedia industry.

Before starting the next academic year, the teaching staff met to lay down the broad outline of the project during the semester and to agree on a work plan. First day of class, the interdisciplinary project was presented in detail to the students, from final objective to production phases, and including the rubrics that would serve to evaluate them (see table 1).

Table 1. Evaluation rubric

Defining their objectives	Defines and identifies objectives correctly	Defines but does not identify objectives correctly	Defines but cannot identify objectives	Does not define objectives correctly	Cannot define objectives
Stage of the multimedia project	Knows how to distinguish and execute the project	Distinguishes but does not execute the project correctly	Distinguishes but cannot execute the project	Does not distinguish the project correctly	Cannot distinguish the project
Obtaining information	Analyses and synthesises the information	Analyses but does not synthesise the information correctly	Analyses but cannot synthesise the information	Does not analyse the information correctly	Cannot analyse the information
Managing information	Classifies and assemble information	Classifies but does not assemble information correctly	Classifies but cannot assemble information	Does not classify information correctly	Cannot classify information
Selecting and using technology	Uses and optimises the technology	Uses the technology correctly	Uses the technology incorrectly	Knows what technology to use	Does not know what technology to use
Innovating and achieving objectives	Responds to objectives and innovates	Responds to objectives implementing improvements	Responds to objectives	Responds to the objectives incorrectly	Does not respond to objectives

Source: Giménez-López (2016).

The rubric had a perfect score of 6 points, 1 point per concept, the whole project influenced the marks 60% of each subject. Every item was explained in class, so the students would be clear about what learning process was demanded from them. Projects were personal, meaning that each student or group were free to choose their own theme (e.g. a children’s shoes shop website). Students would have to make a briefing, plan the work accordingly to the time available, and clarify the objectives (to sell shoes), needs of the clients or users (parents in need of a new pair of shoes for their kids) and the owner’s needs (to edit the content adding new models or campaigns). Having to solve these problems, questions like market competence arise. There is, as a consequence, the necessity of a research previous development.

After the students laid out their work plan, they had until the end of first semester of the academic year to present the proposal to the teaching staff. In the meantime, the subjects involved are providing the knowledge needed for the projects development. The teaching

staff reviews the proposals and make the convenient corrections for constraining their scope in a reasonable time schedule. From this point on, students can start preparing the necessary materials and tools for the execution of their projects. During this time, there are mentoring meetings with the groups to monitor the development and solving doubts. At the end of the second and last semester, students present a dossier with the final project.

2. Results

The students have responded well to this initiative. They were motivated and delivered different projects with a high educational and professional value.

We evaluated the students opinion throughout a 35-questions form, which was divided into the following blocks; learning; organisation; teacher interaction with the group; teacher interaction with the student, at an individual level; training content; and the assessment. This questionnaire was scored with a Likert scale (0 to 5), where 0 meant “completely disagree” and 5 was “completely agree” (Baray, 2006).

The survey was made online, anonymously and voluntary. 17 answers out of 23 projects were obtained. These are the insights:

- Results on the first block, “learning”: 17 students answered. Min. score 3, max. score 5. Average of 3,8.
- Results on the second block, “organisation”: 15 students answered. 7 indicated that the teachers did not coordinate correctly.
- Results on the third block, “teacher interaction with the group”: 90% stated they felt free to question the corrections.
- Results on the fourth block, “teacher interaction with the student, at an individual level”: positive reviews sum up more than 58% of the answers.
- Results on the fifth block, “training content”: 15 students answered, 50% pointed out that the class exercises did not complement each other, but 10 indicated that the projects were appropriate to the required difficulty.
- Results on the last block, “assessment: 15 out of 17 students stated they felt the evaluation reasonable and fair.

Students underlined several characteristics of this task, such as the project being “*very useful with regard to our future, because it is the order of the day*” and “*because everyone wants to update themselves to be visible in the sector. In fact, I have been offered to create a website already.*” Above all, they emphasise on “*the teachers’ interest and help they offered when needed.*” Another student focuses on “*the possibility to carry out your own projects and them being useful later, outside the academic environment.*” The students also comment that they “*feel that [they] had to carry out a higher effort and [they] had to adapt one subject to the other, which is positive because it makes you work more and better,*” it was a “*possibility to share with other classmates and it made [them] able to put [themselves] in a real life situation.*”

3. Discussion

As we can observe, this is a pilot study with a reduced number of surveyed people. This limits the validity of the results, but they can still be of great help, they are already indicators of how we can improve the constructive alignment, the competencies, teaching methods. Their answers are a valuable feedback on how to evaluate the participants.

This kind of multidisciplinary approach favours an integrating, learning process and enhances the students confidence on their work. It fosters learning through researching resources. Regarding the assessment on the solutions considered in this context, the student assumed responsibilities, faced unexpected problems and offered solutions while taking into account the points of view of different disciplines. The students learned to organise content and production schedules. We could affirm that they learned to make their own decisions, to be autonomous, acting independently and being creative and innovative. The student has used the learning resources to develop her competencies and become completely autonomous for the conception, design, implementation and development of her product. We could put into practice an assessment model where different subjects assess different aspects of a common project. The teachers had to coordinate the curricular content since the beginning, so they could establish the suitable rubrics for their students.

This is an experience that could be transferred to other knowledge areas. It could be used in those subjects that share a core theme. In our case it was multimedia. We believe that through this method it is possible to motivate the student, to make him see the usefulness of what he is doing. The students start having transversal tasks instead of isolated exercises for each subject during their whole academic career. It is deducible that students must establish their time dedicated to put in common all the subjects involved. In reality this is quite hard to happen. Students indicated that the teachers coordination was insufficient, and it reflects the necessity of enable a time and a space where teachers and students can debate and agree on their strategies for the development of their projects, something unavailable due to schedule incompatibilities and spaces assignment. It is vital, though, for an effective, collaborative work.

With this methodology we made the students find answers to problems common to all the subjects. They became conscious of their limitations, and motivated by the idea of making their own conceived project, yet polished in a professional way. Almost unconsciously, they develop their competencies.

The student is not only able to assimilate content, but to develop a series of quite advantageous abilities during the creation of their project.

4. Final notes

In conclusion, we could state that students have adapted well to this learning methodology. The overall feeling is positive. When facing a project from different perspectives, they realised its complexity and, at the same time, its possibilities. They might have worked more and with more intensity, yet the results compensate because they found a superior, finished work. Bringing up diverse solutions facilitate the exchange of ideas in both directions: student to teacher, teacher to student; and between students. The latter have learned to work autonomously and collaboratively, they had to decide what their project was, assuming the subsequent problems and providing solutions to them. Furthermore, this process made possible for the student to understand the complete picture, to embrace the contextual nature of their learned competencies, and respond in consequence. Now they combine learning resources and put an answer to complex situations. As a result, they have become professionals with a high adaptability and problem solving abilities.

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Tourism and Dengue Vector: Would Tourism Increase Mosquito Breeding Sites?

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Abstract

In this study, we investigated how tourism affecting mosquito diversity and their main breeding sites in tourist areas of Pak Meng Beach, Trang Province by comparing mosquito larval diversity, abundance and breeding sites between houses and shops/resorts. The breeding sites were randomly selected ten houses or hotels at 0, 200, 400, 600, 800, and 1000 m. from the beach with a total of 60 houses or hotels. We collected all mosquito larvae from both indoor and outdoor containers, identified types of water containers and mosquito larvae up to genus or species level under stereo microscopes. Our results showed that four mosquito larvae species were found: *Aedes aegypti* (n=63), *Aedes albopictus* (n=464), *Culex* spp. (n=217), and *Toxorhynchites* spp. (n=3). The main breeding sites were plastic buckets, coconut shells, tires and small earthen jars. Mosquito larvae were found most at 400 and 600 m. from the Pak Meng Beach. The number of mosquito larvae at the shops/resorts at 200 m. from the beach was significantly higher than houses. This indicates that tourism has some effect by increases mosquito breeding sites.

Keywords: distance, tourist area, mosquito larvae.

Introduction

Dengue fever (DF) is endemic in popular tourist destination in most tropical parts of the world. The incidence of epidemic and endemic dengue has increased worldwide (Hayes & Gubler, 1992). The current annual global incidence of dengue infection is 100 million patients per year. Factors have been implicated in the current increase in the incidence of dengue are tourism, urbanisation, overpopulation, crowding, poverty, and a weakened public-health infrastructure (Lifson, 1996). This impact varies and can be loss of life, medical expenditures, and loss of tourism as a result of negative publicity (Meltzer et al., 1998).

Tourism has become the world's largest business over the past century and is a significant contributor to economies worldwide. With rapid growth in tourism industries, tourist destinations need to have adequate insight into factors that influence tourism demand (Oduber et al., 2014). Several studies show that dengue can influence tourism (e.g. Cobelens et al., 2002; Wichmann et al., 2003, Schwartz et al., 2008) by reporting that dengue infections were frequent in travelers to endemic areas in Asia and returning with the virus back home. No studies have been investigated how tourism industries would lead to dengue outbreaks in Asia.

This is the first to study the impact of tourism industries leading to increases in accommodation, hotel decoration, water storage containers, and trashes which may lead to increases in the mosquito breeding sites in tourist attraction areas. In this study, we investigated how tourism affecting mosquito vector-borne diseases. We compared mosquito larval diversity, abundance, key breeding sites of mosquitoes between houses and hotels at 0, 200, 400, 600, 800 and 1000 m away from Pak Meng beach, southern Thailand.

1. Materials and Methods

1.1. Data Collection

Mosquito larval survey was conducted at Pak Meng beach in Trang, southern Thailand (7.505543° N, 99.313081° E) in July 2016 (Fig. 1a,b). From Pak Meng beach along the main road, we marked the positions every 200 to 1000 m on the Google Earth. Samples were collected in houses and hotels. There were ten houses/hotels per distances with a total of 70 households in this study.

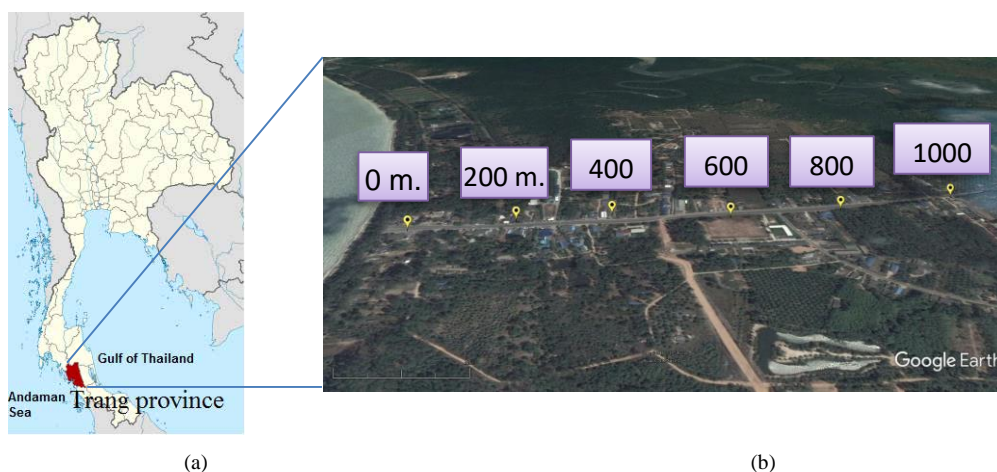


Fig. 1. (a) map of Trang province, Thailand and (b) map of Pak Meng beach and distance for collecting data

1.2. Mosquito Biology

Aedes aegypti (L.) and *Ae. albopictus* (Skuse) are primary dengue vectors in southern Thailand (Thavara et al., 1996; 2001; Kanchanapiroj et al., 2000; Luemoh et al., 2003). *Ae. albopictus* is capable of breeding in a wide range of container types and water-holding habitats. In Thailand, *Ae. albopictus* has been found in forested habitats ranging in elevation from 450 to 1,800 metres as well as in a variety of other habitats in rural and suburban areas (Scanlon & Esah, 1965; Gould et al., 1970; Thavara et al., 1996; 2001). Natural breeding sites have been found to contain *Ae. albopictus* larvae including tree holes, coconut shells, fruit peels, water jars, unused and discarded tyres, and boats holding water have been found to contain (Thavara et al., 2004).

Many factors affecting key breeding places of *Aedes* larvae such as topographical areas, faith-based communities (Wongkoon et al., 2005) and high/low risk DHF area (Chansang et al., 1999). Chansang et al. (1999) reported that earthen jars and cement tanks were the key breeding sites in both high/low risk DHF areas in the northeastern region of Thailand. However, they did not separate *Aedes* larvae into *Ae. aegypti* and *Ae. albopictus*. Wongkoon et al. (2005) reported that *Ae. aegypti* prefers to lay eggs in different types of water storage containers than *Ae. albopictus*.

Culex mosquitoes serve as intermediate hosts in the transmission of several important human diseases e.g. malaria, yellow fever, dengue, Japanese encephalitis and filariasis (Simsek, 2004). Preechaporn et al. (2007) reported that *Culex* females laid eggs in different container types depending on the season and topographical areas in southern Thailand. *Culex* larvae were found in highest numbers in metal boxes in all topographical areas, preferred outdoor containers more than indoor containers, artificial containers than natural containers, earthen containers than plastic containers, and dark coloured containers than light coloured containers.

1.3. Entomological Studies

All water containers were sampled for mosquito larvae both indoors and outdoors by using nets with mesh size of 0.55 mm. Very small water containers were emptied through the fishnet. Larger water containers were sampled by dipping the net in the water, starting at the top of the container and continuing to the bottom in a swirling motion that sampled all edges of the container (Preechaporn et al., 2006, 2007; Wongkoon et al., 2007). All live mosquito larvae were collected in plastic bags, taken to the laboratory, preserved and identified up to genus or species level using Rattanaarithikul and Panthusiri's keys (Rattanaarithikul & Panthusiri, 1994). In this study, the first, second instars and pupae were not analysed because immature mosquitoes at these stage could not be identified.

1.4. Statistical analysis

We used crosstab chi-square tests to test the ratio of mosquito larvae species in each distance and the abundance of mosquito larvae in breeding sites (indoor and outdoor containers). We used t-tests to test the differences in the number of mosquito larvae between houses and hotels. All significant tests were two tailed at a significant level of 0.05.

2. Results and Discussion

The numbers of *Ae. aegypti*, *Ae. albopictus* and *Culex* spp. Larvae were different in all distances (Table 1). The numbers of *Ae. albopictus* larvae were highest in most distances (at 200-600 and 1000 m from the beach). The numbers of *Culex* spp. larvae were highest in at 0 and 800 m from the beach (Table 1). At 200 m, there were higher total number of mosquito larvae in hotels than houses (Table 1).

Table 1. Mosquito larvae species and abundance from Pak Meng beach (*P<0.05)

Distances from beach (m)	<i>Ae. aegypti</i>	<i>Ae. albopictus</i>	<i>Culex</i> spp.	Statistical test	Average number of mosquito larvae ± (SD)		t-test
					Hotels	Houses	
0	15	29	34	$\chi^2 = 7.46^*$	19.50±12.45	0	
200	6	24	9	$\chi^2 = 14.31^*$	15.00±0.00	4.00±2.53	$t_5 = 4.026^*$
400	3	208	0	$\chi^2 = 199.17^*$	54.33±33.02	24.00±29.70	$t_3 = 1.04$
600	1	177	134	$\chi^2 = 161.90^*$	55.00±60.81	40.80±47.86	$t_5 = 0.335$
800	20	8	35	$\chi^2 = 17.43^*$	0	10.67±10.35	
1000	18	18	5	$\chi^2 = 14.31^*$	3.00±1.41	11.67±10.60	$t_3 = -1.092$
Statistical test	$\chi^2 = 32.18^*$	$\chi^2 = 508.51^*$	$\chi^2 = 242.78^*$	$\chi^2 = 289.58^*$			

The dengue vectors in southern Thailand are primarily *Ae. aegypti* and *Ae. albopictus* (Thavara et al., 1996; Luemoh et al., 2003). We found a high number of *Ae. albopictus* larvae in most distances. This might be because *Ae. albopictus* is capable of breeding in a wide range of container types and waterholding containers. Our results indicate that tourism had strong impacts on major dengue vectors in southern Thailand.

Table 2. Mosquito larvae species and abundance in indoor and outdoor breeding sites (*P<0.05)

Breeding sites		<i>Ae. aegypti</i>	<i>Ae. albopictus</i>	<i>Culex</i> spp.
Hotels	Indoor containers	1	0	0
	Outdoor containers	17	272	80
Houses	Indoor containers	2	42	4
	Outdoor containers	43	150	133
		$\chi^2 = 51.571^*$	$\chi^2 = 311.027^*$	$\chi^2 = 201.295^*$

In both hotels and houses, there were more *Ae. albopictus* than other mosquito species (Table 2). *Ae. albopictus* larvae found mostly in outdoor containers (Table 2). Most mosquito larvae were found in plastic buckets, bottles. At 400 m., the abundance of mosquito larvae were found in many water containers such as small earthen jars, discarded tyres, plastic buckets and coconut shells. At 800 m. (all water containers from houses) most of mosquito larvae were found in earthen jars and 1000 m. most of mosquito larvae were found in and plant pots (Table 3).

Table 3. Mosquito larvae species and abundance in the water containers (*P<0.05)

Container type	Distances (m)					
	0	200	400	600	800	1000
Ant-guards						24
Bio-fermentation tanks		15				
Coconut shells			20	22		
Discarded tyres			22	9	6	
Earthen jars		10	27		61	
Flower vases				9		
Plant pots		16		4		66
Plastic buckets/bottles	28	54	21	52	11	10
Used cans/pots		5	10	4	22	

Our results support previous findings that *Aedes* mosquitoes have different key breeding sites (Wongkoon et al., 2005). This study clearly demonstrates that distances from the beach influence container types. Tourists affect dengue transmitted diseases because tourists tend to littering trashes at tourist attraction sites. These trashes from tourists would become mosquito breeding sites when rain water gets in. In this study, trashes that were key breeding sites including plastic buckets, plastic bottles, used cans, used pots, and used tyres. The highest numbers of containers were plastic buckets, coconut shells, discarded tyres and earthen jars. Plastic containers were the most commonly used in the houses, hotels and resorts due to its low cost. Coconut shells were the main mosquito breeding sites which contained good food. These are known to attract ovipositioning females (Wilton, 1968; Beehler et al., 1992; Paradise & Kuhn, 1999). In addition, hotels tend to decorate their places with flower pots and earthen jars filled with water and water lilies.

3. Conclusion

The purpose of this study was to investigate the influence of tourism on mosquito breeding sites. This study found that tourism has an impact on the types and abundances of mosquito larvae by increasing the number of mosquito breeding sites such as plastic bottles, used cans and coconut shells. Preventive actions and campaign are important parts of the mosquito control strategy, especially in tourist attraction areas.

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Biomedical Engineering Bachelor Students: driving practice to theory is not linked with activation and high marks

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Abstract

In a context in which almost any student can have access to a university career, it is frequent to observe how the motivation and commitment of students has no comparison with previous years. New teaching methods must face this reality without falling into the banality of assuming the lack of motivation by default. In this communication, we present a study that proposes a motivational activation by performing practical cases and visits to technological centres as a preliminary step to the theoretical explanation aiming to motivate students and achieve high marks. During the academic year 2016/2017, 76 first year students in the Bachelor of Biomedical Engineering performed practical sessions, a project and exams in four major areas: Biomechanics, Genomic Systems Medical Image Processing and eHealth. Theory and practice was alternated on each area. The results show that the order in which the thematic area is approached (practice-theory or theory-practice) has not significant effect on the student marks. Besides, students who chose a project in Biomechanics and eHealth show a higher score than those who selected Biomedical Imaging and Genomic Systems.

Keywords: *Biomedical Engineering, Activation, Motivation, Practice, Biomechanics, Genomic Systems, Medical Imaging, eHealth.*

Resumen

En un contexto en el que casi cualquier estudiante puede tener acceso a una carrera universitaria, es frecuente observar cómo la motivación y el compromiso de los estudiantes no tiene comparación con años anteriores. Los nuevos métodos de enseñanza deben afrontar esta realidad sin caer en la banalidad de asumir la falta de motivación como un hecho. En esta comunicación se presenta un estudio que propone la activación motivacional

mediante la realización de casos prácticos y visitas a centros tecnológicos como un paso preliminar a la explicación teórica para motivar a los estudiantes y alcanzar calificaciones altas. Durante el año académico 2016/2017, 76 estudiantes de primer año del Grado en Ingeniería Biomédica realizaron sesiones prácticas, condujeron un proyecto y exámenes en cuatro áreas principales: Biomecánica, Sistemas Genómicos de Tratamiento de Imágenes Médicas y eHealth. La teoría y la práctica se alternaron en cada área. Los resultados muestran que el orden en que se aborda el área temática (práctica-teoría o teoría-práctica) no tiene un efecto significativo en las calificaciones obtenidas por los estudiantes. Además, los estudiantes que eligieron un proyecto en Biomecánica y eHealth muestran una puntuación más alta que los que seleccionaron Imágenes Médicas y Sistemas Genómicos.

Palabras clave: *Ingeniería Biomédica, Activación Motivación, Prácticas, Biomecánica, Sistema Genómico, Imagen Medica, eHealth.*

Introduction

Biomedical engineers combine traditional engineering principles with medical and biological sciences to design and develop devices, computer systems and software used in healthcare (Benkeser, 2006). A report from the World Health Organization identifies a total of 117,935 biomedical engineers distributed in 29 countries in 2015 and states that year-by-year universities all around the world are creating new degrees and post-graduate programs for educating and training in biomedical engineering (WHO, 2017). Biomedical engineering is a wide domain, which goes from fundamentals to applications in several different fields such as biochemistry, biophysics, genomics, biology, electrophysiology, bioelectronics, telemedicine, mobile health and biostatistics. On the one hand, education in biomedical engineering is about acquiring knowledge on the methods and techniques with a clear focus on real applications and prototypes. On the other hand, training is about acquiring the skills to bring to practice the methods and techniques in a specific context. Concerning such a complex and heterogeneous science as biomedical engineering, students have to acquire knowledge from several specific areas, which range from biomechanics to genomics. This heterogeneous curriculum may be a cause of distraction, in the way students often tend to pay more attention to one of the sub-fields which attract them the most.

Problem-based learning is an educational method used in many academic disciplines and which has been expanded in the last decades. The method is based on the achievement of four levels from early learner to advanced learner in four dimensions: ability identification, external-internal learning influence, goodness for strengths and weaknesses identification and self-awareness (Barrows, 1994). Among the benefits of this learning paradigm, authors highlight:

- Engages in learning activities irrespective of learning style or any outcome measures.
- Promotes the analysis of resources, learning needs assessment and subsequent constructed goals.
- Selects activities based on instructional methods that are effective in advancement of knowledge.

In this paper, we analyse the extent to which practice-driven learning affects the academic performance of students in the first year of an introductory subject in the Biomedical Engineering Degree in the Universitat Politècnica de València. The study is based on a subject entitled “The Role of The Biomedical Engineer” which accounts for 12 theory based lectures and four practical sessions provided by professors from different departments, researchers, entrepreneurs and industry professionals of the biomedical engineering ecosystem. The four practical sessions are split on each of the following fields: Biomechanics, Genomic Systems, Medical Imaging and eHealth and Devices. The practical sessions are drawn across the first semester calendar and the students have to develop a project belonging to one of these areas in parallel to the practical sessions. Scores and marks

on each assessment point (practical lessons, project and tests) are described and compared according to the type of project chosen by the student.

Our findings suggest that even though sub-groups of students who select specific biomedical engineering areas have better scores in the correspondent practical sessions, the final score of the subject, which is assessed in through two interim exams, is not affected by the selected area.

1. Materials and methods

1.1. Program methodology

The subject lasts from September to January and belongs to the first Semester of the first year in the Bachelor of Biomedical Engineering, gathering 79 students. The evaluation is based on three types of deliverables: written report for each of the practices (individual), a project (group) and two midterm exams (individual). These three evaluations are based on practices, theory contents and the execution of a project (Figure 1). The final score of the subject is calculated by a pondered sum in which the exams weight 50%, practices weight 25% and the project 25%. However, in this study we are going to focus on the scores obtained for each of the evaluation events and not on the final subject score.

Practical sessions were alternated with the theory lectures according to the schedule of the subject. Biomechanics and Genomic Systems practical sessions were performed before the theory session whereas Medical Imaging and eHealth practical sessions were performed after the theory lecture. The justification for this criterion was based on the availability of the research institutes and the academic staff, with no other purpose. The Problem-based learning theory was applied by structuring the theoretical sessions as a continuation of the practical sessions and vice-versa. The concepts introduced in the practical sessions of Biomechanics and Genomic Systems were further developed in the theory session and the other way around with respect to Medical Imaging and eHealth. The time span between practical sessions and theoretical lessons was three weeks, enough time to develop the four dimensions proposed by barrows.

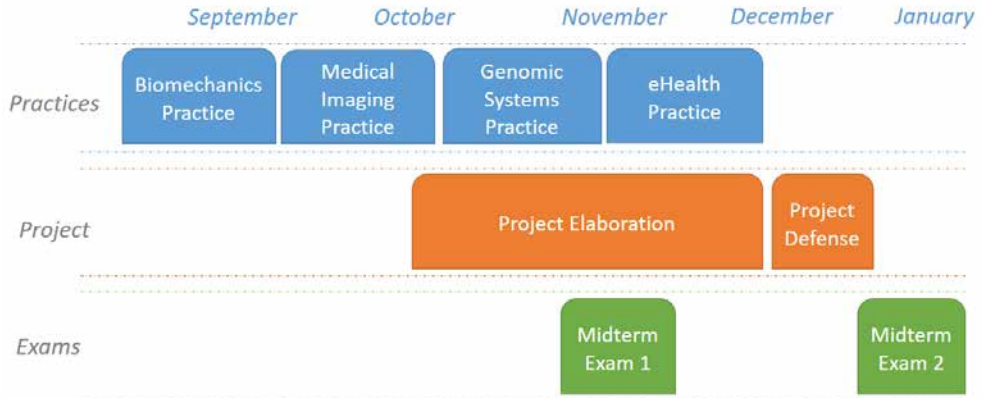


Figure 1. Schedule of the practices, project and exams during the subject

1.2. Practical sessions

The subject contains four different practical sessions which are introduced and lectured by researchers who work in high quality research institutes of the Universitat Politècnica de Valencia.

1.2.1. Biomechanics

This practice consists on a visit to the Institute of Biomechanics from Valencia (IBV)¹. This technological centre is dedicated to the research, development and innovation within the scope of the human body mechanics which was founded in 1976. The IBV is a multidisciplinary centre focused on various fields: automotive, sports, habitat, children, people with dependency, rehabilitation, occupational health, health technology, tourism and leisure, among others. Headquarters of IBV accounts for a four floors building with administrative offices, laboratories, test laboratories and an animal house. The practice consisted on a walkthrough over several projects related to the rehabilitation, biomechanics in the sport, functional assessment and development of prosthesis using different techniques (Vergara, 2002, Epifanio, 2008).

¹Instituto Valenciano de Biomecánica <<http://www.ibv.org/>> [Consulta: 22 de junio de 2017]

1.2.2. Medical imaging

This practice is based on the visit to the Research Institute of Human Centred Technologies (I3B) a research and innovation institute in bioengineering focused on the analysis of images and signals for the rehabilitation and for decision support systems. The practice consisted in a tour through some of the flagship projects the institute participates. The goal of their projects is to provide tools or solutions to doctors to quickly detect diseases such as cancer, retinopathy and liver damage based on advance image processing. This group has four areas of research: computer assisted diagnosis, image processing, video analysis and signal processing (Morales, 2017, López-Mir, 2013, Naranjo, 2014).

1.2.3. Genomic Systems

This practice consisted on a visit to the Center for Research in Methods of Software Production (PROS)² in which genomic information systems where presented for in the new paradigm of personalized medicine, with a special accent on the information infrastructure this type of research needs. During the practice, students were introduced to two emblem projects: VAR SEARCH (Granda, 2016), which facilitates genetic diagnosis in order to help manage and document genetic variations to make the integration of genomic data easier as well as to reduce searching times. The other project was GENES LOVE ME (Martínez, 2010) which offers the possibility of obtaining a genetic profile for different physical characteristics or diseases. This profile is usefull to determine the predisposition to suffer genetic diseases, allowing to know the results with total confidentiality at any time.

1.2.4. Medical Devices and eHealth

This practice consisted on a visit to the Institute of the Applied Information and Communications Technologies (ITACA) and the Centre of Bioengineering Innovation and Research (Ci2B) in which information systems devoted to health and healthcare and medical devices development projects were presented. Students were able to see how big is the challenge of taking the right information and apply it to each patient. Clinical information is obtained from an exhaustive integration of data from different sources, which include Electronic Health Records (EHR), time series from ECGs and other signals from physiological and environmental sensors. The data come from different sources, so it is important to analyse the quality: spatial stability (variability between different sources to detect bias, trends ...), temporal stability (variability over time), contextualization, completeness, uniqueness, consistency and correctness (Saez, 2017). The practice introduced three main projects devoted to the analysis of EHRs (Garcia-Gomez, 2015), analysis of ECGs

² Research Centre on Software Production Methods. <<http://www.pros.webs.upv.es/>> [Consulta: 22 de junio de 2017]

to detect cardiac malfunction (Rodrigo, 2014) (Ferrer-Albero, 2016) and integration of environmental sensors in the paradigm of the Internet of Things (Martinez-Millana, 2016).

Table 1. List of projects

ID	Topic	Thematic area
1	Development of applied biomechanics in the field of orthopedic surgery and traumatology	Biomechanics
2	Development of applied biomechanics in the field of rehabilitation.	Biomechanics
3	Development of applied biomechanics in the field of orthopaedics	Biomechanics
4	Development of applied biomechanics in the field of accessibility	Biomechanics
5	Development of biomechanics applied to the field of sports medicine	Biomechanics
6	Computerized Axial Tomography image analysis techniques.	Medical Image
7	Techniques of image analysis in PET. Fundamentals and applications	Medical Image
8	Magnetic Resonance Imaging. Fundamentals and applications.	Medical Image
9	Analysis of genomic data for the diagnosis of Breast Cancer.	Genomics
10	Analysis of genomic data for the diagnosis of Alzheimer's	Genomics
11	Analysis of genomic data for the diagnosis of Neurofibromatosis	Genomics
12	Analysis of genomic data for the diagnosis of Colon Cancer.	Genomics
13	Analysis of genomic data for the diagnosis of Lactose intolerance	Genomics
14	Analysis of the Quality of Data provided by the Genomic Data Sources	Genomics
15	Connecting Genotype to Phenotype in the Era of High-Throughput Sequencing	Genomics
16	Application of simulation in the treatment of cardiac arrhythmias.	eHealth
17	Devices for remote monitoring of cardiac activity	eHealth
18	Devices for the monitoring of muscular activity	eHealth
19	Brain-computing interfaces	eHealth
20	Standards for medical data acquisition. Connectivity, Types of Standards, Study of devices that comply with the standard	eHealth
21	Monitoring devices. Sensors Wearables and Integration	eHealth
22	Technologies and systems for dependent living and Ambient Assisted Living. State of the art. Applications. Benefits, and barriers.	eHealth
23	The problem of management of chronic patients. Sustainability of the system. Use of ICT to optimize health care and resources.	eHealth
24	Hospital Logistic Model	Management
25	Management of Multidisciplinary teams	Management

1.3. Projects

The subject offered 23 different projects in the thematic areas of Biomedical Engineering and 2 more related with Management. These last two will not be analysed in this study. Each project had specifications on the scope and extension, as well as a specialized supervisor to contact with. Table 1 lists the offered projects and their respective areas.

1.4. Exams

The subject has two midterm exams, each of them with an equal ponderation in the final score and with different topics. The first exam accounts for biomechanics and medical imaging, and the second exam accounts for genomic systems and eHealth. The exam consists of two parts, one test with closed answers (4 options: 1 right and 3 wrong) and an open answer question about a single topic or subtopic. All the questions are based on the contents seen in the theory lectures and require an intermediate understanding of each of the topics.

1.5. Statistical tests

Statistical analysis is driven in Matlab 2017a under the Academic License. For normal distributions t-Student statistical test is used and for nonparametric distributions Wilcoxon test is used. Independence is assumed for p values under 0.05 at a two-tailed 5% level of significance.

2. Materials and methods

73 out of the 79 students fulfilled the evaluation of the subject with scores ranging from 7,52 to 9,01 (Table 2).

Table 2. Scores and descriptive statistics for each evaluation event

Scores	Mean	St.dev.	Range	Min	Max
Practices	7.72	2.18	10	0.00	10.00
Project	8.92	0.94	5.91	4.00	10.00
Midterm Exam 1	7.56	1.23	6.01	3.50	9.52
Midterm Exam 2	7.52	0.94	5.10	4.23	9.33

With respect to the practices, 16.43% (12/73) did not deliver Biomechanics and Medical Imaging report, 15.06% (11/73) did not deliver the Genomic Systems report and 13.70% (10/73) did not deliver the eHealth report. Figure 2 shows the descriptive statistics of the scores for each practice. None of the distributions for these marks is independent from the other ($p \gg 0.05$).

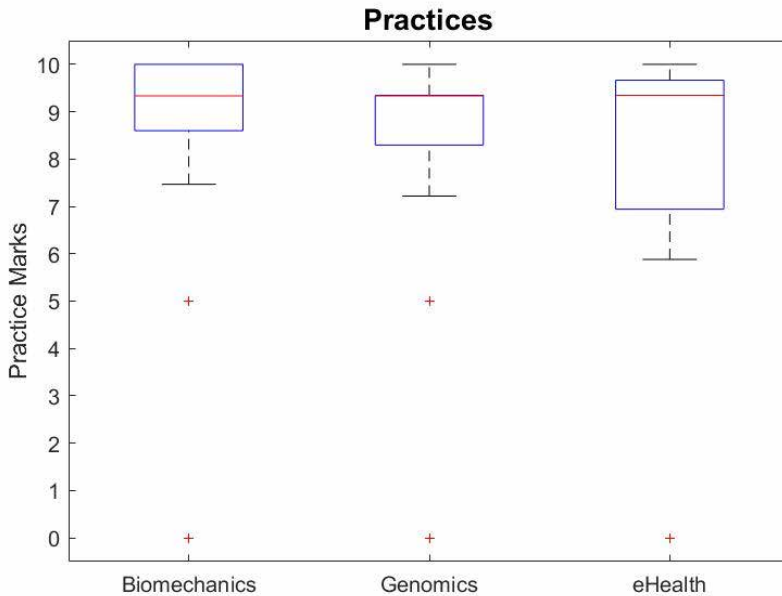


Figure 2. Box whiskers plot for the distribution of the practices marks

From the 25 available projects, 8.22% (6/73) of the students chose Management and Medical Imaging, 23.29% (17/73) chose Biomechanics, 28.77% (21/73) chose Genomics and 31.51% (23/73) chose eHealth. Figure 2 shows the box-whiskers for the marks achieved in each project type. eHealth, Genomics and Biomechanics projects show a statistically significant higher mark than Management projects.

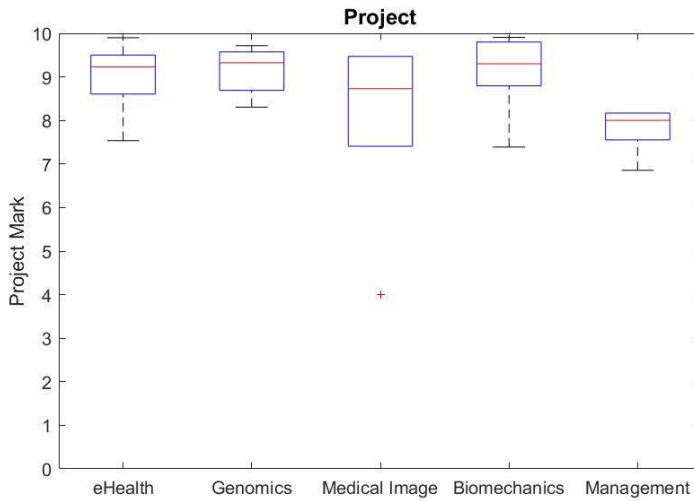


Figure 3. Box whiskers plot for the distribution of the project marks

All 73 students attended to the two interim exams. Figure 3 shows the distribution of the marks achieved in these two exams. Even though the inter quartile range for the first exam is higher than the second (1.40, 1.04 respectively), there is no significant difference ($p=0.811$).

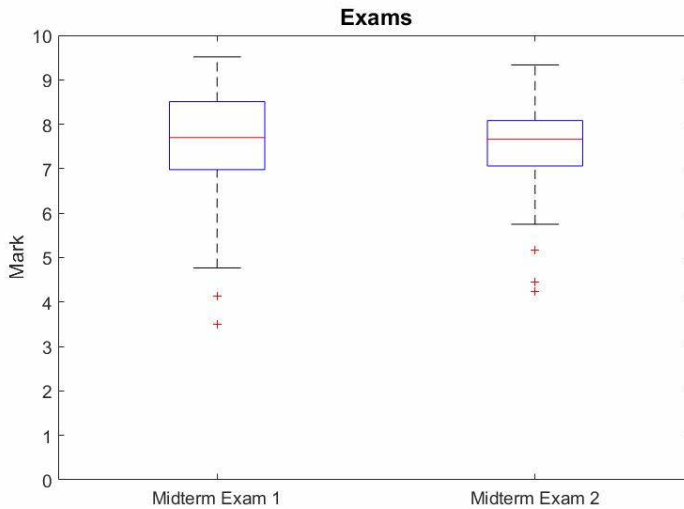


Figure 4. Box whiskers plot for the distribution of the midterm exams

Our second analysis is focused on crossing the variable type of project with the marks obtained in the practical sessions and in the interim exams. Figure 2 shows that eHealth, Biomechanics and Genomic projects have no significant difference among their distribution, being the three of them with high marks ($> 9.00/10.00$). As Figure 4 shows, this is also the case for the practical sessions. It is highly remarkable that the students who chose a project related to Biomechanics obtain very good results (and sharp distribution) for the Biomechanics practice, whereas, for Genomics and eHealth practice this correlation is not found.

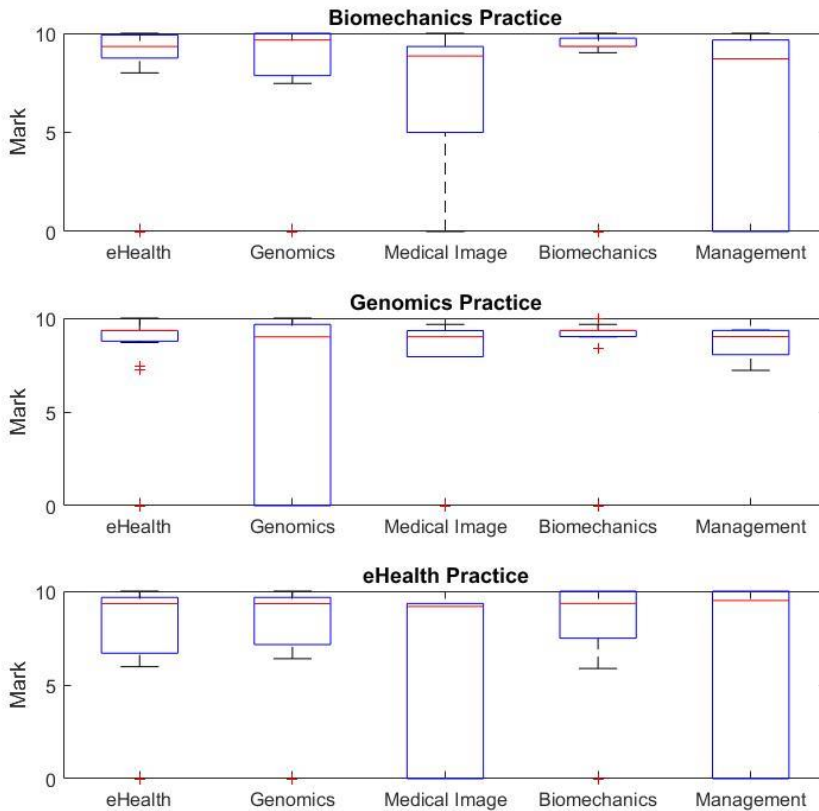


Figure 5. Comparison of the marks on each practice depending of the chosen project

Comparing the mark achieved in the interim exams and the type of project (Figure 5), we can see that the marks are similarly distributed, noting no difference among the students who chose a type of project. In this case, the students who chose Biomechanics projects got marks that are not even higher than other groups, so we can conclude that the activation achieved

Biomedical Engineering Bachelor Students: driving practice to theory is not linked with activation and high marks.

by doing a practical session before the theory lecture is not related to getting higher ranks in the exams.

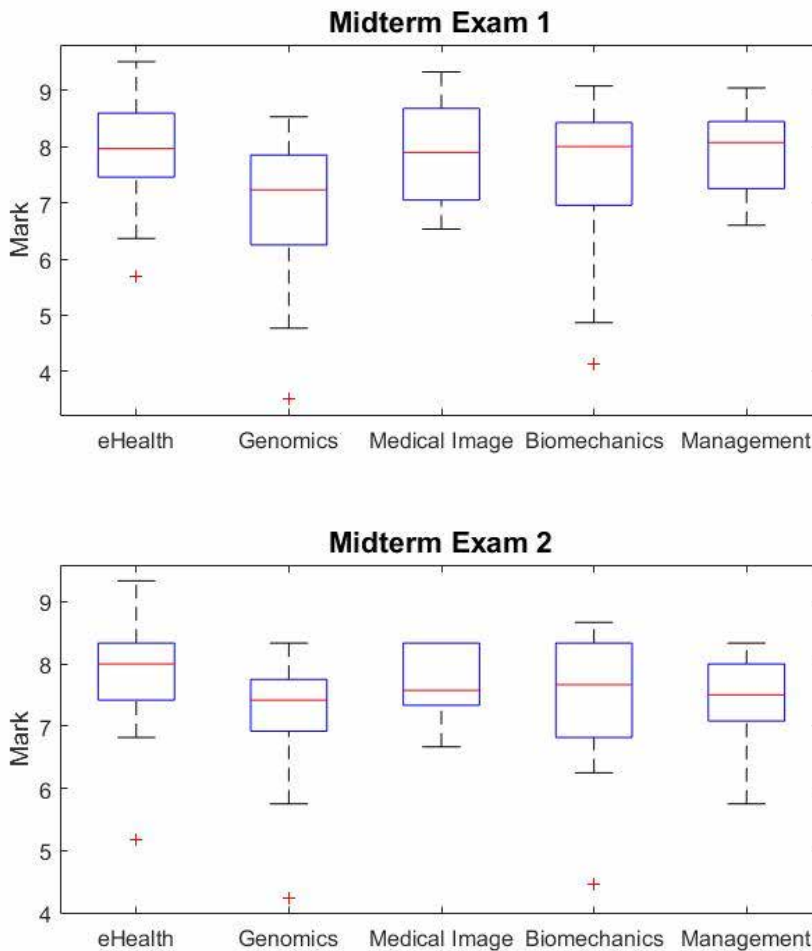


Figure 6. Comparison of the marks on each midterm exam depending of the chosen area

3. Discussion

The hard task of motivating students is becoming a challenge for lecturers and professors. New approaches for innovative teaching are being spread all around the world, mainly based on the use of technology and learning by practice. Practical sessions have the advantage of bringing motivation and rationale to relatively young students, but in the context of a high

variety of possible specialization branches, the extent to which a practical session could motivate specific students was yet unknown. The analysis driven in this study suggests that the marks achieved by students is not determined by the type of field they are interested in. Nevertheless, our study has some limitations. First of them is the context: students have to prepare other subjects on fundamental physics, mathematics, information technologies and design at the same time they are pursuing this introductory subject. The second is that our population is selected only from one year (2016-2017), and no formal conclusions should be driven unless comparing more years, consecutive or not.

Anyhow, it is clear that there are specific learning contents that are activating the interest of students when they perform practical sessions before the theory based lecture. Moreover, for the dicussion of our results, we would stress the fact that the practical sessions were done into the research institutes facilities and were provided by the research staff (Professors, lecturers and posdocs). Staying that close to the reality and by enabling a link with *the people they want to be* stants as a fundamendal element to engage students and activate the desire of investigating further in these domains.

However, we hope that our conclusions help other biomedical degrees to strenght the utmost importance of contextualizing sciences in the real world from the beginning in the manner of practical sessions, as well as opening them to all the possible fields for research, development and innovation that the biomedical engineering brings in.

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Validation of the Individual Entrepreneurial Orientation scale for university students

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Abstract

The last two decades have witnessed an increasing awareness about the factors that foster the encouragement of entrepreneurship. Despite this interest, no one to the best of our knowledge has demonstrated that the existing scales for measuring entrepreneurial orientation were reliable and valid to be used among university students. The major purpose of this paper is to validate the scale developed by Bolton and Lane (2012) so that it can be administered to university students. Differences between groups will be also assessed according to this scales. The sample consisted of 80 first year students in BBA in Entrepreneurship and BSc in Business and Engineering . Our work demonstrates that the three – factor structure suggested by Bolton and Lane (2012) can be used with first – year students, provided that two items with low discriminant power are excluded. The findings revealed that entrepreneurial experiences during this first – year of studies have a direct influence on the development of the entrepreneurial orientation of students. This paper highlights the importance of valid and reliable scales for measuring the outcomes of entrepreneurship education. This research could help professors who teach future entrepreneurs to assess the impact of the new teaching and learning activities aimed to motivate and stimulate these students.

Keywords: *Entrepreneurship education, Individual Entrepreneurial Orientation, scale, confirmatory factor analysis*

Introduction

Entrepreneurship has recently become widely recognized as being a vital factor in social wellbeing (Estellés - Miguel, S., Palmer, M.E., Albarracín, J.M. and Rueda, C., 2016). In this context, universities have increased the number of degrees aimed to train future entrepreneurs. Besides, entrepreneurship education has received much attention as educational researchers have not reached an agreement about the approach and contents yet (Neck & Green, 2011). However, in the light of this social trend toward the empowerment of new business and entrepreneurs, concerns have arisen as regards to the validity of higher education programs for entrepreneurship education. In fact, we should not neglect the relevance of personality traits, such as attitudes towards failure, in how students identify future opportunities (Cotterill, 2012).

Recent findings have led researchers to conclude that entrepreneurship education should be based on a practical and applied point of view. The student – centered approach is also likely to become an important component of those degrees addressed to entrepreneurs. Both approaches will soon be an undeniable issue in those degrees, as entrepreneurs must be trained to face challenging and continuously changing environments around their businesses. However, the learning outcomes young entrepreneurs should possess at the end of their studies have not been defined yet.

Entrepreneurship education has been strongly criticized for the last decade due to the lack of research on its impact on students' willingness to become entrepreneurs (Honig, 2004; Kuratko, 2005). However, this research question has been overcome and researchers are now focusing on how potential entrepreneurs should learn in Higher Education (Henry, Hill, & Leitch, 2005). The typical educational and training situation is not appropriate for future entrepreneurs, as it usually focuses on various abstract concepts for a particular discipline. On the contrary, university professors must become learning process facilitators, so that future entrepreneurs are able to develop a completely different entrepreneurial mindset (Garavan & O'Connell, 1994).

Kolb was one of the first to suggest the combination of different learning styles as the most effective form to get students' best in the process of becoming entrepreneurs: concrete experience, reflective observation, abstract conceptualization and active experimentation (Kolb & Kolb, 2012). It is expected that those students who have developed an entrepreneurial behavior will present a clear preference to favor active experimentation, rather than reflective observation. Additionally, this researcher introduced the concept of 'experiential learning', as a particular form for learning from life experience, in contrast to traditional learning in classrooms. More recent research has suggested the introduction of a practice – based approach for teaching entrepreneurship Neck, Greene and Bush (2014). This suggestion is based on the actionable theory, where theory meets practice. The aim of this approach is to teach a way of thinking and acting based on a theoretical background and using a portfolio of practices to encourage creating, rather than a sequential or linear process of

cumulative knowledge. Overall, a wide variety of entrepreneurship programs and methodologies can be easily found. Although little uniformity can be found between programs, the majority of them share some contents regarding business creation and management, as well as a common agreement that entrepreneurship can successfully be taught by means of practical and applied methodologies (Sirelkhatim, Gangi, & Nisar, 2015). The match between curricular and co – curricular activities should be based on a deeper understanding what educators and trainers wish to achieve from their programme, in order to ensure a more accurate assessment of the learning outcomes and entrepreneurial competences (Henry et al., 2005)

The last two decades have witnessed an increasing awareness about the factors that foster the encouragement of entrepreneurship, since the first proposal of a scale for measuring entrepreneurial orientation by Covin and Slevin (1989). Despite this interest, no one to the best of our knowledge has demonstrated that the existing scales for measuring entrepreneurial orientation were reliable and valid to be used among university students. On the contrary, previous work have only be focused on theoretical or exploratory analyses of individual or firm differences in entrepreneurial orientation. The major purpose of this paper is to validate the scale developed by Bolton and Lane (2012) so that it can be administered to university students.

1. Methodology

1.1. Participants

The sample consisted of 80 first year students in BBA in Entrepreneurship (N = 55) and BSc in Business and Engineering (N = 25), who answered the questionnaire in May 2016. In total, 42.5% were female and the average age was 19.5 years. 45.7% of students had parents (father or mother) who worked in their own business (Only father: 40.7%, only mother: 16.0%). Most of them were willing to work in their own business (51.3%) or in their familiar business (7.5%). Thanks to the entrepreneurial approach of the studies, 26.6% of them had started to work in their own business in this first year of studies.

1.2. Measures

In order to measure entrepreneurial orientation of university students, we used the scale developed by Bolton and Lane (2012), which includes 12 items structured into three factors: (a) Risk – taking, (b) Innovation, (c) Proactiveness. Responses were measured using a 5 – points Likert – type scale ranging from 1 (Low) to 5 (High). Higher scores to this scale may indicate a strong willingness of individuals to become entrepreneurs.

1.3. Statistical Analysis

Firstly, descriptive statistics and item-total correlations were obtained, taking into account the multidimensional definition of the construct Individual Entrepreneurial orientation. As these indicators show the association between each item with the total battery of items (excluding the selected one), high item-total correlations are desirable. Reliability of the scale was examined by using Cronbach's alpha values.

Subsequently, a confirmatory factor analysis (CFA) was performed to validate the three - factor model suggested by Bolton and Lane (2012) using EQS 6.2. All models were tested using the robust maximum likelihood (MLR) estimator, which corrects for both nonnormality. Evaluation of the tested models was based on multiple criteria that considered statistical, practical, and substantive fit.

2. Results

2.1.Descriptive Statistics and Reliability Analysis

Table 1 shows descriptive statistics for each item and factor, as well as the reliability analysis concerning internal consistency. The internal consistency of each factor and of the overall scale was examined using Cronbach's alpha: $\alpha_{RISK} = 0.587$, $\alpha_{INNOV} = 0.537$ and $\alpha_{PROACT} = 0.526$, $\alpha_{TOTAL} = 0.703$, and item - total correlations. Following the guidelines suggested by Churchill (1979) the removal of items 2 and 10 of the initial scale was considered, due to their low item - total correlations (Item 2: 0.25; Item 10= 0.17) and the estimated improved of Cronbach's alpha if each of these items were deleted ($\alpha_{RISK-2} = 0.671$; $\alpha_{RISK-2} = 0.662$). These items have been marked in Table 1 using ‘*’,

Regarding descriptive statistics, it can be easily observed that the range of variation of mean scores was very narrow (from 3.74 in item 5 to 4.20 in item 1), except for items 2 and 10, which had been selected for elimination. The mean scores obtained for both items suggested that students were more in agreement with the need to invest time or money, and work actively in their own businesses. These findings are consistent with the entrepreneurial approach of the studies we described before. However, it worsens the discriminant power of both items. To put it differently, since the majority of students felt that they agreed with both items, these items cannot be used to distinguish between students with low or high levels of risk - taking attitudes or proactiveness. This conclusion confirms our earlier findings regarding the need to discard items 2 and 10 for using the scale for first - year students.

Table 1. Descriptive statistics and reliability analysis for the initial scale

Item	Subscale	Mean	Standard deviation	Item - total correlation	Cronbach's α if item deleted
1	Risk - taking	4.20	0.75	0.49	0.337
2*	Risk - taking	4.54	0.57	0.25	0.671
3	Risk - taking	3.98	0.75	0.48	0.346
4	Innovation	4.23	0.78	0.28	0.502
5	Innovation	3.74	0.87	0.29	0.500
6	Innovation	4.09	0.89	0.43	0.365
7	Innovation	4.19	0.85	0.30	0.486
8	Proactiveness	3.97	0.83	0.44	0.252
9	Proactiveness	4.05	0.93	0.44	0.244
10*	Proactiveness	4.46	0.77	0.17	0.662

NOTE: Items marked with * were dropped from the initial version of the scale

2.2.Confirmatory Factor Analysis

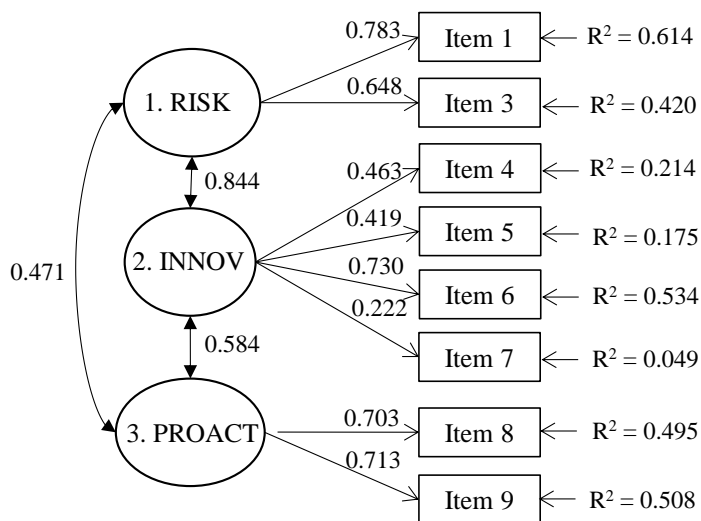
Confirmatory factor analysis represented a valuable and complementary approach to our research, since it allowed us to specify the number of factors and the pattern of item – factor loadings in advance, consistently with the three constructs defined by Langkamp and Lane (2012): Risk taking, innovation and proactiveness.

As the data did not accomplish the requirement of multivariate normality (Mardia’s coefficient = 5.6 > 5) robust maximum likelihood estimation procedures were used. Instead, procedures were used. The theoretical three – factor structure proposed by Bolton and Lane (2012) with 10 items was initially hypothesized, obtaining acceptable fit. On the contrary, our shortened version, excluding items 2 and 10, obtained excellent fit indices.

Table 3. Goodness of fit of shortened scale for measuring entrepreneurial orientation (items 2 and 10 excluded).

	S- B χ^2	Degrees of freedom	p- value	CFI	RMSEA	RMSEA CI	90%	SRMR
Shortened three – factor model (excluding items 2 and 10)	21.78	17	0.193	0.945	0.060	[0.000, 0.126]		0.074

Figure 1. Standardized factor loadings and coefficients of determination



Source: Own elaboration

Apart from the slight discordance regarding the exclusion of items 2 and 10, our work demonstrates that the three – factor structure suggested by Bolton and Lane (2012) can be

used with first – year students. Thus, we compared their responses to these items based on demographical variables and entrepreneurial experiences, as shown in next section.

Next, independent samples t-tests were performed with the aim to compare average scores in each item for different profiles of students. No significant differences were found for gender, age or grade academic performance. However, these tests revealed that entrepreneurial experiences during this first – year of studies have a direct influence on the development of the entrepreneurial orientation of students. Of the 81 students who completed the questionnaire, 21 (26.6%) had started to work in their own business, 41 (51.3%) aimed to work as an entrepreneur after studying and 6 (7.4%) were willing to work in the family business.

Those students who had started to work in their own business scored higher in risk – taking orientation and proactiveness. Moreover, item 6 concerning self – learning showed a higher average score for those students. The experience to work in their own entrepreneurial project had a stronger influence of the development of these attitudes than the students' expectations about their future as entrepreneurs. These findings have important implications in the design of learning activities aimed to develop the entrepreneurial orientation of young people. A student willing to become an entrepreneur will be likely to fail in their objective, if he or she does not get involved in any entrepreneurial project during the first years of university studies.

Meanwhile, we found significant differences in item 1, regarding individual initiative by venturing into the unknown, for students who wanted to work as an entrepreneur after studies. Remarkably, students whose mothers were working in their own business scored also higher in this item. This results could not be replied with students' fathers. These findings offer unprecedented evidence that entrepreneur women have the potential to encourage their children to develop their individual initiative in unstable environments.

Table 2. Group differences according to entrepreneurial experiences

Item	Overall Mean	I have started to work in my own business		Work as an entrepreneur after studying		
		Yes	No	Yes, in my businesses	Yes, in the family business	No
1 I like to take bold action by venturing into the unknown	4,20 ^{a, b}	4,67	4,03	4,41	4,33	3,00
3 I tend to act 'boldly' in situations where risk is involved	3,98 ^a	4,29	3,84	4,12	3,67	3,50
4 I often like to try new and unusual activities that are not typical but not necessarily risky	4,23	4,48	4,12	4,27	4,33	4,00
5 In general, I prefer a strong emphasis in projects on unique, one-of-a-kind approaches rather than revisiting tried and true approaches used before	3,74	4,00	3,66	3,80	3,33	4,50
6 I prefer to try my own unique way when learning new things rather than doing it like everyone else does	4,09 ^a	4,67	3,86	4,20	3,83	4,00
7 I favour experimentation and original approaches to problem solving rather than using methods others generally use for solving their problems	4,19	4,38	4,12	4,15	4,17	4,50
8 I usually act in anticipation of future problems, needs or changes	3,97 ^a	4,38	3,81	3,98	3,83	4,50
9 I tend to plan ahead on projects	4,05 ^a	4,52	3,86	4,25	3,67	3,50

3. Conclusions

In conclusion, our work has led us to conclude that the Bolton and Lane (2012) can be used for measuring Individual Entrepreneurial Orientation within university students. Confirmatory factor analysis represented a valuable and complementary approach to our research. The evidence from this analysis suggested that items 2 and 10 should be excluded when working with this population, due to their low discriminant power.

Secondly, our findings revealed that entrepreneurial experiences during this first – year of studies have a direct influence on the development of the entrepreneurial orientation of students. As expected, those students who had started to work in their own business scored

higher in risk – taking orientation and proactiveness. Remarkably, students whose mothers were working in their own business scored as regards to individual initiative by venturing into the unknown.

Therefore, this paper has highlighted the importance of valid of reliable scales for measuring the outcomes of entrepreneurship education. It constitutes a more elegant solution to existen. These conclusions may represent an interesting starting point for professors who teach first – year courses. Besides, this research could help professors who teach future entrepreneurs to assess the impact of the new teaching and learning activities aimed to motivate and stimulate these students.

However, given the small sample size, caution must be taken. The findings might not be generalized to a larger population of university students enrolled in other degrees from different fields of study. Finally, the analysis has only considered those items included in the Bolton and Lane (2012) scale. The factorial validity of this scale should be compared to other references, such as existing scales for measuring entrepreneurial orientation in firms or the scales suggested by Taatila (2010).

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YouTube as a tool to improve learning

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Abstract

With the development of Internet and social media, and the transformation of student behavior, the learning process in universities and other educational institutes requires new tools.

In this paper we analyze the use of YouTube as an essential mechanism to be used in the classroom. The paper analyzes the advantages and disadvantages of this tool and proposes some recommendations for the appropriate use of this platform to enhance learning..

Keywords: YouTube, learning, education, social media.

Introduction

The analysis of the incidence of social media in education is very important nowadays. First of all, the incidence on this subject is essential, because the use of social media by students, in their private life, has transformed the way they communicate, interact, search, process and absorb information. In addition to how they concentrate, comprehend and in general the way they learn. Secondly, because social media can be also considered to be a new resource that should be considered by teachers to help them to develop their task in a more innovative way. Several studies have pointed out that the spread of social media has transformed behavior in the classroom. Specifically, new generations of students, impacted by the internet and in general a world of pervasive technology and the development of social media, have adapted their brains to the new situation, which requires a different conception of teaching from teacher and lecturers. This situation also affects “digital native” teachers or lecturers. For instance, Lei, (2009), in a study of these teachers, mentions that they have to understand the technology, the pedagogy and the subject matter in conjunction.

Moreover, the similar evolution of social media makes this process a continuous transformation. In this sense, and as an evolution of previous social media, like Facebook and essentially Twitter (which, in the beginning based the communication process mainly on the use of written information), the development and greater requirement for new visual communication, based on images and videos (impacted also by the development of videogames), is forcing a preeminent use of visual learning as an essential instrument. In this

present framework, the relevance of the use of video technologies in the classroom to improve education is critical (Siegle, 2009).

Looking at this situation closely, this paper concentrates on the relevance of the use of YouTube as essential socialmedia to improve education. This paper follows the growing interest in the instructional potential of Youtube as a teaching tool in research in the fields of education and psychology (Jones & Cuthrell, 2011; Kruse & Veblen, 2012; Lee & Lehto, 2013).

1. YouTube

YouTube is a social network launched on February 14, 2005, by three former PayPal employees. One year later, in November 2006, it was purchased by Google (nowadays Alphabet). Youtube could be defined as a web-based platform with public-access, that allows people the option not only to view, but also to generate, upload, and share a wide range of videos, video-clips, movie scenes or homemade videos (Lange (2007; Lee & Lehto, 2013). This material can be uploaded by the general public, as commented before, but also from several previously broadcasted sources. In this sense, the platform has arranged diverse partnership deals with international broadcasters (Burke & Snyder, 2008). As these properties are easy to use, the website has quickly become the most popular free-video sharing resource for user generated content (Burke & Snyder, 2008, Ryu, Kim, & Lee, 2009; Shifman, 2011; Lee & Lehto, 2013).

Focusing on the characteristics of the platform, according to Duffy (2008), a YouTube webpage has a wide range of video content and material, mostly accessible to unregistered users (registered users can upload unlimited content). Moreover, it has the following components: the title of the video, the indication if a video has inappropriate content (Flag), keywords of the content (Tags), channels to group the content; related videos; comments, rating, “likes” about the video by registered or subscribed users; number of views; and the possibility for registered users to subscribe to content feeds from a particular user. Moreover, the possibility to share videos, or subscribe to some channels, allows these channels to organize and select videos made by experts, or for instance the server to send personal emails whenever there is new material available (Pereira et al.(2016).

2. Benefits of YouTube for Education

Youtube can be a powerful educational and motivational resource, as for instance it can be an effective facilitator and catalyst for classroom analysis and discourse (Duffy, 2008). Moreover, its use with other social media tools is considered to result in positive and significant student performance through test and evaluations in university educational courses, also helping to motivate learning capabilities and develop scholastic skills (Dominic & Hina, 2016). For instance, Mao (2014:216) states that together with Edmodo and

Facebook, it is one of “the three most frequently mentioned examples of good use of social media in classes”, stressing the use of their educational videos, its use for getting more information about a topic, for learning, or to help teachers teach. Among its benefits for educational purposes, we can emphasise the following:

Its use is free of charge and any internet user is permitted to register. Therefore, it is a free teaching resource, “which is an important consideration for educational budgets”. (Burke & Snyder, 2008:41), offering teachers and lecturers a very easy access to and the possibility of preparing a simple selection of cost-free content (Majorek, 2015).

It is easy to use, both to collect content and also to create material that is allowed by the platform. For instance, it provides people who do not have specific or wide knowledge of film editing, the possibility to put content on Internet, with a very low difficulty level (Pereira et al.,(2016). Moreover it enables the public or organizations to create specific channels. Nevertheless, the perceived ease of use was not significantly indicative of either perceived usefulness or behavioural intention to use Youtube as an education platform, according to Lee & Lehto (2013).

Like other social media, Youtube is characterized by accessibility and immediacy. Hence YouTube can be used as a teaching supplement by supporting lecturers’ digital learning style. It permits use of both available, innovative and timely resources posted on the platform, as well as helping learners to create relevant and engaging content (Adam & Mowers 2007)

It is easy to obtain and gather videos. The wide variety of the material on the platform, the richness of the content, and the abundance of learning resources that users can access, can enrich the learning activity of very diverse subjects. This material can be produced by the lecturer or teacher, by the students, but also from other diverse resources. For instance, some scientific and education associations have created videos as part of their knowledge transfer (Pereira et al.,2016). Moreover, Dylewski et al., (2017) posit that public web domains can provide a wealth of readily available information and a large quantity of spatially distributed data from diverse sources, groups and organisms. As a result, Youtube allows sharing personal, editorial, current events, or educational videos posted by users of the Website. In addition, through YouTube, teachers and lecturers have the opportunity to create and share their own clips, and discuss videos with their peers (Burke & Snyder, 2008), or with their students. Therefore, as Majorek (2015) mentions, besides being a great source of entertainment, Youtube has become a powerful repository of knowledge available to everyone with basic technological skills.

The information provided by the platform can be relevant to the user’s information needs, but it can be also characterized by the timeliness and up-to-date information provided, and by the sufficiency of the amount and variety of the information provided.. These facts are essential as they increase the perceived usefulness of YouTube (Lee & Lehto, 2013). Especially, according to these authors, the Sense of Vividness, considered as one of the sensations of telepresence, or the ability of YouTube to produce a sensorially rich mediated

environment, is shown as a significant predictor of perceived usefulness of YouTube by Lee & Lehto (2013).

The use of visual education, apart from a verbal one, is one of the most important advantages of using Youtube. In this sense, students prefer the use of more visual social media, such as YouTube or Instagram, instead of other more classical ones such as Twitter (Garrigos et al., 2016a, b, c). For instance Pereira et al.,(2016) mention that students feel that they learn more with the addition of YouTube videos to their course content. Moreover, Dylewski et al., (2017) states that Multimedia sources offer great potential to teaching and learning, and in some subjects or topics multimedia used in the teaching several aspects are better understood and remembered. Let us consider the thinking of Bonk, (2011) “In effect, when a course combines verbal lectures or course readings with a few short YouTube or CNN videos, there is immense learning power. The class comes to life and ideas begin to resonate with students. And since the videos are short, instructors do not have to give up much time. Short 3 or 4 minute YouTube videos help an instructor make a key point without having to sacrifice significant time. The learning payoff is potentially immense as the learner can recall the information through both verbal and visual channels” (Bonk, 2011; 16). In this sense, Bonk (2011) stresses that extending learning beyond text to episodic memory or essentially Visual learning, fosters student dual coding of information, and also enhances and increases learner retention of information (Fox, 2003).

Trier(2007) emphasizes the relevance of “cool hunting and gathering” relevant YouTube and other Internet-based video clips, which can illustrate the material being covered in a course. Hence, teachers can create YouTube playlists based on the material presented by them or even their students. An effective means, as it provides learners and students with an opportunity to be active instead of passive in the learning process. Moreover, for instance, Dylewski et al.(2017:47) mention that sometimes Youtube “may contain new information that has not previously been described in scientific papers or expand scientific knowledge on poorly studied natural phenomena”.

Furthermore, a YouTube video may also provide a “guest speaker” of recognized expertise for a course. It allows use of this free content, in situations where one could not be otherwise be obtained, or for instance for in-class instructors located in dispersed settings “where appropriate speakers may be difficult to find or in online classes where students are scattered across a vast geographical region” (Burke & Snyder, 2008:42). Moreover, appropriate YouTube videos, may be embedded in a learning module about a specific topic, also helping distance learning (Waßmann, et al.,2014), and on the platform it is also common to find, apart from lecturers and courses, conferences being shared, which has “a greater impact in developing countries, where the cost of constantly updating courses, conferences and access to skill based laboratories is often prohibitive” (Pereira et al.,(2016;14), while many data from this platform has been used in actual scientific research (Dylewski et al., 2017).

It can help to promote the active participation of students, also motivating their attitudes. Hence students may search and find YouTube content interesting for them. Specifically the material created or found by them can be more engaging than simply lecture-based delivered content. This aspect is essential as it promotes motivation and also may enhance their interest in further exploring the topic or the specific issue. Moreover, as Majorek (2015) mentions, the content posted is characterized by a high rate of personal relevancy, resulting in a greater engagement in the learning process and in a better application of new knowledge and skills. Youtube can help to create a sense of community. In this sense, through hyperlinks to Youtube and posts, community members engaged in Youtube can co-produce and create meaning and identity through practice in community, a fact that can help to enhance informal learning. (Waldron, 2013). Moreover, the fact that the material can be watched, shared, commented on, or even created, enhances the culture of participatory learning, and also provokes student interest in a topic (Bonk, 2011)

The platform can be conformed and used as a virtual library to support classroom lecturers by providing students with access to videos (Majorek, 2015).

Youtube is considered as a recognized mechanism to enhance Procedural learning, or more specifically, for learning one-time procedural tasks, as it can be used to learn “how-to-do something” through step-by-step procedural instructions (Lee & Lehto, 2013).

Youtube can help the introduction of digital storytelling in all concept areas. Hence, this process can combine the narrative with the advantages of introducing humorous stories, images, sounds, music and videos to enrich these narratives, also offering “tremendous” opportunities for teachers and lecturers to engage and assess students. (Dreon et al., 2011).

Youtube is essential, because, being an important technological and social innovation, “educators can gain insights and gradually incorporate useful and innovational techniques to reach and engage students within and beyond classroom walls, by reflecting on the myriad ways in which learners can access information online” Kruse & Veblen (2012:85).

Videos can become valuable teaching tools and YouTube is a useful tool to disseminate, and share information, for instance among colleagues or lecturers. Moreover, there has been a rapid expansion of YouTube videos on several subjects, and several channels on diverse topics are available at the YouTube website, which can facilitate this process. (Pereira et al., 2016).

Youtube can be a suitable tool for teaching, ‘especially in situations where geographical or socio-economic restrictions would make it difficult to find a suitable instructor otherwise’ (Rudolph and Frankel, 2009: 15).

3. Limitations of YouTube

The power of YouTube lies more in how it is used than in itself (Duffy, 2008), hence, this author suggests that “Effective instructional video is not television-to-student instruction but rather teacher-to-student instruction, with video as a vehicle for discovery (ibid p.124).

Like the use of other social media, as pointed by Garrigos et al (2016a,b,c), it requires careful course design. In this aspect we have to consider that due to the large amount of free available videos in the platform, practical use can have some problems. First of all, it is difficult to find the exact appropriate material, with the appropriate terminology, adapted to the classroom, as the platform has huge amount of content. Secondly, not all videos posted on Youtube are appropriate for teaching as they can contain inaccurate or unreliable content (Burke & Snyder, 2008). Hence it is necessary to carefully evaluate and select the videos that relate to objectives and course content; to use short precise videos to cover the material, and for this reason it is essential to segment the content if possible to deliver it in chunks to the students (Schmidt & Ralph, 2016); measure the humor and the instructional nature of the videos; recheck the availability of the videos on the platform; look for the accessibility of the video within the classroom setting or from the locations of the students; and ask for possible permission to avoid legal problems. Obviously, these issues require time.

The lecturer or instructor has to take care of the accuracy and credibility of the videos, especially those posted on the video-sharing web sites. This aspect is essential as sometimes they do not reflect the opinion of the lecturer or the university (Burke & Snyder, 2008), maybe are not appropriate for the subject, or can create “noise”, by disturbing the initial purpose. As Majorek (2015:61) indicates, we have to consider that “this tool is not designed for the purpose of spreading knowledge and should therefore not be involved in it”. This could imply that the technology, content and value, designed for entertainment, can cause unnecessary chaos and undermine the a proper and well-established education process designed for pedagogical studies.

Majorek (2015) indicates that the main problem is the quality of the videos used for educational purposes, as anyone can post self created content, a fact related both to the cognitive values and also the form of presentation. Hence, some information is repetitive, useless, very general or does not have enough quality. Focusing on this aspect, in addition, sometimes it is difficult to evaluate the quality of the source. Moreover Dylewski et al., (2017) mention that sometimes the records lack critical information about their geographical locations thus one can only extract very general information. Focusing on this quality issue, Pereira et al.(2016) also recommend that educational institutions should collaborate and build their own YouTube channels, to produce high quality relevant material, in order to cover a broader area of content rather than offer repetitive information.

The quality of the videos is sometimes not well assessed or monitored. For instance, Pereira et al.(2016) criticize the fact that sometimes the preferred videos on this platform, or the

quantity of “likes” are not indicative of the quality of these videos. Hence, the platform lacks a reliable tool for video evaluation, to ensure a common understanding and means for quality measurement (Azer, 2012).

Mao (2014:219) stresses some problems related to an inappropriate use of Youtube in the classroom such as the lack of sufficient knowledge, training or familiarity about the internet or the tool by teachers, lecturers, or students, the problem of “using the wrong one at the wrong time”, or the use of “Youtube to teach instead of them”, replacing teaching.

Previously, we have mentioned the necessity for the accessibility of the material within the classroom setting or from the students’ locations . Focusing on this aspect, lecturers have to be provided with appropriate software installed on their computers and on those of their students to see this material. (Burke & Snyder, 2008). In addition, some schools ban YouTube; therefore, if planning on using YouTube to house videos, students would not be able to access these on school grounds unless the lecturer got the ban lifted, so it is necessary to take care about this situation (Schmidt & Ralph, 2016).

Another problem of its use in the classroom is the exclusion of interactivity, due to the unidirectional nature of the YouTube environment. Hence, viewers are not naturally given any control over modifying its content (Lee & Lehto, 2013)

In addition, if students have to create their own video content, they could also require appropriate support resources, and obviously be told the rationale and purpose for the video (Bonk, 2011). Nevertheless, as Majorek (2015) states, for learners, this platform offers the possibility of gaining experience and competencies that can support the development of their future careers.

Students can present great resistance to the implementation of technologies such as Youtube in their courses, although it is quite paradoxical given the environment that they are evolving in (Goethals et al, 2011). This situation is common to the use of other social media. For instance, Garrigos et al (2015, 2016a, b, c) pointed out that with the use of some social media outside the classroom session, students can become overwhelmed, a fact that must be consider by the lecturer when setting tasks.

Other disadvantages are also pointed by Garrigos et al (2015:8) in the case of Facebook, which may be common to the use of other social media. Therefore, as posited by these authors, “Students within the webpage can be distracted by many things; they might waste time on other matters and not concentrate on the specific tasks of the particular group”, and “the fact of being in front of the computer, and the possibility of entering in other websites, can make students deviate from the tasks they have to perform”. In addition, the content shared immediately is public and belongs to the platform.

Kellner and Kim (2010), apart from analyzing some possibilities, critically evaluated some limitations of YouTube related to several aspects of culture, politics, or social transformation. Sometimes, the power of the platform is overestimated. For instance, according to the results of Azer (2012) YouTube is an inadequate source of information for learning surface anatomy.

Moreover, Pereira et al.(2016) mention that the platform still lacks good quality videos on some specific topics, nor covers all subdivisions of diverse areas or subjects. Furthermore, Schmidt & Ralph, (2016) indicate that students also mention that watching videos by the same person or the same source, whether their teacher or someone else gets boring. Finally, the lack of time, or the lack of new attractive ideas on the part of the teacher or lecturers results in the necessity of resorting to material of little value to simplify the difficult task of preparing and selecting this material Majorek, M. (2015).

4. Conclusions

This paper has tried to analyze the advantages and problems of YouTube, as a powerful tool to improve learning.

Among the advantages, the paper has stressed the cost-free content; the ease of use; the abundance, the innovative and timely resources available; the up-to date information provided; the essential provision of visual education; the availability of cool-hunted videos; the possibility of using the expert material ; the possibilities of the tool to enhance students' active participation, motivate and create a sense of community; the potential to provide a virtual library to support education; its importance for procedural learning or the introduction of storytelling in several concept areas; its use to incorporate innovational techniques to engage students; its role to share and disseminate information among colleagues; and its suitability to overcome geographical barriers.

The paper has also analyzed some difficulties in order to provide some recommendations of use. Hence, the article has stressed the need of not considering it as a television-to-student instruction; the necessity to carefully select the material related to the objectives of the learning process; the incidence on the accuracy and credibility of the videos used;the problem of evaluating the quality of the content, or the inefficacy of this tool to monitor quality; the lack of enough knowledge by teachers to use it; possible problems of accessibility of the tool; the necessity of technical support to students to facilitate its use; some problems regarding the resistance of students to its use, and the distraction and deviation of other tasks; limitations related to culture, political and social values; or the fact of overestimating the platform.

We are conscious that all the relevant benefits and limitations of the use of Youtube have not been considered, However, this paper can be seen as an initial step to further theoretical and empirical analysis of Youtube as a reliable and essential platform to improve education.

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A review of the studies done on self-concept and its role in job satisfaction

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Abstract

Since long the study of individuals' behavior in the workplace has been attracting the management scholars' attention and the advent of field of organizational behavior in early years of 1960s led to more serious researches in this area. The research method was case study and different aspects including self concept, vocational self concept, and its role in job satisfaction were studied. The results of the study showed that the most successes and failures that people experience are strongly related to their attitude toward themselves and their interaction with others. The self concept in each individual needs stability and homogeneity in his life and resists against the change. One of the domains that is strongly related to the issue of job satisfaction is the vocational self concept phenomenon. The positive self concept is a vital factor to overcome hesitation in job choice. When the job is in accordance with the person's self concept, that person considers his job as a meaningful and valuable item.

Keywords: *Self-concept, Vocational self-concept, Job satisfaction*

Introduction

One of important psychological issues concerning personality growth is self-concept. Self-concept is the individual's comprehensive attitude toward characteristics and abilities, and in a word, the self. Since the people's characteristics and abilities changes due to experience, learning, and environment during the time, it can be noted that self-concept is a flexible and unstable issue (Yasai, 1998).

At the present time, the scientists and psychologists believe that self-concept determines the individual's behavior and in case the person faces with a situation or stimulation which is on contrary to his behavior or values, he shows resistance, while he would accept that situation if it was agreed with his values (kazemi, 2003). No body is born with self-concept. Self-concept is formed in early months and is shaped through repeated experiences, and is strengthened through experience as a social product. The important point is that people have different attitude toward themselves at different periods of time and self-concept mostly determines behavior path (Kazemi, 2003).

One of the domains which are strongly associated with job satisfaction is vocational self-concept. Vocational self-concept means the person's all beliefs about his job which is somehow related to job choice. This is a key concept in Rodgers and Super's theory which has led to numerous researches. Super states that vocational self-concept is shaped in parallel with mental and physical growth, job observation, adult identification, and finally intrapersonal differences and similarities (Shojai and Gorbani, 2015).

1. Self-concept theory

Self-concept is an idea that the individual observes reflecting on his characteristics. But self-concept is not only what you observe about yourself, but includes what he feels the other see about him. So, self-concept is also shaped by other people's real or imaginary judgments, especially the individuals in social environment (Jalajas, 2015).

So far, the most effective psychological criterion about self-concept belongs to Carl Rodgers in 1947. According to Rodgers, every one's 'self' as a major part, forms the individual's personality. Rodgers introduces "self" as a social product which is developed through interpersonal relationships. He states that there is always a strong desire to get a positive insight about himself from others and the self. Although many self-concept theorists did numerous studies in 1970s and 1980s, self-concept does not receive enough attention at the present time. Of course, this issue is still concerned in psychology studies as a progressive factor. Today, there is a tendency to know about self-concept among both public people and specialized one and this issue is brought up in relation with family problems, addiction, and other social problems (Alizadeh, 2008).

Self-concept can be both positive and negative. Positive self-concept: this self-concept is often formed through providing backgrounds needed for actualization of talents and abilities as well as being awarded. In this case, the person has the sense of worthiness and trustfulness.

Negative self-concept: it is usually formed following failures and the person with this kind of self-concepts feels incapability, hatred, humility, and distrust. The individual self-concept indicates the person's attitude toward one's characteristics including physical properties and sexual, racial, class, social, and economic identity during the time (Tagizadeh, 2000).

Rodgers argues that every man lives in a changing world of life experiences and he is the only one in the center of that world. The person or organism reacts based on the empirical experience and perception (Alizadeh, 2008).

According to piorki, self-concept means a collection of dynamic, organized, and complicated system about beliefs, insights, and attitudes which is presented by individual to achieve a true frame in relation with his personal existence.

Cuper Smith (1967) considers the self-concept as an important factor to develop a behavior and argues that the people with positive self-concept behave in a more acceptable way. Self-concept is the belief the person has about oneself. This belief is related to all aspects that is physical, social, mental aspects. The person's idea about each mentioned factor causes a certain behavior.

He states that self-concept is formed as a result of interaction among following factors:

- a) The parents' belief about the individual
- b) The friends' belief about the individual
- c) The teachers' belief about the individual
- d) The person's belief about oneself (Shafi Abadi, 1994).

Adler has concerned self-concept in his theory about lifestyle. He defines self-concept believing in "who I am" (Krisni, 1991). Adler (1963) points out that if the purpose of behavior is determined, the consequence and evolutionary path of that behavior can be simply specified. It means that the characterization of behavior makes it possible to identify the path of individual's behavior (Shafi Abadi, 2000).

Self-concept means our impression from our physical and psychological nature, as well as social structures such as insights, beliefs, and ideas. Self-concept means the individual's perception of oneself considering dimension of time. Self-concept is constantly balance interacting with other people and is influenced by other factors such as being introverted, extroverted, and self-esteem. job plays an important role in people's lives. For majority of people, job is an activity which they spend so much time for. Today, people look for jobs which are noticeable and rewarding with some external awards (Kadron, 1997).

ShafiAbadi (2000) argues that self-concept determines the path of behavior. Self-concept is the judgment the person has about his successes, values, abilities, credits. Answer to the questions like "am I a successful person?" or "can I do this successfully?" indicates personal self-concept.

Tagi Zadeh (2000) gives another definition of self-concept: individual's awareness about his identity as a person or self-evaluation. Self-concept growth gradually since the child

discovers some parts of his body and then includes all thoughts, feelings, tendencies, values, and ambitions.

2. Self-concept dimensions

In the recent decades, the psychologists' attitude toward the nature of self-concept has been evolved. The early experts considered the nature of self-concept one-dimensional and stable, whereas the present experts believe that the self-concept is a dynamic and multidimensional unit (Kompbel et al., 1996). Some researchers believe that the self-concept includes two parts namely scientific and non-scientific self-concept (Marsh, 1990).

According to Byrne and Shavelson (1986), self-concept has independent components. They consider educational, social, and physical abilities as the main components of each person's self-concept. Mandaglio and Pyryt (1995) has multidimensional attitude toward self-concept's meaning. Self-concept possesses four dimensions: scientific, social, sport, and value dimensions. In present view, self-concept is regarded as a cognitive schema (Kompbel et al., 1996). Indeed, every person's self-concept is an action to develop a schema for organizing his perceptions, feelings, insights about himself (Woolfolk, 1993).

Kursini (1984) believes that some aspects of self-concept of phenomenology can be referred which have received less attention:

- A) Individual self-concept: it expresses the individual's attitude toward one's behavioral characteristics. This self-concept includes physical properties as well as sexual, racial, class, social, and economic identity during the time.
- B) Social self-concept: the individual's behavioral characteristics the person imagines other people observe.
- C) Self-idealization considering individual self-concept: these ideals are imaginations the person hopes to be similar to them.
- D) Self-idealization considering social self-concept: these ideals are imaginations the person hopes the other people observe him similar to them (Byabangard, 1999).

Schultz suggested that self-concept has three main components namely, perceptive, imaginary, and insight components. The perceptive component is the image that individual has about his appearance and other people's impression of this appearance. The perceptive component is often called "physical self-concept". Imaginary self-concept is the individual's impression of his characteristics, abilities, background, and future. This component is often called "mental self-concept" and includes the adaptive characteristics like honesty, self-confidence, reasoning, courage, and negative characteristics (Seyyed Mohammadi, 2004).

3. Job satisfaction

Job satisfaction is defined as the individual's insight into his job. Job satisfaction is one of the most important factors in job success. Job satisfaction is the factor that leads to increase in efficiency and rewarding experience. Job satisfaction has two dimensions. One is hygiene

which includes job's environmental characteristics and external aspects like supervision, salary, interpersonal relationships, and working condition. Second is motivators depending on duties, internal aspects of job and includes the importance of promotion, responsibility, and advancement. That is the reason Herzberg believes that it is not possible to do research on job satisfaction with the title of opposite extremes of a continuum with a neutral point in the center (neither satisfaction nor dissatisfaction) because several characteristics is related to job satisfaction and dissatisfaction in stable way. Many people have reported the internal factors (promotion, recognition ...) as satisfaction source and external factors (organization's policy, supervision, salary, and relationship with colleague ...) as the reason of job dissatisfaction. The job satisfaction can be defined as evaluative process which investigates what the individual has and what he wants (Kaldi and Asgari, 2003).

4. The role of self-concept in job satisfaction

Self-concept is a main concept in job promotion and is defined as the individuals' accurate and complete perception of their characteristics and the environment characteristics. All patterns of job promotion lead into clarification of achieving self-knowledge to choose the job and shape the job promotion. The major presupposition in main theories of job promotion is that the positive self-concept is necessary for job promotion and job satisfaction. In most patterns of job management, it is an accepted principle that an increases in insight in to oneself and working environment results in more success and efficiency (Rothman, Greenland, and Lash, 2008).

Consulting experts believe that the self-concept can be discussed from three aspects. First, self-concept can be acquired. Second, self-concept is an organized item. Third, self-concept is dynamic. Nobody is born with self-concept. Self-concept is formed gradually in early months and is shaped through repeated experiences, and is strengthened through experience as a social product. The interesting point is that people have different insights into themselves at different periods of time. He considers the experience that is not compatible with his self-concept as a threat and if the number of this kind of experiences were more, the self-concept would be more frozen to protect the individual. Every individual's self concept needs stability and resists against the change. In case the individual's self-concept changed quickly, he will lack a strong and supportive personality. The world and the people surrounding the individual are perceived in relation with his self-concept. A healthy person has a permanent tendency to accept new ideas and remove the old ideas. Self-concept always protects itself against losing self-esteem. That is the reason that every loss will result in anxiety (Seyed Mohammadi, 2004).

The society evolution from traditional to industrial manner causes many problems especially regarding employment. Our society needs skillful and specialized workforce while being industrialized and achieving self-sufficiency. To achieve self-sufficiency, it is necessary to develop and implement a precise program which is dependent on economical,

social, and cultural studies of Iranian society. Employment is an inevitable necessity for society survival. Every person makes living through working and each country's self-sufficiency depends on performance of the employed people. The researches indicate that first, unemployment increases corruption and second, employment and job satisfaction causes happiness. Motivating the people and guiding them to choose a job in accordance with their ability and talent as well as finding their interests should be done with appropriate tools (Feghi Farahmand, 2009).

According to Kanjer, as Schneider states, tendency to meet personal needs and suitable environment are considered psychologically as main factors of job choice. Today's generation have more tendencies to jobs with identity. Kadron many job seekers pay a lot of attention to above-mentioned factors while choosing job. At present time, the theory of staff motivation has been brought up emphasizing agreement between individual and his job. Shamir reported that theory based on the self-concept about staff motivation is grounded on mutual relationship between performance and the individual's self-concept. When the person's job conforms to his self-concept, that person considers his job as valuable and meaningful issue. In other words, a valuable job for each person gets meaningful in relation with that person's self-concept (Gorbani, 2006).

In 1980, Vanus put the above-mentioned concepts in a coping model which emphasized on the role of job and employment. In 1987, Schneider presents a model named "attraction, choice". Based on this model, people finally quit working in the organizations where they can't conform to. But this model is not able to choose the people for organizations that they can adapt themselves (Schneider, 1987; Goldshtine and Smith, 1995). Schneider argues that the above-mentioned concepts should be developed in relation with the individuals' self-concept, that is, a relationship between self-concept and the individual's job should be observed (Firuz bakht, 2010).

Workforce experts can choose people with higher possibility and guide them to find the right job focusing on degree of conformity of self-concept with job duties. This method is benefiting in two ways. First, the person can get the job based on his interests and innovations as well as his beliefs to do the duties. Second, the organization can choose the people who conform to its rules and disciplines.

Self-concept influences the individual's job and plays mediator's role. Self-concept is formed when the child distinguishes between him and other objects and continues throughout his lifetime (Firuz Bakht, 2010). Jianan Tanio and Herly Hanson (2006) define the self-concept as ability, traits, values, self-confidence, and efficiency. The self-concept develops while passing growing steps through being exposed to jobs, media, school, society, and other sources (Shafi Abadi, 2007).

Super et al. (1963) state that vocational self-concept means the person's all beliefs and imaginations related to job choice and affect the evolutionary path of job choice. It can be said that the vocational self-concept is a tool to investigate the evolutionary path of job choice

resulting in job choice (Shafi Abadi, 2007). Super argues that the evolution of self-concept undergoes 4 stages namely revelation, recognition, identification, and role-playing (Shafi Abadi, 2007):

Revelation: the individual considers himself as a person separated and different from others and he evolves his existence through experiences.

Recognition: the individual compares himself with others and recognizes his own abilities and characteristics leading to some decisions about job and education.

Identification: children identify with parents at certain age and find out their role in the society.

Role-playing: the person identifies with a job or a person, that is, he tends to get that job and play his favorite role.

5. Conclusion

It can be concluded that the individuals regard their favorite job based on their perception and beliefs about their personal specifications (self-concept). If the individual's job conforms to his self-concept, he will consider his job as valuable and meaningful issue, and this job satisfaction results in a pleasant and positive feeling. It is obvious that positive self-concept is necessary for job satisfaction. Now that the importance of self-concept in evolution of vocational path, it can be said that the consultants' most important role is to help the referrals to develop a strong, realistic, and clear self-concept including finding out interests, abilities, and values. This means that the referrals that have more awareness about themselves and job issues can make right decisions.

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Academic strategies identification using text-mining: a case study at the industrial University of Santander - Colombia

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Abstract

The productive world demands that the university work responds to the society requirements. Therefore, it is fundamental to strengthen the competencies through of effective educational strategies. Then, the objective of the present work is identified academic strategies in order to improve academic development to Industrial Engineering students rolled in the Industrial University of Santander (Bucaramanga, Colombia) according to their experience across the academic semester (Finance and Budgets subject). For this, a cross-sectional self-supplied study was developed to 217 students using a statistical instrument (Survey) which contained an open ended question related to competency-based education improvement; This question is analyzed building a text mining programmed in the statistical software R. The results obtained, show the needs of cluster three students groups, it is representing 69.1% of the total population variability also, the results identified two strategic factors: "concepts application" and "accompaniment degree"; indicating the teaching-learning strategies required.

Keywords: *Clustering techniques, Education methodologies, Finance and budgets, Text Mining, K-means.*

Resumen

El mundo productivo exige que el quehacer universitario responda a los requerimientos de la sociedad, por tanto, es fundamental fortalecer las competencias mediante eficaces estrategias educativas. Teniendo en cuenta lo anterior, el objetivo del presente trabajo es identificar estrategias de mejora académicas a los estudiantes del programa de pregrado en Ingeniería Industrial de la Universidad Industrial de Santander (Bucaramanga, Colombia) de acuerdo a su experiencia durante el semestre académico en la asignatura Finanzas y Presupuestos. Para ello se realizó un estudio transversal a 217 estudiantes mediante la aplicación de un instrumento de recolección de datos (Encuesta) de carácter auto suministrado el cual contenía un componente de pregunta abierta relacionada con el desarrollo de mejoras enfocadas a la educación por competencias; dicha pregunta es analizada mediante una minería de texto programada en el software estadístico R. Dentro de los resultados obtenidos se destacan las necesidades de tres grupos de estudiantes que representan el 69,1% del total de la variabilidad poblacional, a partir de los cuales se identifican dos factores estratégicos: “aplicación de los conceptos” y “Nivel de acompañamiento”, hacia los cuales se deben redirigir las estrategias de enseñanza-aprendizaje de la materia.

Palabras Clave: *Finanzas y presupuestos, Metodologías de educación, Minería de Texto, Técnicas de agrupamiento, K-means*

Introduction

Within the learning tendencies, different methodologies related to how people acquire knowledge is formulated, explaining the relationship between the information that the learner already has and the new information to be learned. There are several currents studied that have enriched their theoretical sense and their applicability, beginning with behaviorism, whose theoretical basis is based on the acquisition of knowledge through conditioned reflexes (Gomez, 2003); In pedagogical fields, the student plays a passive role in their learning and the teacher is in charge of transmitting this new knowledge (Rodriguez, 2004).

Subsequently, cognitivist seeks to discover how the human mind (through the processing of information) is able to think and learn (Portilho, 2005). Unlike behaviorism, this theory makes the student an active subject in the learning process and the teacher is the bridge in the creation of a participatory environment (which the student is stimulated to create strategies for his own self-teaching) (Castro & Guzmán, 2005). It gives rise to the constructivist current, which raises the production of new knowledge in a collaborative way from previous learning and, therefore, the knowledge cannot be taught, because it depends on self-interpretation. (Díaz Barriga & Hernández Rojas, 2002).

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From the different mechanisms with which a student learns, it is possible to propose teaching methodologies that help people to develop their abilities taking into account the social context in which they were grown. For the Industrial University of Santander environment, it is imperative that these methodologies focus on the training of professionals who can adapt to the changing situations of the environment, which are linked to the accelerated progress (Globalization, Technological Development, Information Technology, etc.) (Cano García, 2008).

Within the teaching methodologies, there is Training and Development by Competencies (TDC), this is an alternative that "allows to give meaning to the wholistic formation, the university-society relationship and, particularly, learning to learn as the main challenge that the actors in the academic community face." (Arenas Landínez & Jaimes luna, 2008, p.90). In the case of the Industrial University of Santander (UIS) and in particular, for the Industrial Engineering program - whose mission is to contribute to the development of society through the integral training of professional citizens- (Escuela de Estudios Industriales y Empresariales, 2017). The application of this type of teaching establishes competencies based on skills, knowledge, and values in an integrated way to forge professionals capable of designing, undertaking and improving systems that generate goods and services.

In short, it is through Active Pedagogies (AP) where the professional future plays a role as a direct participant in their academic training (Andrade, 2013). This is in line with the professional profile of the Industrial Engineer (IE) in two major aspects. 1) the IE is a proactive and enthusiastic worker in disciplinary teams, and 2) the IE is a human being who permanently seeks his personal improvement and development (Universidad Industrial de Santander, 2013). Therefore, the way in which the student of Industrial Engineering learns will be fomented by the integration of the constructivist self-lesson and the continuous formation in Information and Communications Technologies (ICT). (As a resource in the didactic process).

In addition, Finance and Budget are particularly remarkable among the various subjects focused on strengthening the IE competencies. Taking into account its topics: the analysis of business risks and uncertainties (in decision-making), the holistic understanding of the company and its different stakeholders, the management of own economies or productive units, the cost-generating elements, the various leverage scenarios, the interaction of the state in business, etc. (León, 1991) (Ministerio de Educación Nacional, 2014).

Taking into account the learning methods explained before, the Industrial Engineer profile and the porpoise of promoting active pedagogy through the relationship between the constructivist self-lesson and learning by TDC. This paper aim is determining the current academic situation of the students which study Finance and Budget; establishing factors that influence its learning (these are identified from the perspective of the student). With this, we will forge theoretical bases that allow formulating pedagogical strategies to implement in the subject Finance and Budget in order to improve the student academic experience.

To this proposed, we developed a cross-sectional statistical study for students who completed the Finance and Budget course during the first and second academic semester of 2016, using a self-supplied data collection instrument (Survey). The survey contained an open-closed question related to the development of competency-based education improvements, in order to develop the analysis, we programmed a text mining in the statistical software R.

The structure of the present work consists of a first section related to the applied methodology, followed by a second one in which is discussed the scope of the study. In the third section, are exposed the results, and finally, the fourth section is focused on the teaching-learning strategies recommended.

1. Methodology

The methodology consists of four major stages. The first stage is the construction of the database (i.e. dataset), the second stage condenses the activities necessary to perform the text mining by applying K-means (KM), in the third stage, is explained the method for determining the number of clusters and in the fourth, the is described the result analysis for each group.

1.1. First Stage: Data collection

From the open-ended question answers related to competency-based education improvement (conducted during the end of the first and second semester by the authors), the database is constructed. The sample is made up of 217 Industrial Engineers students who attended the course Finances and Budgets at the Industrial University of Santander in 2016. The survey answers and the analysis of their responses are carried out in Spanish and later translate to English for the present manuscript.

1.2. Second Stage: Text clustering

The text clustering is an unsupervised machine learning technique involved in pattern recognition that groups individuals (answers) into sets that have a related implicit structure. The technique is characterized by maximizing the similarity between the elements of the same group and to maximize the differences between groups. (Eító Brun & Senso, 2004) in this work, we use a methodology adapted from the work of Contreras et al (Contreras, Talero, & Camacho, 2017).

As the first instance, the Text clustering is generated developing a pre-processing of the data, in this work, we use the statistical software R and its "TM" and "Snowball" packages. The process consists of eliminating from the answers misspelled words and characters such as exclamations, interrogative signs, scores and other elements that are not words. Subsequently, are eliminated the stop-words (i.e. articles, pronouns, and prepositions, among others) since they are present at a high frequency in natural language but lack a concrete meaning and thus impart noise in the results (Karla, 2016).

After the cleaning process, the terms (i.e. words) are transformed into their linguistic root, in order to condense related terms. Subsequently, answers are changed from flat texts to numerical format by creating a matrix that relates the frequency of occurrence of terms (columns) with the corresponding original answer (rows). Following this transformation, it is possible to identify which words the students frequently use, and formulate a correlation matrix between terms (understood by the related appearance of terms in each document); in addition, from the terms – answers matrix, it is possible to identify the weight of each word identified.

The weight of the terms identified is calculated as the effect between the frequency of occurrence of a term (TF) and the inverse frequency of the answer which containing the term t (IDF). Where TF the sum of all frequencies, a term is appears for each answer (relative occurrence frequency). Otherwise, the IDF factor of a term is inversely proportional to the number of answers in which that term appears, thus seeking to highlight non-generic terms (words less used in answers). The equations for determining the factors are listed below:

$$Tf_{ij} = \frac{T_i}{d_j} \quad (1)$$

It is the frequency of the term T_i in the document d_j .

$$IDF(t) = \log_{10} \frac{N}{df(t)} \quad (2)$$

It is the importance of the term where N is the total number of documents and $df(t)$ is the frequency of documents containing the term t .

In this way, the weight of each word in a given document is the product of its frequency of appearance in the document (TF) and its inverse document frequency (IDF) $TF * IDF(t)$. From this relative weight, the matrix of the terms document is generated, and with this, the sets are build. In this paper, we work with the k.means clustering technique (see **Figure 1**).

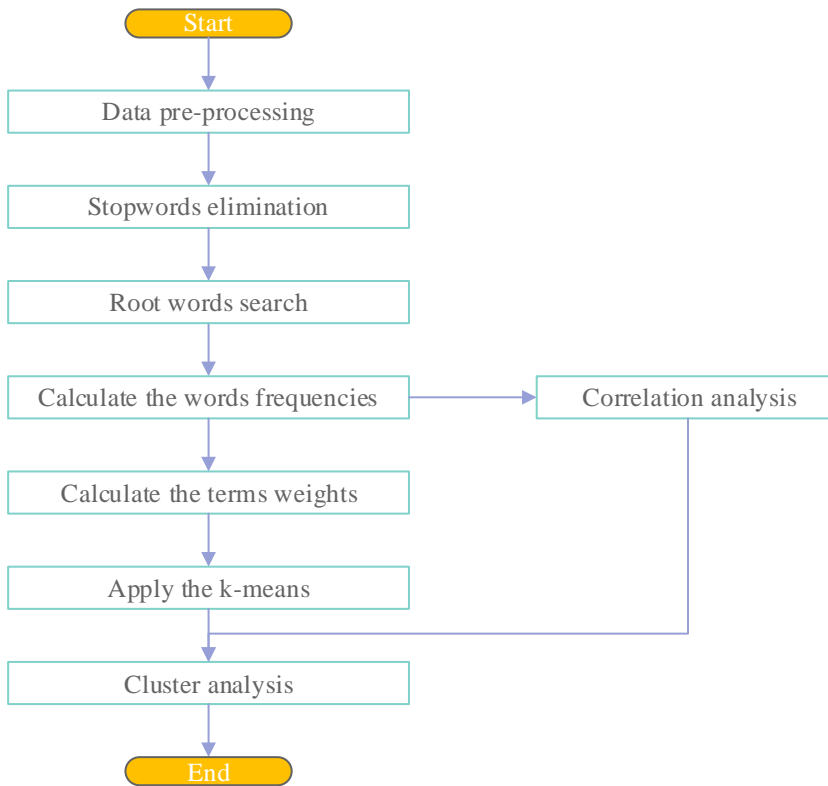


Figure 1 Process for text mining

The k-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells. When the cluster changes its population, it is necessary to calculate the new mean coordinates; the algorithm works until it is no possible to change the cluster population and there is not an allocation better than previous. (Pascual, Pla, & Sánchez, 2007). The k-means algorithm is described in **Figure 2**.

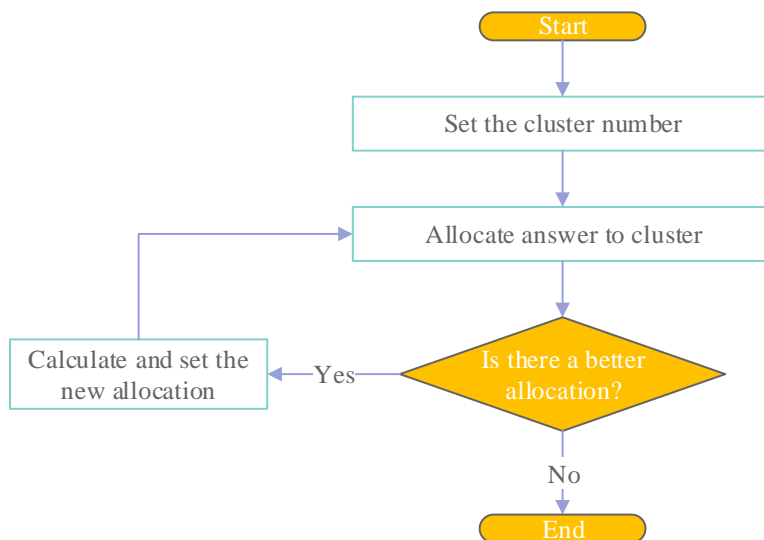


Figure 2 K-means grouping process

1.3. Third stage: assessment of homogeneity of results

In order to identify the uniformity in the response of the instrument, it is necessary to determine the number of groups to form in the first instance. To do this, we use the methodology called Elbow Method, this calculates the variability of global on the basis of the number of groups to build, selecting the number of clusters where the graph changes sharply bend (i.e. add more groups does not affect significantly the total variability reduction) (Kodinariya & Makwana, 2013).

1.3.1. Terms of the document

After transforming the linguistic structure of the documents into a numerical frequency matrix is analyzed the relationships between terms. In Figure 3, there is a first approximation, which related the word workshops with the methods of course evaluation, followed by subject methodological proposals, indicating a possible latent relationship. In order to determine if subgroups exist within the open-ended responses, is applied the Elbow Method to the $TF * IDF(td)$ matrix, finding that there are three large groups among the respondents (See **Figure 4**).

Once defined the number of groups to find, is made a comparison between linking methods and their respective distance, finding that the best combination for this case is the Hartigan Algorithm with Manhattan distance.

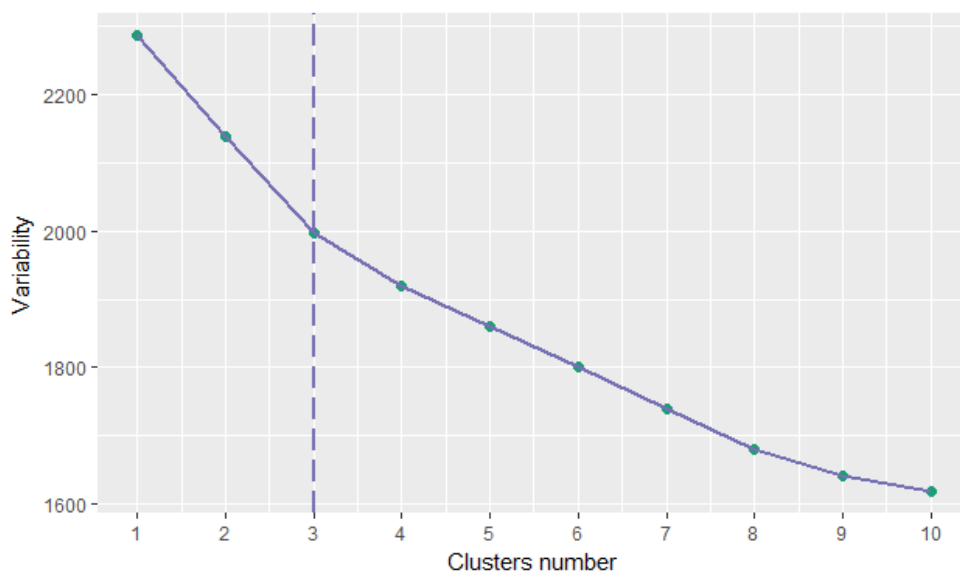


Figure 4 Elbow Method graph

Because of **Figure 5** information, it is possible to define the main components (axes or latent factors found) according to their incidence in the spatial orientation of each cluster and taking into account the answers given by the students; which are related to the expected improvements in the teaching-learning process. It is possible to define the first strategic factor as the *expected application of the concepts* seen during the course and the second strategic factor is the *Level of accompaniment* that the student expects to have during its process in the semester.

In conclusion, in order to improve their teaching-learning experience, students in three different levels (a combination for each cluster) expect to develop and implement strategies that clarify how to use theoretical concepts in the workplace. Moreover, having a greater accompaniment of teachers: more evaluation methods with more frequent feedback and theoretical and practical material supported by the use of ICTs.

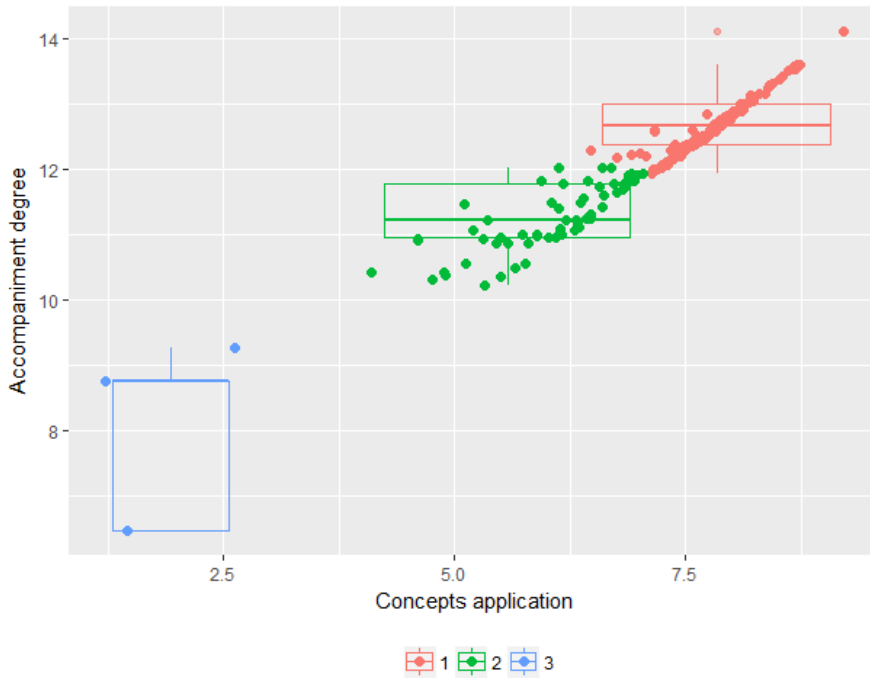


Figure 5 Spatial distribution of groups

1.4. Fourth stage: Result Analysis

1.4.1. Group 1 description

The students of group 1 expect to implement strategies in the course focus on training them to obtain positive results when presenting the evaluations (i.e. test, assessments, etc.). In order to do this, they require workshops supported by office tools such as Excel, more / different student support space, step by step guided classes in the classroom, computer lab workshops and finally, guided handouts that mix calculation tools with Finance concepts. **Figure 6** presents the most used words in the responses.

1.4.2. Group 2 description

Students in group 2 expect to implement strategies with which the concepts seen during the course are applied in a work environment such as case studies, management of office tools, technical visits or workshops in different formats (virtual, Excel, etc.); a constant teacher accompaniment, and more (and frequent) feedbacks than expected by cluster 1 students. The most used words by students in the second cluster are listed in **Figure 7**.

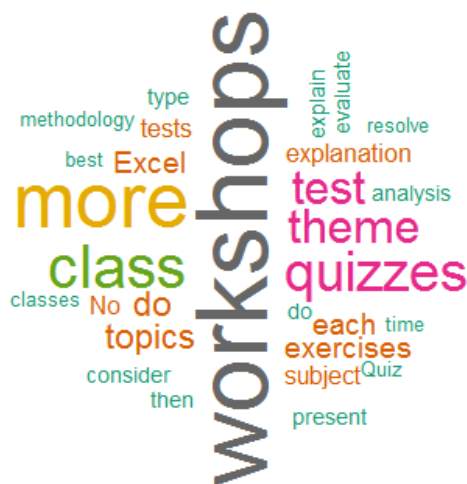


Figure 6 Group 1 word cloud

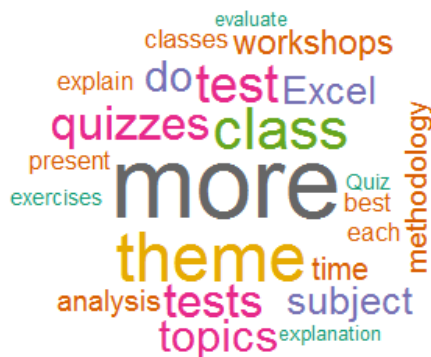


Figure 7 Group 2 word cloud

1.4.3. Group 3 Description

The Group 3 students expect to implement basic theoretical learning strategies; in general, they expect more workshops without articulating any real-world approach, suggesting that they are satisfied with the way they study the subject and their professional projection runs towards another profile of the Industrial Engineer, so they only expect more material to study. The most used words by students in the third cluster are listed in **Figure 8**.



Figure 8 Group 3 word cloud

2. Discussion

Text mining is a powerful methodology for identifying trends or patterns that underlie in documents. Therefore, there is possible to increase the spectrum of questions in diverse surveys and thus not limit them only to the traditional categories of scale or multiple choice. However, it is necessary to work collaboratively with the experts on the subject under study (such as finance and pedagogy in this case) and professionals related to artificial intelligence issues, to achieve better analysis.

One difficulty with methodologies as the proposed is that it is not possible to guarantee that the population (students enrolled in each academic semester in the respective institution) is homogeneous period after period. Therefore, it is necessary for the semester beginning to carry out test focused on competencies and methods of study in order to identify student profiles and thus formulate customized materials. Synthesizing, both approaches (previous competencies and experience during the course); future longitudinal studies can be carried out, in order to identify the relationship between the student's study profile, the proposed teaching-learning strategy and the academic performance in the course.

3. Results

Based on the two factors identified and the three large groups found (with similar behavior during both academic semesters), is necessary to develop strategies that allow a faster response, to facilitate communication between student and teacher, allowing interaction and discussion among peers in an interactive channel. This is expected to be achieved by building interactive material as digital handouts, linking self-guided and self-evaluated workshops; together with a virtual platform (such as Moodle) to improve response speed in an alternative communication channel between teachers and students. A fundamental part of the strategies proposed is that students could take more advantage of independent study time in order to prepare the subjects in such a way that the lecture (i.e. self-study lesson) is a space for greater reflection and analysis.

3.1. Strategies

3.1.1. *Creation of new theoretical material (Digital)*

The design of new theoretical material does not seek to replace the material which teachers recommend for independent study; on the contrary, it hopes to act as a complement in order to integrate the concepts seen in the classroom in a student familiar language. The material will be generated in PDF format (generating a repository) and its reading will be structured according to the academic plan of the course in order to carry out a more fluid study process.

3.1.2. *Self-guided workshops according to the material created (Excel)*

The proposal of the Excel self-guided workshops is integrated the theoretical concepts seen in the classroom with the complementary material (books, guides, videos, and PDFs created for the course) in the independent self-study lesson. In addition, seek following the practical exercise by verifying the deep conceptual understanding and not only the grades obtain, simulating a real professional environment.

3.1.3. *Preparation of topics and anticipated evaluation (Moodle)*

The objective is to develop a continuous academic monitor process, in this way; the teacher can take corrective measures at the right time and thus offer students quality practices. For this purpose, Moodle has a questionnaires module, which will allow the teacher to design their own questionnaires and apply them to their students before explaining the subject (similar to Just in Time Teaching), after that, the professor resolved doubts acquired through their independent study time.

3.1.4. *Immediate response and new communication spaces (Moodle)*

One of the advantages of the Moodle platform is the questionnaires (which automatically corrected and graded) generating time saves. Besides, Moodle offers the option of delayed feedback, so the students can check their grades and verify their mistakes once the test finalized, destining time to carry out a deeper teacher accompaniments. Moodle would become an extra intermediary between the teacher and the student thanks to this type of meeting, which facilitates the teacher's work and helps the student to be continuously aware of their academic process; focus on the concept applies in the real world.

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The Olympian gods: a didactic unit with CLIL methodology

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Abstract

Nowadays, teaching in a foreign language has a huge importance. But the most important is to develop a different methodology to enhance students' learning and to boost their knowledge. In this context is needed to integrate contents and language in order to seek the best benefits for our pupils.

Our aim has been to develop a didactic unit using CLIL methodology to aid both, teachers and students, to teach and to deal with a language in a natural way, while contents are reinforced. This unit is planned for Classical Culture, an optional subject in 3rd of CSE. It is named The Olympian gods. It is formed by six lessons and we are going to develop the first one. It will take us seven sessions. Throughout this lesson, the Bloom's taxonomy has been used to plan the different activities. We tried to design these by following the thinking skills what is supposed that our students should have achieved at the end of the unit, in order to reach the top of the pyramid. At the same time, we seek that the relationship between language and content developed during the lesson is related to the Cummins matrix, because our aim is that our students are able to go from the third quadrant (Low Linguistic Demands + High Cognitive Demands) to the fourth one (High Cognitive Demands + High Linguistic Demand).

Through CLIL, the cognitive skills, according to Bloom's taxonomy, are grown and this facilitates that students build their own knowledge. We have also to take into account that the centre of the learning processes are the children and we, as a teachers, are becoming the guides in the classroom.

Keywords: *CLIL, didactic unit, classical culture, multilingualism, cognitive skills..*

Resumen

Hoy en día, la enseñanza en un idioma extranjero tiene una gran importancia. Pero lo más importante es desarrollar una metodología diferente para mejorar el aprendizaje de los estudiantes y aumentar sus conocimientos. En este contexto es necesario integrar contenidos e idiomas para buscar los mejores beneficios para nuestros alumnos.

Nuestro objetivo ha sido desarrollar una unidad didáctica utilizando la metodología CLIL para ayudar tanto a los profesores como a los estudiantes a

enseñar y utilizar la lengua de manera natural, a la vez que se refuerzan los contenidos. Esta unidad está prevista para Cultura Clásica, una asignatura opcional en 3º de ESO. Se titula Los dioses del Olimpo. Está formada por seis lecciones y vamos a desarrollar la primera en siete sesiones. A lo largo de esta lección, la taxonomía de Bloom se ha utilizado para planificar las actividades. Intentamos diseñarlas siguiendo estas habilidades de pensamiento que se supone que nuestros estudiantes deberían haber logrado al final de la unidad, para llegar a la cima de la pirámide. Al mismo tiempo, buscamos que la relación entre el lenguaje y el contenido desarrollada durante la lección esté relacionada con la matriz de Cummins, ya que nuestro objetivo es que nuestros estudiantes puedan ir desde el tercer cuadrante (Baja Demanda Lingüística + Elevada Demanda Cognitiva) a la cuarta (Elevada Demanda Cognitiva + Alta Demanda Lingüística).

A través de CLIL, las habilidades cognitivas, de acuerdo con la taxonomía de Bloom, se trabajan y esto facilita que los estudiantes construyan su propio conocimiento. También tenemos que tener en cuenta que el centro de los procesos de aprendizaje son los niños y nosotros, como docentes, nos estamos convirtiendo en guías en el aula.

Palabras clave: *CLIL, unidad didáctica, cultura clásica, multilingüismo, habilidades cognitivas.*

Introduction

Our aim has been to develop a didactic unit using CLIL methodology to aid both, teachers and students, to teach and to deal with a language in a natural way, while contents are reinforced. This unit is planned for Classical Culture, an optional subject in 3rd of CSE. It is named *The Olympian gods*. It is formed by six lessons and we are going to develop the first one. It will take us seven sessions. Throughout this lesson, the Bloom's taxonomy has been used to plan the different activities. We tried to design these by following the thinking skills what is supposed that our students should have achieved at the end of the unit, in order to reach the top of the pyramid. At the same time, we seek that the relationship between language and content developed during the lesson is related to the Cummins matrix, because our but is that our students are be able to go from the third quadrant (Low Linguistic Demands + High Cognitive Demands) to the fourth one (High Cognitive Demands + High Linguistic Demand).

The activities have been planned using different scaffolding tools (e.g. visual organizers, pictures, online games...) because we are of the opinion that these are absolutely essential in a CLIL methodology. If our aim is to engage students in the learning process, we have to make use of different educational tools to involve our pupils in their own development.

First of all, in this paper we proposed a structure of a didactic unit following the four C's model (Coyle, 2007) related to the learning outcomes that our students would be able to achieve according to the teaching objectives. Secondly, we developed the first lesson and we included here the activities that were considered the most suitable for the topic. Everyone contains a table through it we tried to organize the task: subject, outline, thinking skills, language focus, language skills, time, level and preparation. After that, we suggested the steps to follow, the justification and the heading of the activity. Finally, we tried to connect the proposed activities with the Bloom's taxonomy (Anderson and Krathwohl, 2001) and the Cummins matrix (Cummins and Swain, 1996).

2. Unit Template

Table 1. Unit Template Example

Unit: The Olympian Gods	Area: Classical Culture	Lessons: 6	Ed. Level: 3rd CSE
Teaching Objectives	Final Task	Create a new Mount Olympus	
<ul style="list-style-type: none"> To raise learners' awareness of Olympian Gods To develop learners' abilities to classify gods' main facts To enable learners to distinguish a god and a hero To encourage students to learn with autonomy To make learners conscious of cultural differences To help learners to integrate different thinking skills 			
Assessment Criteria	Key Competences		
At the end of this unit, students will be able to: <ul style="list-style-type: none"> identify the Olympians associate the different symbols and powers compare the god's and heroes' characteristics select information about the topic present a god's or hero's fact 	<ul style="list-style-type: none"> Linguistic competence Digital competence Learning to learn Social and civic competencies Initiative and entrepreneurship Cultural awareness and expression 		
Materials Resources	<p>The Greek Gods: https://www.youtube.com/watch?v=eJCm8W5RZes http://www.theoi.com/greek-mythology/olympian-gods.html Quiz: https://b.socrative.com/teacher/#import-quiz/26011736 The weekdays: http://www.livescience.com/45432-days-of-the-week.html Activities: https://www.educaplay.com/es/recursoseducativos/2765094/the-Olympians-gods-power.htm https://quizlet.com/178564284/the-Olympians-flash-cards/ http://www.inspiration.com</p>		
Content	Student Learning Outcomes	Cognition	
Communication	<p>Olympians: gods and heroes</p> <ul style="list-style-type: none"> Identifying the Olympian gods and heroes Associating the different gods' symbols to their powers 	<ul style="list-style-type: none"> Identifying the Olympian gods and heroes Associating the different gods' symbols to their powers Identifying the different gods' powers Identifying the god's characteristics Selecting special information from the text Identifying information about a new god Identifying gods' main facts Identifying the most famous heroes Distinguishing a god and a hero Identifying a main fact 	
Language for interaction			
<ul style="list-style-type: none"> Giving opinions: It seems to me... In my opinion... Agreeing: I agree, I see your point... Disagreeing: I see your point, but... Interrupting: Can I interrupt you for a second?.. Summarizing: In a nutshell... Rephrasing: In other words... Asking for other's opinion: How do you feel about...? 		<ul style="list-style-type: none"> Inventing a new Mount Olympus 	

Language for the topic

Vocabulary

- Nouns: names of the gods, names of the gods' symbols, names of the heroes.
- Adjectives: beautiful, handsome, bad-tempered, highest...
- Verbs: overthrow, ride, spring...

Structures

Grammar

- The present simple: rides, is...
- The past perfect: married, were...
- The passive voice: are named, were known...
- Prepositions: above, on, from, of...

Structures

- The family relationships: Zeus' son...
- Comparisons: Heracles is stronger than Perseus, Afrodite is more beautiful than Hera...
- Descriptions: Cerberus has got three heads...
- Questions: Who's the goddess of marriages? Where did the gods live? How did Theseus get out from labyrinth?..

Culture

- Be aware of cultural differences: the names of the weekdays.
- Get conscious about the myths' influence in western art: the birth of Venus, Saturn devouring his children...
- Learn about etymology: myth, music, labyrinth...
- Interact with peers.
- Be able to do cooperative and collaborative tasks.

3. Lesson template

Table 2. Lesson Template Example

Unit: The Olympian Gods		Lesson: 1/6	
Content	Learning Outcomes		
<ul style="list-style-type: none"> • Generation of the Olympians: gods and goddess • Symbols of the Olympian gods • The Olympians' powers 			Culture
	<ul style="list-style-type: none"> • Be aware of cultural differences: the names of the weekdays • Interact with peers. • Be able to work in groups. 		
Cognition			
<ul style="list-style-type: none"> • Identifying the Olympian gods • Associating the different gods' symbols to each one • Classifying the different gods' relationships • Comparing the god's characteristics • Distinguishing special information from general information • Designing a new god 	Communication		
<p>Vocabulary</p> <ul style="list-style-type: none"> • Nouns: names of the gods, names of the gods' symbols. • Adjectives: beautiful, handsome, bad-tempered, highest... • Verbs: overthrow, ride, spring... <p>Grammar</p> <ul style="list-style-type: none"> • The present simple: rides, is... • The past perfect: were, called... • The pasive voice: are named, are known... • Prepositions: of... <p>Structures</p> <ul style="list-style-type: none"> • The family relationships: Zeus' son... • Comparisons: Afrodite is more beautiful than Hera... • Descriptions: Cerberus has got three heads... 			

Students will be able:

- to identify the Olympians
- to associate the different symbols and powers, to compare god's characteristics
- to classify god's relationships
- to select information about the topic
- to present a new god
- to do a self-assessment and a peer-assessment

Assessment Criteria

Material

The Greek Gods: <https://www.youtube.com/watch?v=eJCm8W5RZes>

The week days: <http://www.livescience.com/45432-days-of-the-week.html>

Quiz: <https://b.socrative.com/teacher/#import-quiz/26011736>

Activities:

https://www.educaplay.com/es/recursoseducativos/2765094/the_Olympians_gods_power.htm

<http://www.inspiration.com/go/ipad>

<https://quizlet.com/178564284/the-Olympians-flash-cards/>

4. Procedure and activities

The activities planned for this lesson have been divided into four parts: introduction, warm up, main activities and reinforcement. Everyone has a justification to include it in every part.

4.1. Lesson Stages

4.1.1. Introduction

Table 3. Activity 1

Subject	Classical Culture
Outline	Students have to look at two pictures and answer two questions to make a hypothesis about the topic.
Thinking Skills	Comparing and predicting
Language Focus	Giving opinion expressions
Language Skills	Speaking
Time	10'

Font: Own elaboration

Steps to follow:

- Give students two pictures: Zeus and Thor.
- Write on the blackboard two questions: *Who is the character in the first picture? What do you think both characters have in common?*
- Students will be encouraged to answer these questions, using different samples about giving opinion.
- Learners gather their ideas making a brainstorming.
- Say the topic to the pupils.

Justification: This is an introductory activity whose purpose is to discover our pupils' language level, meanwhile we boost their curiosity about the topic. As a help, students are provided by some linguistic models below the pictures.

Heading: Look at the pictures and answer these questions. You can use the expressions in the box.

4.1.2. Warm up

Table 4. Activity 1

Subject	Classical Culture
Outline	Students have to guess the names of different gods and their powers in a quiz.
Thinking Skills	Retrieving
Language Focus	None
Language Skills	Reading
Time	10'

Font: Own elaboration

Steps to follow:

- Say the pupils they are going to create a game about the topic.
- Students switch on their computers or laptop.
- The page [web](#) is indicated to the learners.
- Give them the access code.

Justification: This is a warm up activity. Through to a game, we will achieve information about students' knowledge on this issue. It's a way of encouraging the teenagers to remain focused at the topic within a competition.

Heading: Do you know the Olympians? Start the quiz!

Table 5. Activity 2

Subject	Classical Culture
Outline	Students have to read a little text and see a video about the Olympians. Then they have to write a sentence following different patterns.
Thinking Skills	Identifying and associating
Language Focus	Special vocabulary about the topic. Possessive forms and preposition.
Language Skills	Reading, listening and writing
Time	25' + 45'

Font: Own elaboration

Steps to follow:

- Hand an introductory scaffolded short text to the students.
- Learners should read the text.
- After reading, a [video](#) will be shown.
- Give the pupils a grid with the god's name in the first column, the god's power in the second column and his power in the third column.
- Students have to complete the grid.
- Ask the learners to make sentences following the pattern given and using the possessive form (*his/her*) and the preposition *of*.

Justification: The first main activity is used as a topic presentation. It has two parts: a text and a video. First of all, students are provided with a text in which there will be passive voice structures and their explanation. Secondly, the new vocabulary will be introduced with synonymous. Finally, students will have a word bank at the end of the text. With this design we can scaffold student's learning process not only at the text level, but also at the sentences and words level.

In the second part of the activity, they will see a video. It will be used as a grammar reinforcement for possessive forms and as a knowledge of new vocabulary, through associating words and images.

The activity is planned in order that our students were able to identify the gods, their symbols and power and as well as to write correct sentences following a pattern.

Heading: Read the text. Do you want to know more about them? Click on the video! Now, complete the grid and write a sentence following the model.

Table 6. Activity 3

The god's name	Power	His / Her Symbol
Zeus	Rain, thunder and order	Eagle
	Marriage, childbirths, empires and kings	Pomegranate
Aphrodite		Scallop shell
Hades	Underworld and death	
	Fire	Hammer
Poseidon		Trident
Artemis	Hunting	
	Music and poetry	Lyre
	War	Broze-tipped spear
Hermes		Winged sandals
Eros	Lustful love	
Athena		Owl
	Celebration	Cup of wine

Font: Own elaboration

Table 7. Activity 4

Subject	Classical Culture
Outline	Students have to complete the God's Family Tree.
Thinking Skills	Classifying and Applying
Language Focus	Special vocabulary about the topic. The Saxon genitive.
Language Skills	Writing and speaking
Time	45'

Font: Own elaboration

Steps to follow:

- Put students in groups of three.
- Say the pupils they are going to do an online family tree.
- Students switch on their computers or laptop.
- The page [web](#) is indicated to the learners.
- After finishing the activity, the learners will be provided by the correct and complete family tree.
- Explain to the class that they have to do a self-assessment.

- Hand them the assessment table.
- The grid will be completed
- Collect the tables.

Justification: With this activity students are expected to be able to classify the gods' relationships using a visual organizer that helps to encourage them, and to deal with the Saxon genitive (e.g. Aphrodite's son). In addition, the use of IT tools fosters the learning process. At the end of the activity, they have to assess their knowledge through a formative assessment to help us understand how much and how well our learners are learning.

Heading: Complete the Gods' Family Tree. Explain it to your classmates using Saxon genitive: 's.

Table 8. Activity 5

Subject	Classical Culture
Outline	Students have to describe different images of gods to a partner who will have to guess it.
Thinking Skills	Describing and comparing.
Language Focus	Special vocabulary about the topic. Passive voice, present simple, adjectives and comparatives.
Language Skills	Speaking
Time	25'

Font: Own elaboration

Steps to follow:

- Put the students in pairs.
- Learners are provided by a sheet of paper with different images.
- Images should be described to the partner and he has to guess the god's name.
- Go around each pair of students to assess their knowledge.
- The results will be put in a grid.

Justification: In this activity we will try to enhance our students' communicative abilities providing them a situation in which they can use the language in a natural way by interacting with a partner. To help them, they are supported by a *structure box*.

Heading: Work in pairs. Describe the images to your partner. He has to guess the god or goddess.

Table 9. Activity 6

Subject	Classical Culture
Outline	Students have to investigate the origin of the weekdays.
Thinking Skills	Analyzing , selecting and summarizing
Language Focus	Special vocabulary about the topic. The past perfect.
Language Skills	Reading and writing
Time	45'

Font: Own elaboration

Steps to follow:

- Present the origin of the weekdays as a mythical fact.
- Hand over a scaffolded text to the students.
- Learners have to read it and the main ideas should be underlined.
- After reading, provide the students to a [web](#) page.
- They have to switch on their computer or laptop.

- Ask them to look for more information.
- When pupils have finished, a brief summary should be written.

Justification: Students will have to deal with a text that will have been adapted at sentence and word level, and have to cope with an original page web. In this activity, students have to prove their autonomous learning and their ability to select information and to summarize it.

Heading: The weekdays: their name comes from? Read the text and write a summary explaining the name's origin of Sunday and Thursday. You can get more information in the web site.

Table 10. Activity 7

Subject	Classical Culture
Outline	Students have to create a new god and present it to the classmates.
Thinking Skills	Integrating and inventing
Language Focus	Special vocabulary about the topic. Description language
Language Skills	Writing and speaking
Time	45'

Font: Own elaboration

Steps to follow:

- Divide the class in groups of four students.
- Explain the task: a new god will be created (main characteristics, relationship with the Olympians, power and symbol.
- Learners will present their character to the rest of the class.

Justification: This activity is the last of the lesson, so the students have to use their all knowledge about the topic to create their own character. At the same time, they have to cope with a level of language that proves that they have achieved the linguistic structures and the new vocabulary.

Heading: In groups create a new god: main characteristics, relationship with the Olympians, power and symbol. Present your invention to your classmates.

4.1.3.. Reinforcement

Table 11. Activity 1

Subject	Classical Culture
Outline	Students have to complete a text with the correct words
Thinking Skills	Solving
Language Focus	Special vocabulary about the topic. Passive voice and present simple
Language Skills	Reading and writing
Time	15'

Font: Own elaboration

Steps to follow:

- Say the pupils they are going to complete a text about the topic's specific vocabulary.
- Students switch on their computers or laptop.
- The page [web](#) is indicated to the learners.
- The quiz will be solved.

Justification: A higher level of language is needed in this activity, due to the passive voice and the third person –s of the present simple. We are to take advantage of a game to foster the learning process, while students are applying their previous knowledge by solving the text.

Heading: Go to the web page and fill in the gaps with the correct word.

Table 12. Activity 2

Subject	Classical Culture
Outline	Students have to make a quizzlet
Thinking Skills	Applying and creating
Language Focus	Special vocabulary about the topic.
Language Skills	Writing
Time	45'

Font: Own elaboration

Steps to follow:

- Explain the pupils they are going to create a quizlet
- Students switch on their computers or laptop.
- The page [web](#) is indicated to the learners.
- Present a quizlet example.
- Learners will make their own quizlet.

Justification: This activity is used to do a review of the content and the language, and to encourage learners for the next lesson.

Heading: With the information about the gods make a quizlet. Remember that you have to include an image, the god's name, his power, his symbol and his relationship.

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Strengthening mathematical skills through SPOCs and collaborative learning

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Abstract

One of the main objectives of teachers nowadays is not only to offer knowledge to the students but also to give them the necessary competences to learn by themselves. Use of new blended methodologies as flipped classroom or collaborative learning has provided good results when moving from a teacher-centered learning to a student-centered learning.

The implementation of SPOCs as an element of the learning process during the academic year has brought new educational opportunities. On this context, some MOOCs created by the Technical University of Valencia (UPV) in collaboration with Applied Mathematics Department, called Basic Mathematics, have been adapted to a lower number of users, both in content and duration, and offered to freshmen students showing mathematical difficulties during the first months at the university.

A problem-base collaborative methodology has been implemented in the face-to-face sessions in which students are tested after each SPOCs lesson, individually and in groups.

We have found out that interaction between students helps them to really understand the knowledge needed. This combination of SPOCs – Flipped classroom and collaborative work has provided us with better results than employing only one of the mentioned methodologies. This methodology has been tested with small groups of different degrees at the UPV and we present here the obtained results.

Keywords: *Flipped teaching, SPOC, freshmen, blended learning, collaborative work.*

Resumen

Uno de los principales objetivos de los profesores hoy en día es no solo ofrecer conocimiento a los estudiantes, sino además proporcionarles las competencias necesarias para que puedan aprender de forma autónoma. El uso de nuevas metodologías blended, como la clase inversa o el aprendizaje colaborativo han proporcionado buenos resultados al pasar de un aprendizaje centrado en el profesor a uno centrado en el estudiante.

La implementación de cursos SPOC como un elemento más del proceso de aprendizaje durante el año académico ha permitido nuevas oportunidades educativas. En este contexto, los MOOC sobre Bases Matemáticas ofrecidos por la Universitat Politècnica de València (UPV) han sido adaptados para un número menor de usuarios tanto en contenido como en duración y se han ofrecido a los estudiantes que han mostrado carencias matemáticas durante los primeros meses en la UPV.

Se han implementado metodologías colaborativas basadas en la resolución de problemas en las cuales los estudiantes son evaluados de forma individual y grupal en una clase presencial, después de cada lección del curso SPOC.

Se ha encontrado que la interacción entre estudiantes ha ayudado en la comprensión de los conocimientos. Esta combinación SPOC – Clase inversa con trabajo colaborativo ha proporcionado buenos resultados. Esta metodología se ha empleado en diferentes grados en la UPV, y se presentan los resultados obtenidos.

Palabras clave: *Clase inversa, SPOC, estudiantes de nuevo ingreso, aprendizaje blende, trabajo colaborativo.*

Introduction

New technologies have become a fundamental part in the learning process, allowing innovative teaching methodologies, both inside and outside the classroom. Nowadays, most of the academic and not academic knowledge is available via Internet.

In recent years there has been an important development on *Massive Online Open Courses* (MOOC), one of the main objectives being to offer worldwide quality content to students about topics of interest, usually from the academic world. The resources and tools they provide can transform the learning process in a more social and collaborative methodology connecting students worldwide and allowing them to work at their own pace in the environment of their choice. Up to date, there exist many platforms offering MOOCs, like for example, EdX [4] and Coursera.

MOOCs allow students to broaden, strengthen or supplement their academic curricula. However, its use has been restricted to complement the knowledge in an autonomous way and not as an active learning tool. Nevertheless, recently, much more methodological possibilities are being implemented [2]. For example, using MOOCs as an active element of the learning process during the academic year has brought new learning opportunities.

Recently the Technical University of Valencia (UPV) has become a collaborative partner of the EdX platform, creating several courses on different subjects. For example, Basic Mathematics: Number and Terminology, Differentiability, Integrals and Algebra have been conducted in collaboration with the Department of Applied Mathematics and their objective was to strengthen freshmen mathematics level and were designed to be attainable to any student. These MOOCs consist in a series of short videos in which a topic is presented and then some assessments about the contents are taken. Forum tool can be used to interact with other students or the instructors.

In this study, MOOCs have been adapted into SPOCs (Small Private Online Course) to reinforce and review mathematical skills. The self-assessment tests available in the SPOCs give instant feedback to the students, so they are able to evaluate their improvements. Forum plays a crucial role, allowing students to interact and share knowledge growth. SPOCs have been offered to Electrical, Electronic and Mechanical Degrees at the UPV (2013/14, 2014/15 and 2015/16). The results and opinions are presented in this paper.

1. Blended Learning and SPOCs

Blended learning refers to a learning methodology in which e-learning is combined with traditional learning forms [13]. It has been suggested that blended courses emerge when 30-80% of the complementary instruction is delivered online [14]. According to David Nagel [12] there are six models of blended learning, being the “online driver” the model where “the courses are primarily online and physical facilities are used only for extracurricular activities, required check-ins, or similar functions”.

This model has been applied to our study. Students work predominantly outside of the classroom, but face-to-face sessions with the instructors are offered several times per week in order to review the topics with a flipped classroom and collaborative methodology.

On the other hand, Massive Open Online Courses (MOOCs) are classes delivered in an online environment with significant differences to online education. Two types of MOOCs are presented and discussed in [5]. One is based on the connectivism theory of learning, encouraging networks of learners evolving informally and are known as cMOOCs. The other ones are called xMOOCs, and are more similar to traditional education, including, for example, deadlines for assignments and online continuous assessments. xMOOCs remained relatively unknown until 2011 when leading Universities in the United States began to offer MOOCs via commercial platforms such as Coursera, Udacity or EdX. MOOCs have been recognized as a major advancement of higher education [10].

Apart from providing free and open education, MOOCs allow new blended learning methodologies at schools and universities [11]. For example, MOOCs are used to improve flipped classrooms methodologies. When used in this form, i.e., to improve the quality of teaching and learning, leads to what has been called SPOCs (Small Private Online Courses) in the media [3].

2. Mathematical Learning Difficulties at the UPV and starting point

Freshmen have different mathematical backgrounds and perform differently depending on the knowledge or skills required in the mathematics subjects, usually known as Mathematics I. UPV in collaboration with the Applied Mathematics Department created four MOOCs with the aim to help freshmen to overcome their mathematical deficiencies. These four MOOCs covered the basic topics freshmen are going to need and they are normally open in different periods of the academic year.

On the other hand, continuous assessment has been a fundamental pillar in education at the UPV for many years. It allows instructors early detection of students' learning problems, normally due to a lack of mathematical skills that would require long periods of time to solve. In this context we have redesigned the massive use of the MOOCs [1, 7, 8], to use them with a more reduced number of students with problems in their mathematical learning [9]. Since the courses are no longer massive in its use and they are used privately, they become SPOCs. These SPOCs allow scholars to strengthen the knowledge they need through a progressive and effective teaching methodology in a reasonable period of time and under a closer supervision by the instructors. Assessments in these SPOCS allow to keep track of the evolution of the students.

Instructors can choose and recommend freshmen the appropriate SPOC that help them best. Most of the learning process has been done outside of the classroom via the Internet, but also periodic office hours have been part of the process in which to apply flipped classroom methodology. These sessions have been called face-to-face sessions. This methodology (SPOC + Flipped Classroom) has provided a constant interaction between instructors and students.

Freshmen from Electrical, Electronic and Mechanical Engineering enrolled in the subject Mathematics I (2013/14, 2014/15 and 2015/16) have participated in this project. It is worth noting that MOOCs do not cover the topics taught during the academic year, but strengthen the basic mathematics needed to understand Mathematics I.

3. Procedure

At the beginning of the academic year, after the first assessments and assignments, instructors can detect students showing the worst results and meet them in a personal interview in which they are offered the possibility to join one, or several, SPOCs. These SPOCs consist in a

sequence of units, videos and assessments covering a concrete topic. Figure 1 shows a picture of a video of the SPOC Basic Mathematics: Differentiability.



Figure 1. Video of Differentiability SPOC

The duration depends on the quantity of topics covered by the SPOC. Normally each SPOC lasts 3 or 4 weeks, with a weekly dedication of about 4 hours. Videos have an average duration of 10 minutes and are followed by an assessment or an assignment. When these courses are offered to freshmen, they are also offered the possibility to have weekly meetings with the instructor and other students in order to review some doubts not solved in the forum, and to practice some more exercises and assessments.

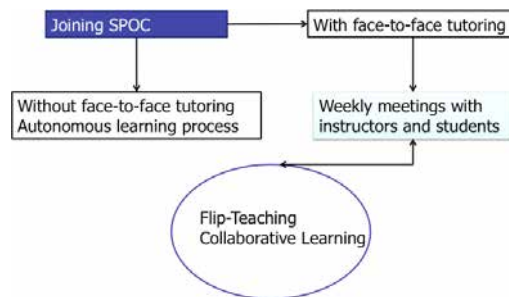


Figure 2. General procedure

The methodology applied in the face-to-face sessions it can be considered flipped classroom, since students have to prepare autonomously online for the face-to-face sessions, and therefore a significant part of the learning process depends on them. Figure 3 shows an outline of the methodology applied into the face-to-face sessions.

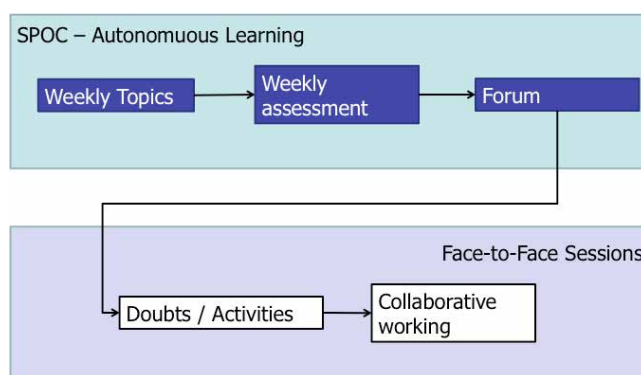


Figure 3. Flipped classroom methodology

Each week, students participating in this process are asked to prepare some topics from the SPOCs. They can find assessments within the course that help them to evaluate their progress. Doubts can be solved through the Forum, interacting with other students and instructors. Until this moment, learning process has been almost autonomous and need no interaction with instructors, except via forum.

In the face-to-face sessions, students can review the doubts and are provided with more exercises and assessments. Once instructor decides topics are correctly understood, a collaborative test is taken. In this assessment, a group work together to find the answer of the test. Students should collaborate since the entire group will have the same grade.

4. Results

There are different ways to enter the university. One way is through the University Access Tests (PAU), and the other is completing a Certificate of Higher Education (CHE). Table 1 shows the participation rate of these two groups. As it can be seen, CHE students have a higher participation in this methodology. Normally, these students have an excellent practical base but have more difficulties when dealing with theoretical problems or lack some necessary mathematical skills.

Table 1. Participation rate

Freshmen	CHE	PAU	Total
2013-14	80,0%	20,0%	15
2014-15	72,0%	28,0%	25
2015-26	92,9%	7,1%	14

Once the students have been proposed to join the SPOCs, they need to select between tow options: the first one is to participate only in the SPOC with no further interaction with instructors, and the second adds face-to-face sessions in a flipped classroom methodology

with collaborative work. Table 2 shows the participation rate between these two options and as can be observed, second option has a higher rate.

Table 2. Percentages between the two methodological options

Option	SPOC	SPOC + FC	Total
2013-14	40,0%	60,0%	25
2014-15	10,7%	89,3%	28
2015-26	36,4%	63,6%	22

Figure 4 shows that Electronic Degree has a higher participation rate than Electrical and Mechanical Degree. This participation rate depends on many parameters, like the total number of students in each degree and the minimum grade to access the degree, etc.

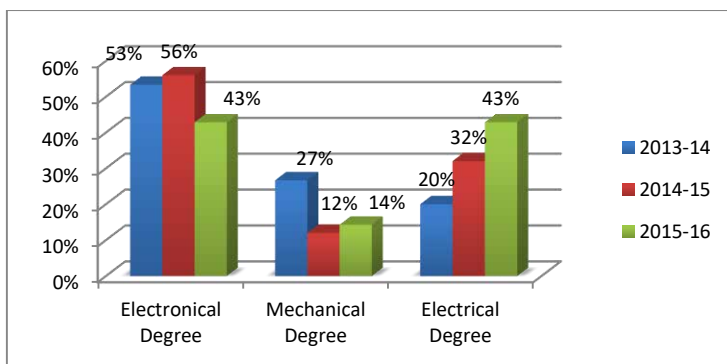


Figure 4. Participation by degree enrollment

In order to collect the opinions of the students participating in the SPOC + FC methodology, a survey was conducted. Students were asked about the SPOC, the collaborative tests taken and the face-to-face sessions. Results are shown in Figures 5, 6 and 7. It can be observed that opinions support this methodology. In average, 80% of the students think that SPOCs have helped significantly in their learning process.

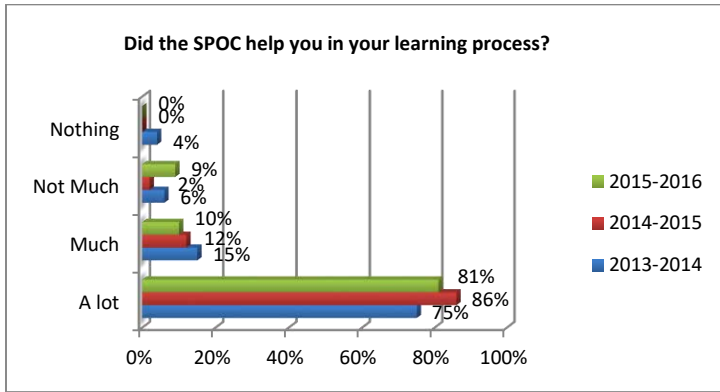


Figure 5. Student’s opinion about SPOCs.

Figure 6 shows that in average approximately 70% of the students think that collaborative work has helped them in their learning process. These results have encouraged us to continue with the collaborative work methodology. Also, students have been asked about face-to-face sessions, obtaining that almost 80% of the students think that these sessions are indispensable.

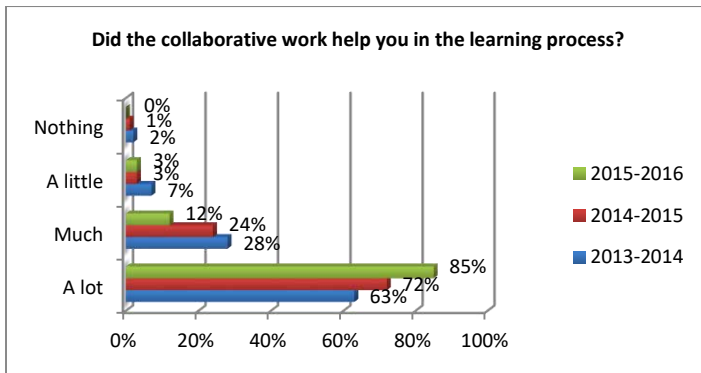


Fig. 6 Student’s opinion about collaborative work.

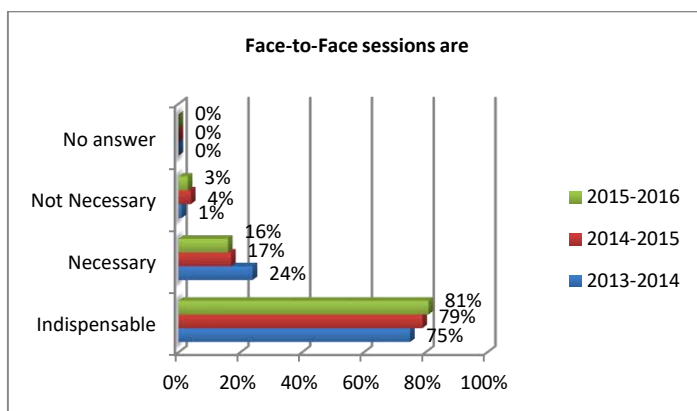


Figure 7. Student's opinion about face-to-face sessions.

5. Conclusions

A blended learning methodology has been applied to help small groups of freshmen students with mathematical deficiencies. Methodology consists in using a SPOC in combination with a flipped methodology. The courses have been modified to attend the students' needs, adding extra materials or new videos when necessary. SPOCs have been used with the objective of reviewing and strengthening the knowledge of students with significant gaps in basic mathematics. The flipped classroom methodology in the face-to-face sessions has been applied to solve possible doubts and reinforce the knowledge in a collaborative environment. We have found out that interacting with each other helps them to really understand the knowledge needed. This combination of SPOCs – Flipped Classroom with Collaborative Learning has provided us with better results than employing only one of the mentioned methodologies. Opinions have been good and encourage us to enlarge the number of students and the sessions face-to-face.

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The role of higher education in the acquisition of innovation competences

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Abstract

In the last years, a high number of studies have dealt with the relevance of innovation competencies in the new European study programs. Despite this interest, it has not yet know which factors contribute to develop innovation competencies among higher education graduates. We called into question the impact of different modes of teaching and learning on the acquisition of innovation competencies and professional development, which eventually may contribute to the development of other competencies. Participants were 5,474 graduates from Spanish universities that took part in an international research project. The findings of this paper were based on a structural model, which estimated the effect of active learning on the development of interpersonal and entrepreneur skills. We concluded that professors should place more emphasis in the introduction of student - centered activities, so that students could easily acquired the abilities they will need in their future workplaces. Taken together, these findings suggest that higher education institutions, as well as firms and organizations, should be aware of the importance of the role they play in the education and training of future innovators.

Keywords: *Innovation, competencies, structural equation modelling, teaching and learning modes*

Introduction

In the last years, those charged with the responsibility to teach competencies in higher education have been making big efforts to shift from the traditional teacher - centered forms towards more student – centered approaches, according to Bologna principles. Related to this paradigm shift, a series of studies have progressively aimed to describe theoretical models of capability development in higher education and test it with empirical data. Kember and Leung (2005) showed that teaching which aimed for understanding and required active involvement from students was more appropriate to develop cooperation abilities. These conclusions were confirmed in posterior studies by Kember, Leung, and Ma (2007) and Kember (2009). These studies aimed to answer the key question of how higher education can help graduates with the acquisition of competencies for lifelong learning. In fact, despite there is a common belief that most of intellectual abilities can be developed in higher education, there is little information about this mechanism, as found by Pascarella and Terenzini (1991) in their study of the effects of college education.

Focusing on innovation competencies, a high number of studies deal with the relevance of this competence in the new European study programs. Despite this interest, it has not yet know which factors contribute to develop innovation competencies among higher education graduates. Most of existing literature regarding this issue appear to be not well grounded on quantitative procedures or fail to address the problem due to methodologic issues. This research outlines a new approach to this topic, as we aimed to validate existing knowledge through the application of quantitative methodologies using a large sample of assessments made by Spanish higher graduates. We called into question the impact of different modes of teaching and learning on the acquisition of innovation competencies and professional development, which eventually may contribute to the development of other competencies.

Thus, it is predicted that:

- *H1: Professional development is positively associated with self – assessed competencies innovation competencies*
- *H2: Higher education contributes significantly to provide students with the competencies needed to achieve success in innovation activities, through student – centered modes of teaching and learning, moderated by the professional development*

1. Methodology

1.1. Participants

The participants were graduates from Spanish universities that took part in the international research project 'The Flexible Professional in the Knowledge Society: New Demands on Higher Education in Europe' (REFLEX Project). In the framework of this project a large - scale survey was addressed to Higher Education graduates who got their degree in the academic year 1999/2000 (Allen et al., 2007). The data gathering took place in 2005, i.e. some 5 years after leaving higher education. The questionnaire was administered to graduates by postal mail, phone calls and online. Interviewed graduates were selected by means of random stratified sampling, based on the geographic region the university was located in and the field of study. As a result, a representative sample of Spanish 5474 graduates was gathered. According to the official number of graduates in Tertiary Education between 1999 and 2000 in Spain reported by UNESCO, which is the reference population in this study, sampling errors were considered appropriate (Graduates from tertiary education in 2000 in Spain: 260.225; Sampling error: 1.4%).

1.2. Measures

Within REFLEX Project, graduates completed a questionnaire that aimed to gather a number of evidences on graduate's educational experiences before and during Higher Education and through transition to the labor market (Allen et al. 2007). For the purpose of the model tested in this paper, only sections concerning teaching and learning modes acquisition of competencies were handled.

1.3. Statistical analysis

In order to evaluate the goodness-of-fit of the data set for the hypothesized measurement and causal models, several criteria were used. Maximum likelihood estimating procedures (ML) based on the variance-co-variance matrix (Satorra & Bentler 2011), were used to compute all model parameters. Heeding to the Yuan and Bentler (2000) advice, robust statistics were also obtained to overcome misfit resulting from non-normal data. However, given the very large sample size and the well-known sensitivity of the chi-square statistic to the sample size, the appearance of a statistically significant model misfit was not surprising (Gerbing & Anderson 1985; Hu & Bentler 1999). Thus, the overall absolute model fit for each model was assessed using the root mean square error of approximation (RMSEA), the incremental comparative fit index (CFI), as well as the standardized root mean square residual (SRMR). As Browne and Cudeck (1992) and Steiger (1990) suggest, confidence intervals for RMSEA values (CI) were also reported to test the accuracy of the analysis. According to Byrne (2008) and Browne and Cudeck (1992) RMSEA values less than .05 indicated an acceptable model fit, representing, hence, a reasonable approach to the

population. CFI values near 1.0 were considered optimal, and values greater than .90 showed a satisfactory fit. Finally, an SRMR value under .08 was considered as an indicator of good fit. All structural and measurement model analysis were performed using EQS package version 6.2 (Bentler, 2006).

2. Results

In order to test the last hypothesis, referred to the role of higher education in the acquisition of innovation competencies, we followed similar procedures. Before estimation of structural models, the assumption of univariate and multivariate normality was examined. The distributions of the variables were slightly skewed (modes of teaching and learning: skewness ranged from -0.58 to 1.15; kurtosis ranged from -0.96 to 0.69; competencies acquisition: skewness ranged from -0.40 to 0.37; kurtosis ranged from -0.95 to -0.44). The normalized estimates of Mardia's coefficient form multivariate normality differed statistically from zero in the structural model (108.66). Therefore, robust maximum likelihood estimation procedures were used for parameter estimation for a second time. In order to measure the reliability of the scales stated above, Cronbach's alpha coefficient was used. For nine out of ten scales, the Cronbach's alpha values obtained were greater than the recommended 0.7 level (Active learning: $\alpha = 0.78$; Laboratory and Practical lessons: $\alpha = 0.67$; Knowledge Management: $\alpha = 0.73$; Communication: $\alpha = 0.79$; Innovation: $\alpha = 0.76$; Organizational competencies $\alpha = 0.79$; Interpersonal competencies: $\alpha = 0.77$; Professional development: $\alpha = 0.79$), except for the 'Traditional teaching' (scale $\alpha = 0.37$), due to the limited number of items within it. Thus, the internal consistency of the scales was considered acceptable.

The confirmatory factor analysis results for modes of teaching and learning measurement model showed that the hypothesized model provided a good approximation to the data: SRMR = 0.031, RMSEA = 0.053 (90% CI: [0.049, 0.058]), CFI = 0.958. Although the chi – square/df ratio was above the acceptable range of 1 – 3 (SB- $\chi^2 = 439.82$, df = 30, p = 0.000), this statistic was influenced by the large sample size and was considered in conjunction with other fit statistics, which are all within the appropriate range. Similarly, the measurement model in which competences were grouped under six latent variables provided a good approximation to the data: SB- $\chi^2 = 2297.06$, df = 118, p = 0.000; SRMR = 0.042, RMSEA = 0.062 (90% CI: [0.060, 0.065]), CFI = 0.938.

Regarding the structural model, a good fit to the data was indicated by the goodness – of fit indexes: CFI = 0.901, RMSEA = 0.055 (90% CI: 0.054 – 0.057), SB- $\chi^2 = 5187.9$ with df = 334 and p < 0.001. As shown in Figure 2, this model estimated the effect of active learning on the development of interpersonal and entrepreneur skills. At the same time, professional development has a direct effect on the acquisition of organizational and interpersonal skills. Secondly, laboratory and practical lessons were slightly related to the development of innovation skills, which is simultaneously related to the acquisition of communication and knowledge management skills. Error terms of measured variables and covariances and

disturbances terms of the latent variables were omitted for simplicity. This combination of different modes of teaching and learning with the acquisition of a set of generic competencies aims to test hypothesis 1, about the contribution of universities in providing students with training and knowledge for successful innovations. Moreover, this model allows to confirm again hypothesis 2, based on the relationship between professional development and innovation competencies.

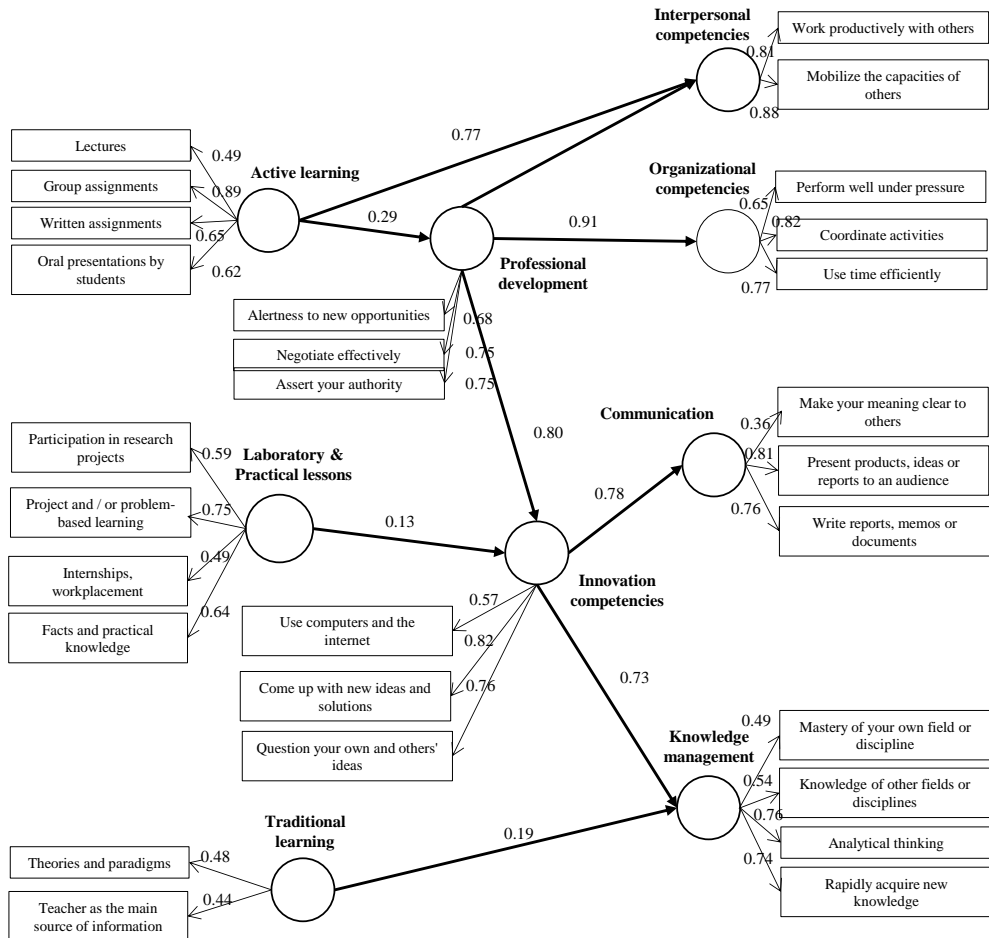


Figure 1. SEM model showing how different modes of teaching and learning influence the acquisition of competencies in higher education. Standardized coefficients.

Understanding the role of universities in providing the adequate training and education to foster successful innovations involves considering a high number of factors that intervene in the processes of teaching and learning in higher education. The most remarkable result to emerge from the data is that innovation competencies can be nurtured

through laboratory activities and practical lessons, though the influence of the professional orientations of each graduate has a higher influence. Our results are consistent with Kember, Leung, and Ma (2007), Kember and Leung (2011) and Kember (2009), although the limited influence of college education for developing intellectual abilities and teamwork was also found by Leung and Kember, (2006) and Pascarella and Terenzini (1991). These findings have important implications for higher education managers, implicated in the redefinition of study programs according to Bologna principles. Despite high efforts are being made by higher education institutions to follow the guidelines suggested by the European Higher Education Area, the key gap between university and labor market seem to be still ambiguous. More emphasis should be placed in the introduction of student - centered activities, such as lifelong learning, internships, research projects, group assignments or practical lessons to provide students with the abilities they will need in their future workplaces.

3. Conclusions

The findings from this study have highlighted the importance of the relationships between different modes of teaching and learning in higher education in self-assessed competencies in innovation. We have provided further evidence that student – centered teaching activities like attendance to laboratory lessons or practical lessons hold considerable potential for developing abilities related to the introduction of innovations in new products or services. Taken together, these findings suggest that higher education institutions, as well as firms and organizations, should be aware of the importance of the role they play in the education and training of future innovators.

The study has three limitations worth acknowledging. First, although the main research question has been examined from different approaches, our research lacks a general and holistic model that includes all the factors and variables considered in this study. Indirect effects between endogenous latent variable should be estimated for the latent factor professional development, as a key mediator latent factor between the predictors included in the model and innovation competencies. As structural equation modeling does not effectively accommodate dichotomous variables, future research should explore invariance causal models according to these nominal variables to analyze multiple group latent mean differences. A second limitation of the study concerns the sample selected for the study. Although the sample is of considerable size, it over represents higher education graduates excluding the interesting population of employees working successfully in innovation activities, without a degree in higher education. Finally, other existing scales from the organizational behavior research area, with demonstrated construct validity, could have been used for measuring competencies

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A Flipped Learning Approach to Develop Soft Skills in Multidisciplinary Higher Education

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Abstract

Soft skills play an important role in higher education degrees since they have to be developed and assessed along the different academic years. The advent of online instruction and the ability of our students to use multimedia material for self-instruction have paved the way for flipped learning to rise. This work focuses on the development of Soft Skills by means of Flipped Learning in different higher education degrees. This involves diverse subjects in Computer Science, Telecommunications, Linguistics, Agricultural Science and Physics, providing use cases on which flipped learning techniques can be applied to develop Soft Skills such as: Comprehension and Integration, Specific Instrumentation or Long-life Learning. The paper centers the discussion in the Soft Skills that need to be evaluated by the aforementioned subjects addressing their requirements, the Flipped Learning methodology used, the technological material underpinning the experiences, together with the results obtained. Results hint that students have more difficulties developing soft skills without personal interactions, and consequently new online approaches applied to class groups are needed to address this challenge.

Keywords: *Soft Skills, methodology, assessment, Flipped Learning*

Introduction

University education is facing a profound renovation that can be seen in institutions around the world. Knowledge society together with the large amount of online information available through the Internet, require that students consolidate information processing skills, rather than acquire specific pieces of knowledge.

In addition, this amount of online material on the web has encouraged many face-to-face courses to incorporate these materials into their curricula, thus becoming blended courses, and offering the student the opportunity to diversify their learning (Moltó et al., 2013), (Fita et al., 2016). Under these circumstances, students may consider that classroom teachings are no longer interesting, and that they can instead prepare the subjects relying exclusively on the online material, skipping class attendance. In order to avoid this inclination, face-to-face classes must necessarily add significant value to the teaching-learning process when compared to online courses.

In this scenario, teaching only by means of master classes is no longer a valid assumption. Instead, students are encouraged to adopt a proactive role in their learning process. Indeed, many universities are changing their educational approach in order to introduce Flipped Learning (FL), in which direct learning is transferred to the individual space, and the collective classroom space is replaced by a dynamic and interactive learning environment, in which the teacher assumes the role of a mentor and enabler of creative and group learning (Crosby, 2000).

The FL method provides the opportunity to use Information and Communication Technologies (ICTs) for the preparation of face-to-face classes in advance, performing out-of-class activities such as watching video-lectures or researching on a specific topic. This way, class hours are dedicated for students to interact with their classmates and the instructor, multiplying the possibilities of learning in the classroom. The goal is that students become aware of the results and turn into active agents of their own of their learning process. This way, students will recognize the importance of face-to-face activities and the teacher will go back to being a crucial asset in the students learning.

However, due to the nature of the methodology, these changes in the classroom have to be accompanied by an important modification in the way students are assessed. Indeed, it is increasingly less relevant to know whether or not students have learnt by heart certain concepts, and much more to evaluate whether or not they are competent in a set of skills essential to their future careers (Ion et al., 2016). In the Universitat Politècnica de València (UPV), starting from the 2015-2016 academic year, professors responsible of certain subjects must assess some of the Soft Skills of this University, becoming control points of such skills. This way, it will be possible to determine to which extent a student has acquired the skills that are supposed to be achieved upon finishing the degree.

This paper aims at compiling and evaluating different approaches framed in what is commonly known as Flipped Learning (FL), but applied specifically to the development and, in some cases, to the evaluation of several Soft Skills. The common axis of the experience lies in the use of ICT (as is the case of audiovisual educational material including but not restricted to video-lessons and video-exercises produced entirely by the authors) as a driving element of the activities of FL and that allows its application to the development of Soft Skills.

1. Innovations to Develop and Assess the Soft Skills

In this section, we provide a brief description of the Soft Skills used together with a description of the experience carried out, the methodology employed and the obtained results. We mainly focus on those Soft Skills that represent a control point in the subjects discussed, i.e., where professors need not only to create strategies for students to develop that skill but also to assess the level of achievement of the soft skill by the students.

1.1. Soft Skill: Understanding and Integration

The methodology described below has been developed in the subject of Physics for Biotechnology in the 1st year of the degree of Biotechnology. The objective of this work is to link the development of the *Understanding and Integration (UI)* soft skill to the understanding of theoretical models, as well as the integration of this knowledge in the methodology developed in the laboratory sessions specially when measurements of physical parameters are concerned. In the 2015/2016 academic year, a specific activity was developed, based on a multiple response test, so that the student could settle concepts and better understand the links between theory and practice. In the academic year 2016/2017, several numerical problems, based on the physical model of each practice, were added to this activity. Each practice is associated with a battery of multiple-choice questions on which the student works during a fortnight in which the corresponding practice takes place. These questions are based on physical models that are checked in the laboratory. At the end of each practice, a numerical problem related to the theoretical model on which the practice is based is activated. Students can self-assess their soft skills by solving these quizzes and problems in the Exams section of PoliformaT (the LRMS used at UPV). At the end of the laboratory sessions, the students are assessed by means of a face-to-face examination published in the Exams section of PoliformaT.

The students have a video that describes the most important technical aspects of each

practice. The lab book is also a fundamental material that students must use both at home and at the laboratory sessions. In addition, students must answer a quiz of 5 questions related to the video, before starting the face-to-face session. At the beginning of each face-to-face session, the students have 15 minutes to summarize the objectives of the practice in a conceptual map, to discuss those questions and problems proposed in PoliformaT that have had the greatest number of errors, as well as to sort out any doubt.

In order to assess the degree of approval of the FL methodology related to the development of *UI* during the development of the lab activity, a survey was carried out to all the students of the subject. The statements were valued on a scale of 0 to 5, from lowest to highest degree of agreement. In addition, a final open-ended question was asked so that the students could freely express their opinion. The number of surveys computed was 104. The results are presented in bar charts in the following figures:

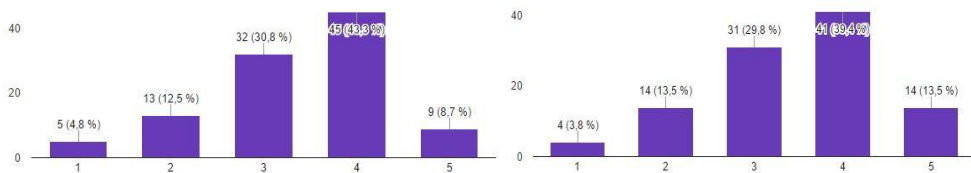


Figure 1. (Left) The methodology favored my learning. (Right) The methodology made the class more dynamic.

Students found a positive relation between the methodology, the rhythm of the classes, and the theoretical-practical learning acquired in the subject. However, this opinion contrasts with the impact that the methodology produced in the development of this soft skill. According to the students, a methodology with a large amount of quizzes and a final exam does not have a positive impact on the acquisition of this soft skill

1.2. Soft Skill: Specific Tools

In the Master's Degree in Parallel and Distributed Computing, the subject Advanced Cloud Infrastructures (IAC) develops and is also a control point of the soft skill *Specific Tools*, which refers to the use of the tools and technologies necessary for the professional exercise associated with each degree. The student must be able to identify the most appropriate tools in each case, knowing their uses and being able to integrate and combine them to solve a problem, to carry out a project or an experiment.

In this subject, students learn different Cloud Computing platforms, focusing on Amazon Web Services (AWS)¹, the leading public cloud provider. AWS's core services for the creation of scalable cloud application architectures are described and worked on. This is an eminently practical subject in which students must experiment with multiple services and use

¹ Amazon Web Services: <https://aws.amazon.com>

the different access interfaces (command line, web interface, APIs) that allow them to integrate different AWS services to solve real problems. Developing this skill in this subject is very appropriate, since it involves using multiple software tools and services in order to deploy software application architectures in the cloud. Students use a preconfigured working environment that has the necessary software tools to perform hands-on activities as well as the user credentials required to use AWS services. In order to deploy this practice environment, ODISEA (Segrelles, 2015, 2017) was used to define virtualised computing environments according to the hardware, software and configuration requirements necessary to support the educational activity. In our case, a virtual machine configured with multiple user accounts with the specific credentials, the AWS command line tool and the training material (documents, source code, etc.) necessary to carry out the practices is used. Using ODISEA, the remote lab is deployed in the cloud. They also connect to the AWS Management Console with a web browser to manage the different services.

The FL experience encouraged students to use the remote lab to gain the necessary skills with AWS tools and services. It was proposed that the students start the practical activity at any time (even outside the classroom) so that they could dedicate the classroom session also to progress with the practices but, above all, to solve the doubts that arose during the realization of the hands-on labs. Indeed, offering a remote lab allows practical activities to be carried out at any time and not just on the assigned schedule. This greatly facilitates the student to progress with practical activities and keep up with the pace of the class. This experience has been carried out since the academic year 2013/2014. The remote lab infrastructure has been shared with other subjects taught in other degrees, together with an online course of AWS which has been managed to continuously train more than 700 students in the last years. Students were asked to fill-in a satisfaction survey with a Likert questionnaire (10 means highly satisfied). Figure 2 includes the result for a population of the 213 students who provided an answer.

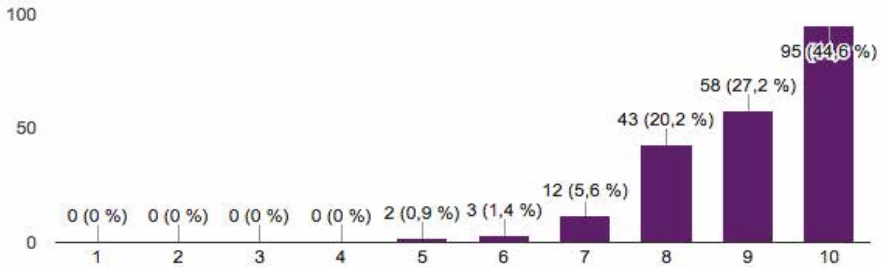


Figure 2. Satisfaction with the remote lab infrastructure, for the development of the Specific Tools skill.

The students especially highlight the benefits of being able to carry out the lab session at their own pace, of course within the time constraints imposed by the subject. The approach employed in this subject can be reproduced in other subjects by means of adopting the ODISEA platform to be able to deploy customized virtual infrastructures to support educational activities. Further resources are available in the aforementioned references and in the open-source tool Infrastructure Manager (IM).

1.3. Soft Skill: Life-Long Learning

The subject IAC is also a control point of the “Life-Long Learning” soft skill, closely related to the idea of training reflective professionals, who do not conform to routinely reproduce already known solutions, but seek to generate new solutions or solutions adapted to new situations. In order to deal with the development of this soft skill, educational material was developed in an online format that was always accessible by the student from day one. The material consisted of: video-lessons of about 7-10 minutes on the main AWS services; Self-assessment tests, which allow the student to be tested after each thematic unit; A remote computer lab, described in the previous section, which allows students to have an environment configured to perform the practices; Learning guides, which suggest to the student a learning itinerary, although the student is free to modify said itinerary based on his own personal and professional needs. This material is also used in the context of other Cloud Computing subjects taught in other degrees as well as online courses.

The FL experience is, therefore, to offer this educational experience from the starting of the subject, enabling the student to have access to all the material. However, the teacher suggests a pace of work. The students can watch the video-lessons at home and perform certain practical activities there (or finish those practices that was not able to finish during the classroom sessions) that are complemented with the support given by the instructor during the classroom sessions. These always combine a theoretical explanation, complementary to the video-lessons, although with some degree of overlap to emphasize the main concepts, followed by free time to advance in the practical activities.

The same questionnaire indicated in the previous section included a question so that students could rate the satisfaction degree with the video-lessons, included in Figure 3.

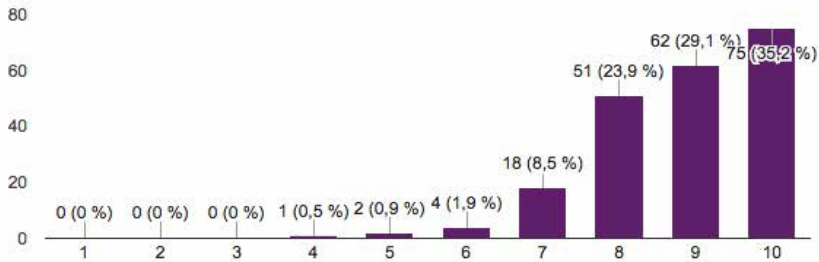


Figure 3. Satisfaction with the video-lessons, for the development of the Life-Long Learning skill.

1.4. Soft Skill: Knowledge on contemporary problems

This skill refers to the need for students to understand contemporary political, social, legal and environmental issues and values, as well as mechanisms for the knowledge spreading. The aim is to develop the ability to "be up to date" about current events in their field of knowledge and society in general. In order to work this skill, it is necessary to look for formative scenarios in which the students discuss in depth these types of questions, so that the FL is presented as a very interesting element to develop this competence.

In the degree in Engineering of Telecommunication, Sound and Image Systems, the subject of Wireless Communication Systems (WCS) works and is the control point of this skill. The FL technique was used so that several documents on electromagnetic security were offered describing the official position of World Health Organization (WHO), as well as different websites dedicated to spreading fear about the danger of mobile radiation. Students read and worked the material at home without knowing their position on a live debate on it. In the classroom, a public discussion was carried out in pairs concerning the problem of electromagnetic safety, with pros and cons, followed by an assessment of the argument used. The role assigned to the student was random, so it was also intended to develop the skills of conviction. For the development of the materials we used the Office 365 suite (Murray, 2011), which is officially the online cooperation tool of the UPV. This allows for the creation of specific FL contents. Thanks to this application, and in particular the Sway program, you can upload the contents, include screen recordings, surveys, text, as well as directly the teacher's explanation, all created using a very friendly and intuitive platform.

The experience was very satisfactory for the students, since knowing that there is a confrontation in the classroom, they took very seriously the preparation before the session. In addition, the surveys carried out marked an almost unanimous vision of class success. Even those students who indicated they had some reluctance to speak in public, found the experience very satisfactory.

1.5. Soft Skill: Effective communication

This soft skill is assessed in the subject of Business English taught during the third year of the Degree of Tourism, at UPV. Two different groups developed the activity, and the tutoring was carried out in two different sessions. The purpose of the soft skill is that students learn to communicate in an effective way, in this case, in English language.

For the activity, the instructor elaborated two different videos, in which some pragmatic aspects of the language were explained. These aspects are quite universal, but they were explained in relation to the English language. On the one hand, they were explained, as a brief reminder and summary, connectors and connecting structures to be used to guarantee cohesion and coherence in texts (both oral and written), and on the other, they were reminded of the difference between formal and informal language. These are aspects of the language that are studied before, but that are often forgotten, albeit crucial in effective communication, in search of simpler quicker messages. Students were then asked to elaborate a chart in which these aspects were explained.

In the classroom, a volunteer student explained the chart that he had elaborated, and then, a set of activities prepared to encourage them to put effective communication into practice were started. First, students were introduced on the idea of a democratic soft skill, which is being elaborated by the Council of Europe, as a continuation of the Common European Framework of Reference for Languages, as one of the capabilities to be acquired through the learning of a foreign language. Once students had analyzed the text and decided whether it was formal or informal and why, and after having identified the connectors used in it, a second activity was proposed, which consisted in the explanation of the different skills that had to be acquired to reach it. They read the skills, and had to explain them to the rest of the class, using the necessary connectors and formulae. A third activity was proposed as a culmination of the class, which consisted of debating what types of topics would be interesting to discuss in a class which developed this type of capacities, and how they should be debated, so that people would be able to communicate efficiently, formally, respectfully and in an informed way.

Once the activity was completed, students were invited to give their opinion about the experience, on a set of subjects. There was no written proof of improvement or of development of the skill, students were asked to give their opinion on how they perceived their learning. Although only 11 students replied to the requests, the results are summarized below. The answer to the opinion about the usefulness of the materials proposed is unanimous. Students liked the videos they were proposed to watch at home, and found them

useful for their later class. Also, students were provided with further materials for their class work, which also seemed appropriate and interesting. Both the materials chosen to work at home and the materials chosen to work in the classroom were considered useful.

The next question is related to the perception they have on their own improvement; “This methodology improved my learning”. Again, it needs to be pointed out that students were asked about their learning process, and not about the results obtained from it.

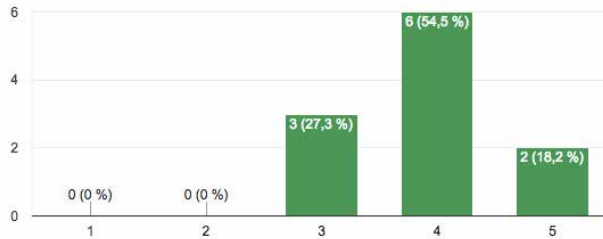


Figure 4. Opinion of students about the learning. Effective communication.

On a 1-5 Likert scale, it can be seen that the majority of students found that the methodology had favored their learning, although three of them were not too enthusiastic in their perceptions. Another aspect of interest was whether the post-homework activities had been appropriate for the continuation of the learning. The question students were asked was “After working at home, the class dynamics was appropriate for the understanding of new concepts”. Here, opinions are more diversified. Half of the class considered it very good, and half of the class considered it acceptable. Opinions are split as to whether this methodology should be expanded and used in other subjects. This shows that students are cautious as to how to deal with this new methodology.

1.6. Soft Skills: Application of Practical Knowledge; Innovation, Creativity and Entrepreneurship and Ethic Responsibility

During the lectures of the subject ‘IP rights and commercial plant material management’ the aforementioned soft skills have been developed through a project in which students must apply their knowledge of the subject to a real situation. FL was applied in four sessions in which students were asked to visualize a video related to the next classroom session. During the classroom students worked with the help of the teacher on their project and the teacher conducted discussions or debates, on some relevant aspects of the videos displayed. Before

starting each class, a small quiz was done asking if the student has visualized the video and asking about the video content. The students who followed the activity raised from 50% (first day) to 80% (last session), as shown in Table 1, which indicates that students value the positive effect of visualizing the videos in order to achieve more profitable master classes.

Table 1. Evolution of video visualizations and quiz scores along the sessions.

	Session 1	Session 2	Session 3	Session 4
Quiz scores over 10 (only students who visualized the video)	6	6,94	8,46	8
Percentage of students who visualized the video	50	50	60	80

The analysis of the survey indicated that students agree that this methodology makes the classes more dynamic, favored the engagement and learning during the lessons and that, in general, resulted in a useful strategy to work the aforementioned soft skills.

2. Conclusions

This paper has compiled several experiences concerning the integration of Flipped Learning to the development and assessment of Soft Skills using technological methods across multidisciplinary degrees. The development and application of technology has been shown in this work to foster the innovations. The results obtained are promising and, therefore, we will continue in the next courses with this line of research, extending the scope of study to other skills, further deepening the activities more suitable for the development of each one of them and proposing a comparative study of the different applications of the FL in the results of the acquisition of each soft skill.

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Multimedia Tools and Neuroeducation in a First Course of Business Statistics

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Abstract

The main objective of any excellence university teacher is that their students acquire a preparation of excellence for their professional career. However, nowadays the current problems faced by teachers of statistics, in some degrees, is the lack of motivation and previous knowledge in these fields. This contrast with the current trend where Statistics is becoming more and more important. This work intends to offer to students and teachers complementary tools that can serve both excellent as well as medium and low motivated students. These tools are based on: 1) concepts derived from the neuroscience and 2) multimedia tools such as video-lectures (flipped classroom), screencasts for computer lab and the use of the different options that are provides by a learning platform as Moodle. The results obtained after to implement these tools in the short term shows: 1) a greater motivation and involvement of the student, 2) a better average grade, 3) a higher homogenization of the students.

Keywords: *Motivation, learning process, flipped class, multimedia tools.*

Lean manufacturing methodology in training to improve teamwork and leadership

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Abstract

Training students in transversal competences has been of the main innovations in Higher Education in recent years. In this context, teamwork and leadership are key competencies that involve creating and developing a climate of trust, enabling cooperation, and sharing knowledge, commitments and responsibilities. The objective of the present study was to evaluate the best role that each team member can play, analyzing each person's perception of himself or herself in comparison to the opinion that others have of that person. The results show that the surveys were answered honestly, only two cases were verified in which they rated themselves with the highest scores in all roles. Another important aspect is that there were no significant variations between the self-evaluation and the one made by the team members. On the other hand, since the formation of the teams was randomly generated and there was no previous knowledge among them, not all teams covered all roles. The disagreements that arose in one of the groups caused its split and regrouping with another one. This was due to an overlapping in the roles preferred by the team members. Finally, better results were observed in those teams that had the most balanced roles.

Keywords: Transversal competences, training, Belbin, roles, competences.

Introduction

Teamwork is a reality present in the daily function of any company operations. There is a constant growth of industries that have replaced the group work model, based on a single leader distributing the work among its members, for a model that seeks teamwork. In this, people organize themselves in a certain way to achieve a common goal. Each member of the group must contribute and share knowledge, commitment and responsibility, what results in a direct improvement in the performance of the tasks that they assume.

In 1981, Meredith Belbin presented his theory of team roles in the book: "Management Teams: Why they succeed or fail" which became one of the reference books for working in teams. Table 1 shows the list of roles and their description as per this author. He defines the basic role of a team, "our particular tendency to behave, contribute and socially relate". The author identified nine roles and grouped them into three major groups: Plant, Monitor-evaluator and Specialist.

In this framework, the Universitat Politècnica de València is not outside the margins of the labor market needs and, therefore, it promotes, teamwork being carried out by the students in the topics of the different degrees and this discipline being evaluated as a transversal competence. In order to be successful, it is essential that the achievement of the groupal objective is based on shared leadership, in which all issues are thoroughly discussed and where the work carried out is the result of a group and not an individual effort. Hence, if students are overwhelmed by an enormous quantity of tasks they tend to distribute the workload following a group work model instead of a teamwork one. This means that the lack of motivation results in an unbalanced approach and low interactivity among the members of the group. Furthermore, the absence of prior knowledge of the individual skills of each member of the team implies not being able to make the most of each person's abilities for the group as a whole.

Table 1. List of roles and their description as per Belbin (1993)

Role	Definition	Strengths	Weaknesses
Plant	Tends to be highly creative and good at solving problems in unconventional ways.	Creative, imaginative, free-thinking, generates ideas and solves difficult problems.	Might ignore incidentals, and may be too preoccupied to communicate effectively. They could be absent-minded.
Resource investigator	Uses their inquisitive nature to find ideas to bring back to the team.	Outgoing, enthusiastic. Explores opportunities and develops contacts.	Might be over-optimistic, and can lose interest once the initial enthusiasm has passed. They might forget to follow up on a lead.
Co-ordinator	Needed to focus on the team's objectives, draw out team members and delegate work appropriately.	Mature, confident, identifies talent. Clarifies goals.	Can be seen as manipulative and might offload their own share of the work. They might over-delegate, leaving themselves little work to do.
Shaper	Provides the necessary drive to ensure that the team keeps moving and does not lose focus or momentum.	Challenging, dynamic, thrives on pressure. Has the drive and courage to overcome obstacles.	Can be prone to provocation, and may sometimes offend people's feelings. They could risk becoming aggressive and bad-humoured in their attempts to get things done.
Monitor	Provides a logical eye, making impartial judgements where required and weighs up the team's options.	Sober, strategic and discerning. Sees all options and judges accurately.	Sometimes lacks the drive and ability to inspire others and can be overly critical. They could be slow to come to decisions.
Team-worker	Helps the team to gel, using their versatility to identify the work required and complete it on behalf of the team.	Can be indecisive in crunch situations and tends to avoid confrontation.	They might be hesitant to make unpopular decisions.
Team-worker	Helps the team to gel, using their versatility to identify the work required and complete it on behalf of the team.	Co-operative, perceptive and diplomatic. Listens and averts friction	-
Implementer	Needed to plan a workable strategy and carry it out as efficiently as possible.	Practical, reliable, efficient. Turns ideas into actions and organises work that needs to be done.	Can be a bit inflexible and slow to respond to new possibilities. They might be slow to relinquish their plans in favour changes.
Completer finisher	Most effectively used at the end of tasks to polish and scrutinise the work for errors, subjecting it to the highest standards of quality control.	Painstaking, conscientious, anxious. Searches out errors. Polishes and perfects	Painstaking, conscientious, anxious. Searches out errors. Polishes and perfects
Specialist	Brings in-depth knowledge of a key area to the team	Single-minded, self-starting and dedicated. They provide specialist knowledge and skills	Tends to contribute on a narrow front and can dwell on the technicalities. They overload you with information.

1. Objective

The objective of the present work is to evaluate the suitability of the different roles adopted by the team members in a subject of a master in quality management in accordance with Belbin's role models. With this aim in mind, the roles profile within the group and the self-perception of each individual were compared with the ones given by the teacher and by the rest of their own work team. All these based on a work carried out by the group and individually.

2. Innovation Development

A total of 36 students from a master's subject on quality management participated in the study, forming a complete eight groups. The subject, which this study is based on, belongs to the second semester, which favored that the teams had already worked together before and consequently knew each other very well.

In order to evaluate the equilibrium among the members of each team, two questionnaires as proposed by Belbin (1993) were carried out. In the first one, they were asked to evaluate themselves, with a rating from zero to ten (Table 2).

Table 2. Self-evaluation of each team member. 0=does not identify himself with the role assigned, 10=he is fully identified

Name:	0	1	2	3	4	5	6	7	8	9	10
Plant											
Resource investigator											
Co-ordinator											
Shaper											
Monitor											
Teamworker											
Implementer											
Completer finisher											
Specialist											

Secondly, they were asked to quantify, from zero to ten, the extent to which their colleagues fulfilled one or more of the given roles (Table 3). The first column shows the different roles. For the following five columns, the students were asked to write the name of the different members of the team and their rating for each role.

Table 3. Evaluation of the roles of the team members

Roles	Member 1	Member 2	Member 3	Member 4	Member 5
Plant					
Resource investigator					
Co-ordinator					
Shaper					
Monitor					
Teamworker					
Implementer					
Completer finisher					
Specialist					

3. Results

Figure 1 shows the results of the self-assessment i.e. how they rate themselves in each of the presented roles. Each team has been assigned with a number from 1 to 8 and within each team, all members with a correlative number. As an example member 34 is the fourth member of team 3. In view of the results, all of them have been rated, to some extent, in all roles. In some cases, they have also been scored with the highest values in all disciplines, as this is the case for the 55. There are some few exceptions to the rule such as the 14 and the 21 who in general had low scores.

Figure 2 shows how they have evaluated the rest of the team members. In this case, the results are very different in comparison to figure 1. There are some roles that have not been recognized in any member of their own team. Other roles tend to have scores often below 40%. Analyzing the data, it is to highlight that group 8 is the one that stands out the most due to the fact that it has three members with clear roles at 100% (plan, coordinator and finisher). Group 3 does also have three members with clear roles (plan, resource investigator, coordinator, monitor and specialist), but only the third one up to 100%, the rest do not reach 80%. The opposite case is observed in team 2, where all of them have scored the rest of the members with low values. Finally, in teams like 5 or 6, some roles remain unrated, which means that none of the members are able to play that role.

A Principal Components Analysis (PCA) (software Unscrambler X.10) was performed with the data of the scores given by the teacher (those obtained from the team's work, the individual work and those resulting from the perception that the teacher has of each student as a result of their participation in class). Figure 3 shows the PCA biplot obtained (scores: participant student codes and loadings: the different grades). The proximity between the scores obtained from the individual work and those resulting from the teacher's perception show the correlation between both. On the contrary, the rating obtained by each student for the teamwork, are less correlated. There are students who have scored very high, such as the

34 that is located at the end of the right quadrant. Despite, the rest of the group, located in the left quadrant, has obtained lower individual scores. It is worth noting the homogeneity of the members of group 8, having all of them similar scores, with the exception of the 84 whose location at the extreme left quadrant shows that he has obtained very low individual scores.

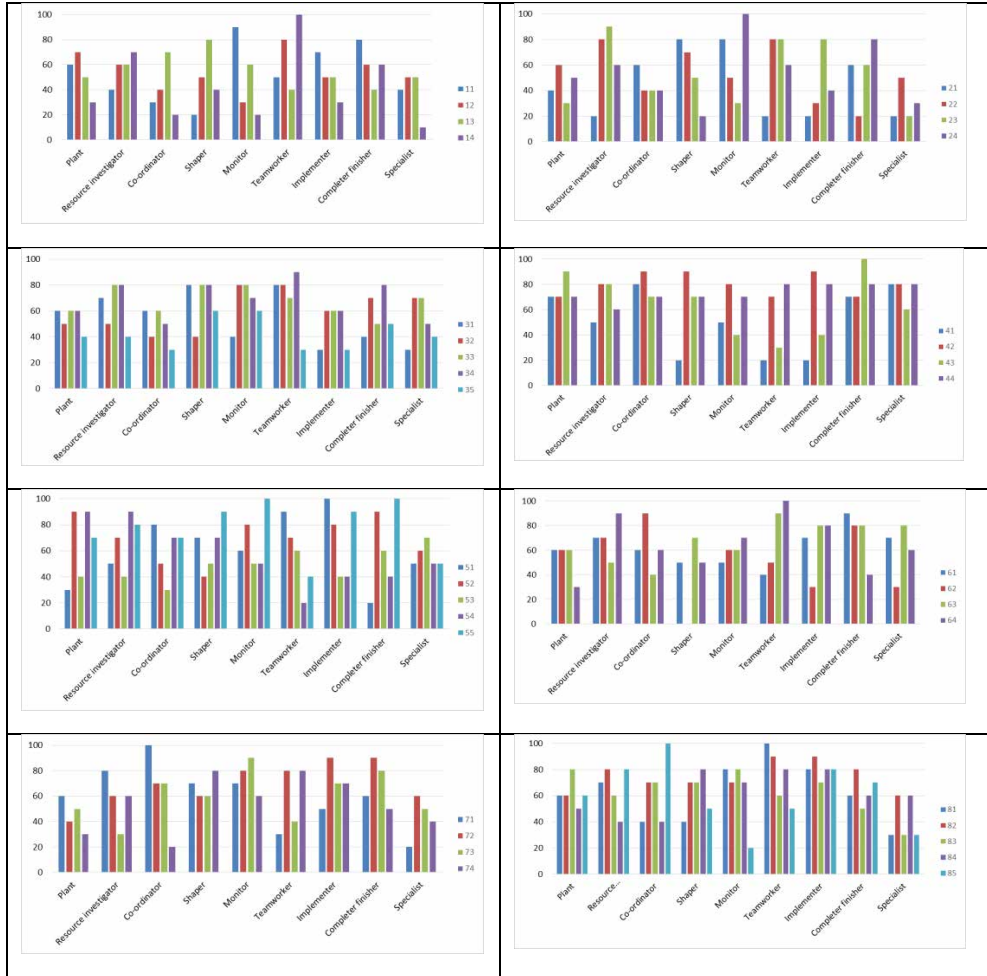


Figure 1. Self-assessment results in each of the roles

A similar study was made by McHarg et al., 2012, however in this case the groups were not 'voluntaries', they define two types of groups, which follow the ideal Belbin group and those what not. They concluded that there were no significant differences between both. Despite the fact that one was a business management team and the other a student team. In addition it is not easy to perform good team work, it depends on many factors, such as strategy, structure, technology, people and management processes (Senior, 2006).

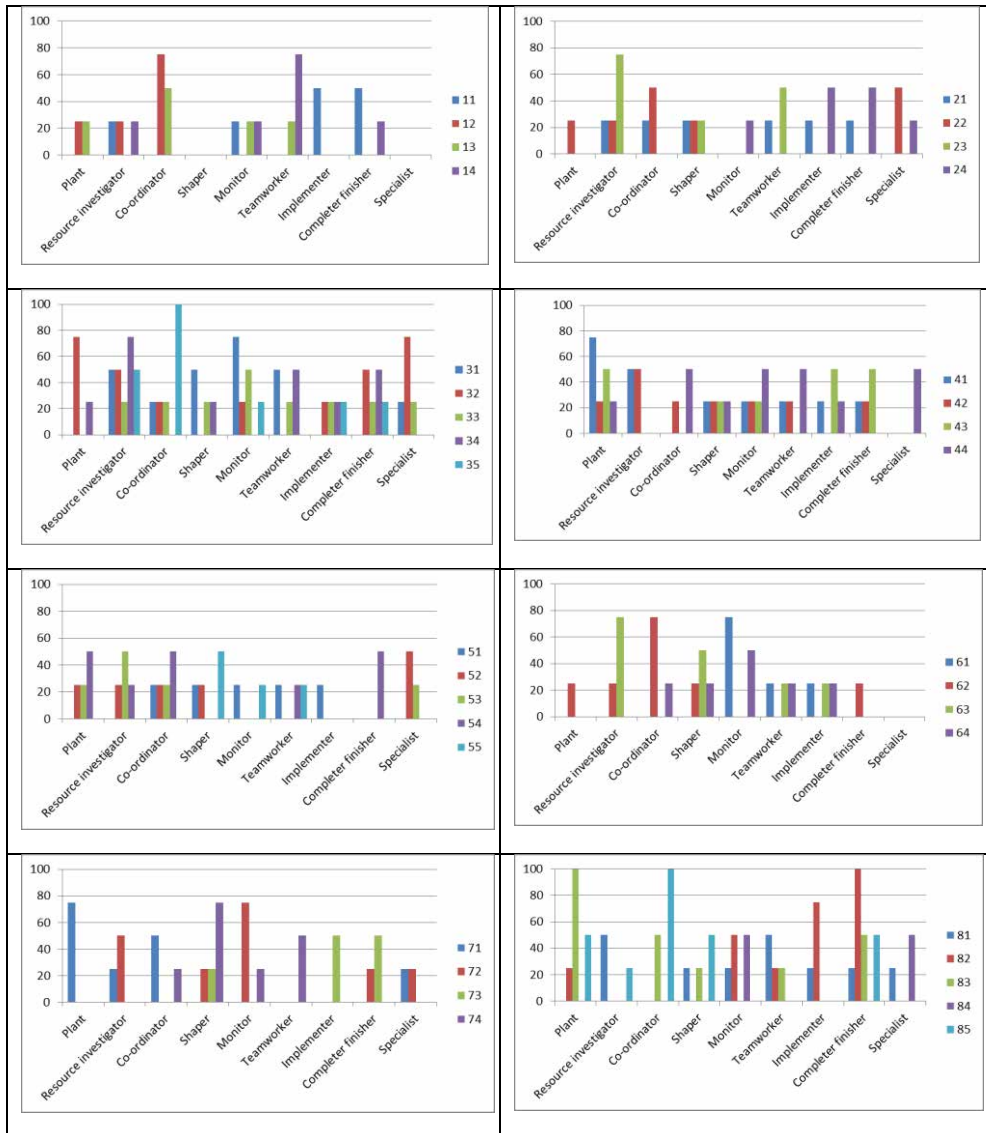


Figure 2. Results of the evaluation of the roles performed by each team member in relation to the others

One of the main difficulties is to understand how teams perform (Payne, 1990; Brannick, Sales and Prince, 1997; Bradley and Hebert, 1997; Jones and Schilling, 2000; Mjos, 2002). In this paper the gender composition of the teams has not been considered, however Aritzeta and Ayestaran (2003) and Park and Bang (2002) reported that gender composition may affect interpersonal adjustment within teams which may help them to be balanced in terms of the number of natural roles presented with implications for overall team performance. However, Balderson and Broderick (1996) found differences between men and women only on the

Monitor Evaluator and Plant roles which were higher for women. In addition, Sommerville and Dalziel (1998) showed a higher predominance of Team Workers among women and both Implementers and Co-coordinators among men.

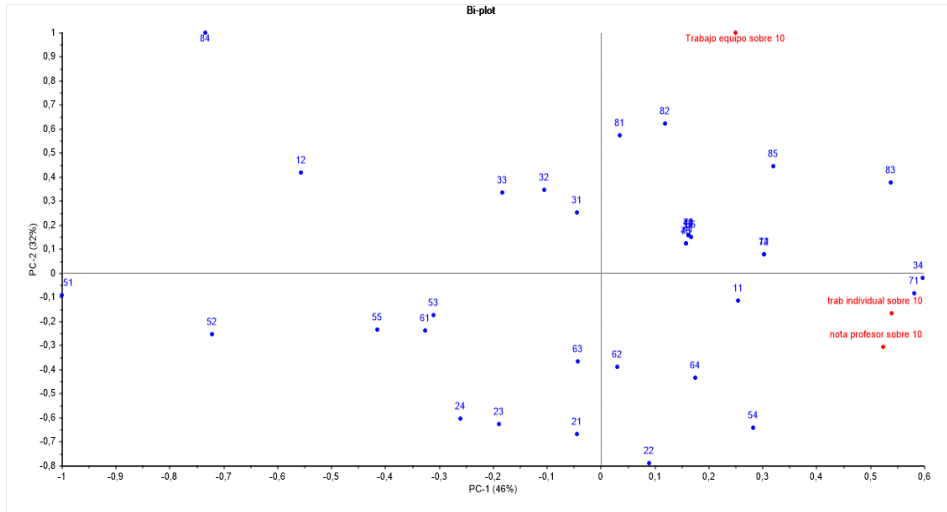


Figure 3. PCA-Biplot. Scores (participant student codes) and loadings (different grades): "trabajo en equipo sobre 10", obtained from teamwork; "trabajo individual sobre 10" obtained from individual work; "nota del profesor sobre 10" resulting from the teacher's perception of each student as a result of their participation in class.

4. Conclusions

The composition of the teams has been decisive in the qualifications obtained from the tasks they were given. Having members with high scores in one of the roles has been fundamental in obtaining good grades of the work done as a team. However, in these cases success could be attributed more to personal merit than to the collaborative work. The teams that have covered all roles have had average ratings with small variations depending on how good their members were in the different roles. Finally, the teams composed with people who did not cover or stand out on the given roles, obtained the worst results.

An ideal team should have an adequate balance of all 9 team roles. Strong teams normally have a proper coordinator, a plant, a monitor evaluator and one or more implementers, team workers, resource investigators or completer finishers.

This paper raises the question of whether it would be pertinent for the teacher to be involved in the constitution of the teams, not only to improve their results in the subject, but also to learn how to form good teams in view of future work. In this case, it would be necessary to look for new formulas to make up good teams, given that their own perception of the student is, in most cases, too optimistic and will not be very useful.

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Exploitation of Learner-Generated Content from an Intercultural Communication TeleCollaborative Project

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Abstract

This paper draws upon the experiences of a telecollaborative project with five universities from five European countries: Estonia, Finland, Hungary, Poland and Spain, around the common axis of teaching English as a foreign language. The objective of this paper is to explore the effects of empowering students through their active involvement by means of their creation of learner-generated content and the exploitation of the results achieved through the telecollaborative project from different perspectives: teaching English as a foreign language, intercultural communication and English as a global language.

Keywords: telecollaboration; higher education; intercultural communication; English as a foreign language; learner-generated content.

Introduction

Helm and Guth (2016: 241) provide a concise definition of telecollaboration as “online intercultural exchange between classes of foreign language students in geographically distant locations”. A quick revision of the literature on telecollaboration (Guth and Helm, 2012; Helm and Guth, 2016; O’Dowd and Ware, 2009) allows us to identify different modes of telecollaborative projects such as class to class, teacher to teacher, teacher or expert to class, or student to student, to mention just a few, each one of them with different aims and planning strategies.

The study of telecollaborative projects is not new (Guth and Thomas, 2010; O’Dowd, 2007), but thanks to the continuous advances in technology and the performance and capabilities of new IT platforms, the approaches and possibilities of exchange are constantly improving (O’Dowd and Ware, 2009). Guth and Thomas (2010: 40) point out that: “As technology has changed and offered more varied possibilities for communication so have the tools used in telecollaboration.”

Lee and McLoughlin (2007:1) take into consideration the active participation of users and add that “the emergence of Web 2.0 technologies and social software tools is creating a new set of dynamics leading to increased user-led content and knowledge production that is transforming higher education curriculum and instruction.”

Although the literature considers different types and categories of telecollaborative projects, in many cases emphasis is made only on the results of the projects and not on the design or inception of these projects (Guth and Helm, 2012; Helm and Guth, 2016; O'Dowd and Ware, 2009). However, telecollaborative projects do not always fit completely into a specific category as they need to be fine-tuned as they progress, especially when team members do not have the same experience and expertise in telecollaboration, as it happens in the project described here.

According to Lee and McLoughlin (2007:1), the use of technology in the classroom and the advent of Web 2.0 is strongly influencing the learning context to the point that "the one way flow of information between teacher and student is now being challenged."

The most productive telecollaborative experiences in higher education institutions arise when institutions with similar curricula or interests establish partnerships. However, it is not always possible to initiate a telecollaborative project with a partner institution that has your same academic profile and interests. For this reason, participants' motivation plays a pivotal role in the development of a telecollaborative project and may compensate for the lack of institutional compatibility during the initial stages.

From the point of view of foreign language teaching in higher education, institutions traditionally focus on common grounds such as intercultural communication, language teaching, communication skills or intercultural competence from which they can benefit from a telecollaborative project (Helm and Guth, 2010).

This paper draws upon the experiences of a telecollaborative project around the common axis of teaching English as a foreign language with five universities from five European countries: Estonia, Finland, Hungary, Poland and Spain. Due to the number of institutions, nationalities, interests and participants' degree of motivation, among many other variables, this telecollaborative project was initially structured in three stages: team coordination, identification of common ground, and design of telecollaborative actions.

Other variables that strongly influenced the telecollaborative team at the institutional level were the profiles of the participating universities (polytechnic, college, university, and liberal arts college); the different organization of schools and departments; the different academic calendars, which sometimes hindered students' coordination; and the different teaching methodologies.

With this heterogeneous context, participants' motivation and engagement in the project was thus identified as the main barrier to overcome. Thus, the objective of this paper is to explore the effects of empowering students by means of their active involvement through the creation of their own learning material (learner-generated content). From the instructors' point of view, motivation and engagement was achieved with the exploitation of the telecollaborative project from different perspectives: teaching English as a foreign language, intercultural communication and English as a global language, thanks to the variety of participants mentioned above.

Learner-generated content, or any of its equivalents such as “peer learning strategy”, “student created content”, “student-generated content” or “collaborative learning” are seen as a way to increase students engagement and change education for the better (Lee and McLoughlin, 2007:3). It seems that peer to peer learning is more easily digested, students use contemporary formats and messages and their own language to approach complex concepts.

1. Methodology

The origins of this telecollaborative project date back to a meeting of language teachers in higher education in Finland in 2015, where the five universities participating in this project met and proposed to further expand the collaboration initiated during the meeting, specifically on teaching English as a second language. After that brief initial organization in person, meetings and other communications were carried out online through videoconferences and email coordination. The five participating institutions were: Tampere University of Applied Sciences, Finland; Budapest Business School, Hungary; Tartu University Pärnu College, Estonia; Silesian University of Technology, Poland; and Universitat Politècnica de Valencia, Spain.

The first barrier to overcome was the varied interests and specializations of the participants, one of them focused exclusively on intercultural communication, others on English as a second language from a language center perspective, English as a second language from a Content and Language Integrated Learning (CLIL) perspective, and English for specific purposes from a polytechnic university.

During the collaborative project, the team identified different priorities of its instructors, mainly around teaching or research purposes, which also conditioned the type of telecollaboration from the initial premises for participation.

Basically, the first action consisted in prioritizing the launch of a collaboration project with the design of a short-term action to test the potential of the telecollaborative team that would allow for future development and expansion of the project: a video repository with students’ recordings on intercultural communication topics was devised as the most feasible common project.

First, instructors coordinated and facilitated the students’ research on topics from three areas: Business, Communication and Culture. Then, subtopics within these areas such as “doing business in Spain”, “communication failures”, “non-verbal communication”, “presenting across cultures”, “cultural differences”, “etiquette”, “food and culture”, “stereotypes”, or “personal space across cultures”, among others. Secondly, students carried out guided research and documentation work on the topics selected and recorded a video which was then uploaded to a YouTube channel shared by all the participating universities. Finally, this media repository was further exploited by each institution according to their objectives and interests: from the perspective of intercultural competence, based on the different approaches provided by the different nationalities, students receive a first-hand view of different

intercultural concepts; from international English, as students from different nationalities present their work with different English as a foreign language accents; from intercultural communication, students are exposed to cultural issues with more detail than in traditional language learning approaches.

The channel (http://www.youtube.com/channel/UC0NMczhwIBOM_HvknJHBNQ) involved the participation of 40 students from 12 nationalities who prepared a 5-minute presentation on topics proposed by the coordinating instructors. The students' work can be summarized as follows: selection of topics, students' independent research and work, instructor's supervision, video production, peer revision and evaluation.

The topics proposed dealt mainly with communication, culture, and the professional context, which most college students share and which were expected to motivate them to carry out documentation tasks and prepare the recording of a video that would be exploited later on in class by their peers.

2. Analysis and discussion

From the didactic point of view, the active participation of students as creators of learner-generated content is a fresh approach to teaching because messages and formats have a contemporary perspective and are more adapted to the expectations of the students, who use their own language, and peer to peer transmission of knowledge seems to be smoother (Lee and McLoughlin, 2007).

The first stage of the project faced some technical barriers such as Youtube copyright policy, video format and definition, or sound quality. However, the advantages of using the YouTube platform compensated these problems: it is a known platform, it has user-friendly content management capabilities, it is a video standard and can be easily shared through social media and is accessible from any device.

For some participants the Youtube repository was used to consolidate intercultural communication concepts and check students' research skills and teamwork. Likewise, from the language teaching perspective, oral skills and language proficiency were key to the production and assessment of videos.

From the peer learning strategy, by empowering students through learner-generated content, the presentation of their work, messages, formats and styles were fresh and adapted to students' expectations. In addition, the participation students of 12 nationalities was an excellent opportunity to expose students to different pronunciations and ways of presenting, and made them understand from a first-hand approach the basics of international communication and global English.

3. Conclusion

The design of a collaborative project with five European institutions was initially based on the creation of a repository of educational video material generated by students about culture, communication and the professional environment. As the project evolved, instructors identified different interests that affected their involvement and motivation in the overall project, namely a focus on language teaching or on research.

After the experience of the project described above, it seems appropriate to add another type of collaborative project conceived from the desire to collaborate internationally in language teaching in higher education that is fine-tuned as it progresses and where its team members do not always have a full experience of telecollaboration, which can be referred to as an “ad hoc telecollaborative project”.

The probabilities of a telecollaborative team to have the equivalent profile, same interests, or similar participating institutions are very low. Therefore, in order to make the most of a telecollaborative project, the exploitation of results can also be carried out independently to fit the participants' interests and priorities, such as intercultural communication, English as a global language, or exploitation of learner-generated content, as in the project described here. From the perspective of English as a lingua franca this project allowed students to listen to different accents and presentation styles, and help them grasp international communication from real life examples.

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A Social-Network-based methodology for fostering educational innovation practices

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Abstract

It is currently accepted that the inclusion of new technological tools to improve both the efficacy and performance of educational practices is highly adequate. This paper focuses on the design of a social-network-based methodology as a technological tool to foster innovation within the high education ambit. Social network tools are widely used in private life and its adaptation and usage at the enterprise level is continuously growing, as they are easy to use and provide, among others, the opportunity of fomenting communication, knowledge exchange and innovation fostering and creation practices between users. Then, this paper highlights the main steps that should be followed when aiming to successfully implement a social-network based environment between the main high education actors: Teachers and students. Further, the main outputs and advantages of its usage will be outlined as well as the innovation controlling and measuring specific elements, specially performance indicators, which will help to evaluate the results obtained from using the social network and its impact over the innovation process at the high education level.

Keywords: Social network; innovation; educational; performance indicators; methodology.

Introduction

It is currently accepted that the creation of a common environment that promotes interaction, collaboration, information and knowledge interchange, as well as creation and innovation processes is highly desirable within educational ambits. In this sense, the usage of recent ICT is able to model organisations entirely, affecting to employees' productivity and firm's capacity of innovating (Molina-Castillo et al, 2012). Many institutions of high education have developed in the last years technological platforms in order to promote these activities and processes. In this sense, Coporative Social Networks (CSN) have demonstrated their potential to improve organisaitons' process such as internal and external communication capabilitites, creation of best practices, fostering experiences interchange, generation of knowledge among users, etc). A CSN gathers and decrides not only the information but also both the tacit and the explicit knowledge that flow between a group of people, who may adopt the role of knowledge transmitter (transmitting values, ideas, experiences, advices, best practices, etc) and/or knowledge receiver (interacting with other memebers of the group to receive both answers and solutions to their queries/problems) (Hanneman et al., 2005).

Therefore, it is possible to affirm that the usage of this technological tool within high education enviroments could surely help to reach the following improvements:

- To facilitate a learning technological environment in which will participate both teachers and students, enabling processes of interchange/generation of both tacit and explicit knowledge as well as foster innovation.
- To create a set of best practices that will help not only to improve the communication process of different ideas but also to outcome innovative actions.
- To explore and enable multidisciplinary interactions.
- To develop the collaborative learning process and responsibility.
- To improve the academic results achieved by students, as it is an additional educative source of information.

1. Social Network Analysis for educational innovation practices

Nowadays, access to a CSN is gained via invitation from the network administrator, who organises the different groups and allocated the appropriate users to them. Then, this leads to the creation of different groups with the adequate members, which assures that the working and learning environment will be the most idoneous (Gunawan & Huarng, 2015). A CSN can be defined as a set of relationships developed between and among the members of a group, or as a representation of a series of nodes and lines that link these nodes, where the nodes represent the users (individuals or teams) and the lines are the relationships established between two nodes, based either on their preferences or on their needs (Sandru, 2012). Generally speaking, the usage of a CSN is very similar to other open social networks such as

Facebook, which allows its correct usage from the very beginning. Inside a CSN, different work spaces or groups can be defined, which facilitates the creation of specific working groups about a subject. Users can also be members of different groups, which facilitates the interdisciplinarity of these groups and, therefore, foster innovation creation.

Apart from fostering knowledge creation/transmission as well as innovation creation, the usage of CSN might lead to facilitate the execution of both different educational activities and achievement of specific competences. The former could be, for example, the design, following and assessment of academic works such as Master Thesis final Project, or a supporting tool for experimenting active methodologies; on the other hand, the latter could be the formation and evaluation on specific transversal competencies such as effective communication and/or problem solving.

On the other hand, the CSN offer the possibility of developing different assessments of the results achieved, coming as data stored made out of the usage made by the users in a certain time period. Such a data is constituted with the conversations, topics, interchange of files, uploading of files, etc, that the users have made using the CSN. One of the most powerful analysis is quantitative in nature and consists on, taking the data as starting point, applying some analytic tools that will output meaningful additional information. Then, it is possible to analyse the the main relationships established between the members of the different working groups from a graphical point of view. Additionally, there are three main key performance indicators or performance metrics that identify meaningful information: range, proximity and betweenness (Turetken & Sharda, 2007). The range metric indicates what users of a group are more and better connected (Zhu et al., 2010). These are, at the same time, the users that possess a greater degree of influence over the other members of the group. On the other hand, the betweenness metric reveals when the member of a group plays the role of intermediary between two other members that do not keep any direct relationship (Hu, 2013). Finally, the metric of proximity indicates the relative position of a user within a group and which is his/her ability to reach other member/s of the group (regarding to establish communication) (Lin & Lo, 2015).

It is possible to affirm that the usage of these three metrics allows to reach important and meaningful conclusions about the multidisciplinary degree, knowledge creation/exchange and innovation creation degree.

2. Methodology

In order to properly design, implement and analyse a CSN at educational environments, we propose different phases and activities. These can be seen in Figure 1 and are further explained.

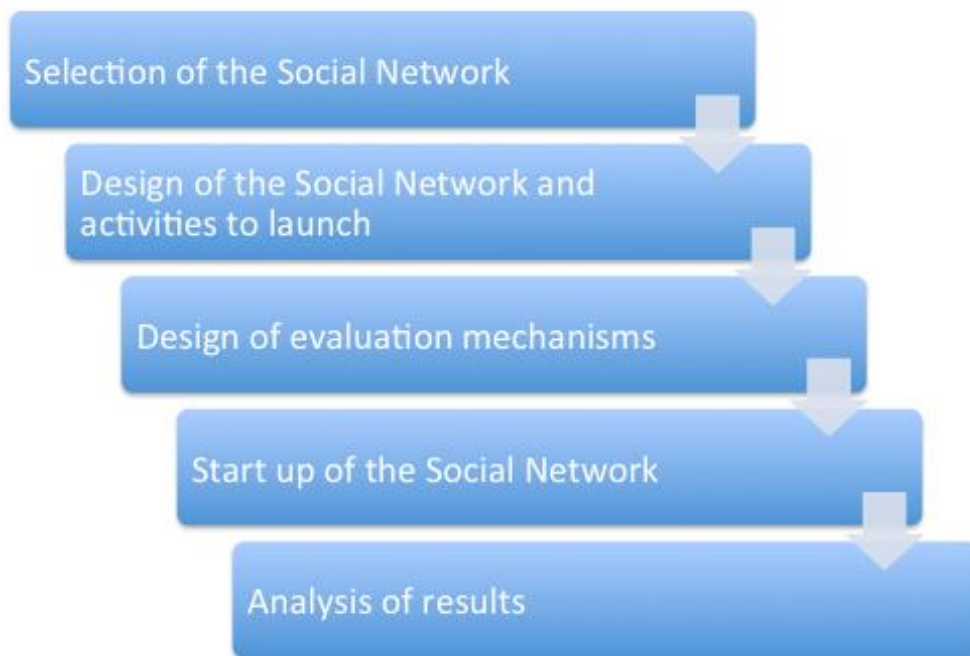


Figure 1. Phases of the methodology (Own elaboration)

Phase 1. Selection of the CSN

There are different CSN available in the market. The most important characteristics of the chosen CSN are: easy to use (intuitive and friendly), management tools available, open source and graphical options. A good option could be to use Yammer, which is include within the Microsoft suite and is free for higher education entities.

Phase 2. Design of the CSN and of the associated activities

It will be necessary to design the selected CSN not only regarding the working groups aimed to created but also regarding contents, main topics, initial best practices guide and learning activities that it is wanted to be launched, treated and developed during the time horizon under study. This activities, contents and topics will provide to the users with initial information to start with their connections, relationships and, extensively, with the knowledge creation/exchange, fostering the pave to create adequate conditions for innovation practices to appear.

Phase 3. Design of evaluation mechanisms.

These mechanisms should provide the basis for identifying the achievement level. The development of concrete evaluation instruments such as control lists, self-evaluation checklists, etc, will output to what extent determined learning objectives have being reached

or not. These mechanisms and instruments, together with the performance metrics to be developed in the Phase 5, will provide with precise results about how and to what extent the objectives defined for the specific project have been achieved.

Phase 4.- Start up of the CSN

Users to join the CSN will be selected and invited to join the CSN. For instance, in the case of creating a group to design, development, monitor and improve the final project of Master Thesis students, the actors invited to join the specific group of the CSN will be: Students carrying out final projects, supervisors, members of the academic title and administrative staff. Ane ven better approach would be to invite to join students that make their final projects from different degrees within the same Technical School; this would augment the interconeciton and multidisciplinary degree and would help to build up transversal best practices for different master of these School.

Phase 5. Analysis of results

Decision-makers will be able to gather together all the data stored within the CSN and analysed it. Such data will be individually treated for each one of the formed groups, being also possible to analyse it together in terms of, for instance, following the activities of certain user who is involved in more than one group. Mainly, two are the analyses that can be carried out:

- a) Qualitative. Applying the graphical capabilities of the CSN, it will be possible to graphically observe the composition of the different groups in terms of users and their relationships. Additionally, it will be possible to identify the main topics of discussion/interchange of knowledge between users (the ones that come up apart from those proposed initially) and it will be able to establish what the main interest topics and frequent questions/doubts are, which will be a direct input to enrich the best practices guide.
- b) Quantitative. The CSN will provide to decision-makers with a historical of data (Excel format), that will be analysed and whose main results will be the values of the three performance metrics previously presented, for each user of the groups. The results achieved will complement the ones obtained from the qualitative analysis, and will help to establish in a more accurate way the role of the different users and their importance within the group when it comes to both knowledge and innovation generation. Therefore, the creators of innovation and knowledge will be identified and their role will be potentiated in order to further foster innovation generation practices.

It is advisable that, within the Analysis of Results phase, all the participants of the groups get access to the achieved results. This is important because the different actors might differently benefit from the results. Then, the main actors involved in the learning process will be:

- Students. They will directly benefit from having participated in the CSN. For instance, students that develop their final projects will have a better communication tool available, as well as better ideas when designing, developing and presenting their works.
- Teachers. They will benefit by fostering and participating from innovation and knowledge environments. They should evaluate the tool and the generated innovation and knowledge as well as the results achieved by students with the CSN, and collect improvements in the use of such a tool. This can be seen as a continuous improvement tool regarding educational practices.

profesores, se intercambien impresiones sobre el desarrollo del piloto y se registren todos los aspectos comentados en un informe final.

3. Conclusions

This work has brought the possibility of using CSN as a tool to foster educational innovation practices and knowledge sharing and generation, among others. The usage of CSN at business organisations has proved to be efficient and satisfactory in terms of fostering communication (internal and external), identifying roles within the users, deployment of company culture and generation of both knowledge and innovation. In this context, it has been thought that extrapolating this usage to the higher education environment could also provide these advantages. Then, based on the experience of the authors on designing and implementing CSN at the business organisation levels, this paper presents a methodology that could serve as a guide to those academics willing to develop a CSN at the university context. Such methodology goes from choosing the most adequate CSN to analyse the results as gathered by the CSN, having also described both qualitative and quantitative tools to carry out the pertinent analyses. The next step is to implement this methodology at the academic context and extract conclusions that would enrich this methodology.

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On the adequacy of courses sharing contents

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Abstract

In higher education, having different courses sharing some contents is common. Even though, this repetition or revision does not ensure that the knowledge and the skills are truly acquired by the students. Particularly, students find some difficulties in applying procedures and abilities developed in previous courses into the following ones. In this work, the relationship between 'Fluid Mechanics' (FM) and 'Advanced Fluid Mechanics' (AFM) is analyzed. Both courses are part of the Aerospace Engineering Degree at Universitat Politècnica de València (UPV). MF is a compulsory course with a lot of new theoretical and practical content, whilst AFM is an elective course offered as a continuation of FM. Furthermore, in AFM, students practice with computational tools to solve fluid mechanics problems presented in both courses. This investigation focuses on an assignment proposed in AFM, in which students analyze the flow behavior through a convergent nozzle or diffuser using Computation Fluid Dynamics (CFD) software. Despite they already solved this classic problem in FM, very few of them successfully compare both analytical and computational solutions. Some tried to make the comparison but fail due to significant conceptual mistakes. And most of students did not even mention different ways to solve the problem in the report. After this issue arose, the solution proposed is to use exactly the same learning resources (notes, presentations, literature...) in both courses to make easier for the students to remember what they studied in previous courses. Same notes and slides, being presented at least twice and by different professors, help to clarify the content and, at the same time, verify the applicability of analytical and computational solutions. Additionally, this methodology allows to enhance UPV transversal competences of critical thinking and specific tools.

Keywords: *transversal competences, courses correlation, fluid dynamics, applied assignment, continuous formation.*

Resumen

En educación universitaria es habitual tener diferentes asignaturas directamente relacionadas, pudiendo llegar a solapar parcialmente contenidos, sin que esto garantice la asimilación de los mismos por parte de los estudiantes. En particular, se percibe que los alumnos tienen dificultades para aplicar procedimientos y habilidades adquiridas en un curso a las cuestiones tratadas en el siguiente. En este trabajo se analiza la relación entre las asignaturas ‘Mecánica de Fluidos’ (MF) y ‘Ampliación de Mecánica de Fluidos’ (AMF), impartidas en el Grado en Ingeniería Aeroespacial de la Universitat Politècnica de València (UPV). Mientras que MF es una asignatura obligatoria con mucho contenido novedoso para los alumnos, su continuación AMF es optativa y presenta un temario que frecuentemente profundiza en conceptos de MF. Además, una parte sustancial del curso se emplea en proporcionar herramientas computacionales para resolver problemas fluidodinámicos propuestos en ambos cursos. En el presente artículo se analiza el caso del trabajo académico de AMF, en el que los estudiantes analizan el flujo a través de una tobera o un difusor mediante Mecánica de Fluidos Computacional (CFD), problemas que ya resolvieron de forma teórica en MF. A pesar de esto, pocos alumnos comparan de forma correcta las soluciones computacionales con las analíticas del curso anterior, algunos cometen errores significativos al intentarlo y la mayoría ni siquiera menciona otras formas de resolver el problema en el informe que entregan. Tras detectar este problema, se propone emplear exactamente los mismos recursos de aprendizaje (apuntes, presentaciones, literatura...) en ambos cursos de manera que sea más fácil para el alumnado recordar lo que se estudió en cursos pasados. Al ser presentados como mínimo dos veces y por profesores diferentes, mantener los mismos apuntes y las diapositivas ayuda a clarificar contenido y al mismo tiempo se verifica la aplicabilidad de las soluciones analíticas. Adicionalmente esta metodología permite trabajar las competencias transversales de la UPV de pensamiento crítico e instrumental específica.

Palabras clave: *competencias transversales, asignaturas correlacionadas, mecánica de fluidos, trabajo aplicado, formación continua.*

Introduction

Nowadays, several companies are transmitting to universities their concern about the skills acquired by students in their training cycle (McMasters 1996). The companies do not agree with a teaching methodology based only on lectures that divulge theory and concepts applied in laboratory practices because they do not allow the student to grow socially (Crawley 2007). This problem occurs primarily when each course is isolated as if it was a single stage of independent steps without any relation between them. Transferring this situation to the business world, the companies see an isolation action determined by the worker, who considers his tasks essential and independent of the rest, including the relation with other people. On the opposite side, the policy of worldwide companies offers a fully interconnected panorama particularly due to the policy of globalization. The comprehension and integration between workers from different countries need to be taken into account because there are several actions carried out by them as a team, tasks such as coordination, connection, continuous improvement, production and even design.

Formation on every action listed above, together with the corresponding attitudes, depend on the University staff. Those skills should be trained at the University (Yusof 2014). Bologna system (European ministers in charge of higher education 1999) promotes students to demonstrate a series of competences at the end of their formation. Under this scope, the Universitat Politècnica de València (UPV) has been the precursor in the design of a work plan focused on a series of specific competences, assigned to each course or subject, but that also establishes an understanding or nexus that must exist between them. The connectivity between subjects has the resemblance to a "spider web", where there are straight lines that correspond to a knowledge of a particular area (i.e. fluid mechanics), and circular connectivity between different area. The circular connections have the characteristics of transversal competences that it can be trained and shared in the different straight lines. (UPV 2017).

This document describes the actions carried out on a line of knowledge defined by two subjects of the Aerospace Engineering Degree at UPV. These subjects correspond to a certain line of knowledge, in particular, fluid-mechanics and aerodynamics. The results of the students in both courses are analyzed in terms of final grade and competences. In particular, the effectivity of a given activity is considered. This activity is a short course project whose content is related to both courses. In any case, it is planned to extend the current analysis of consistency to the rest of contents shared by both subjects.

2. Description of the courses

2.1 Fluid Mechanics

Fluid Mechanics (FM) is a compulsory course offered to second-year students of the Aerospace Engineering Degree at UPV. It takes place during the second semester of the year (summer semester) and covers 7.5 ECTS. This course is the one that introduces ‘fluids’ to the students, even though a very brief introduction is given in the Physics course during the first year of studying. Its contents are divided in three different units:

- Unit 1: Equations of Motion (3.8 ECTS)
- Unit 2: Incompressible viscous flow (1.2 ECTS)
- Unit 3: Compressible flow (2.5 ECTS)

As it can be observed, contents which should be mastered by the students at the end of the course range from the basic definition of fluid to the calculation of multiple oblique shock waves. In other words, the students develop two different specific competences, which are the principles of continuum mechanics and the fundamentals of fluid mechanics. In addition, the UPV transversal competence ‘01 – Comprehension and integration’ is also trained during the course. The employed methodology for accomplishing these goals includes theoretical lessons and laboratory sessions.

The activities that each student must carry out to pass the course include two multiple choice test (each weighting 10% of the final grade), two written exams (30% each) and one course assignment (20%).

2.2 Advanced Fluid Mechanics

Advanced Fluid Dynamics (AFM) is an elective course which is offered to third-year students of the Degree. Nonetheless, students in its fourth year may also take it. It takes place during the first semester of the year (winter semester), right after FM course, and covers 4.5 ECTS. Obviously, it is the continuation of the FM course, therefore complementary contents are treated, divided as follows:

- Unit 1: Laminar flow: lubrication problem (0.5 ECTS)
- Unit 2: Unsteady shock waves (1.0 ECTS)
- Unit 3: Introduction to turbulence (0.75 ECTS)
- Unit 4: Introduction to CFD (0.75 ECTS)

Unit 1 in AFM is continuation of Unit 2 in FM; and Unit 2 in AFM extends Unit 3 in FM. Units 3 and 4 introduce to the student a new fluid dynamic problem, which is turbulence, and a useful tool to solve all fluid dynamics problems, such as Computational Fluid Dynamics (CFD). This last Unit of the course rises a lot of interest among the students because most of them clearly see the potential of the tool. The main specific competence gained by the students in this course is the applied knowledge about aerodynamic forces. Indeed, this

course is seen by some people as preparatory of Aerodynamics course which, in fact, is offered the subsequent semester.

The evaluation of this course comprises one written exam (30% of the final grade), one multiple-choice test (30%), observation of laboratory sessions (15%) and one short course project (25%).

3. Description of the proposed activity: a course project

Since one of the courses is the straight continuation of the other, activities proposed in AFM may also deal with concepts and skills trained in FM. Particularly, the course short project is suitable for this task (Sánchez, 2011). Specially the proposed one, which is a sort of open proposal. Therefore students can go back to their FM notes (or any other information sources such as books, papers, news...) to come up with ideas for the topic of their project. This way, students get involved in the project from step 1, which is setting the focus, refine the issue(s) and identify the stakeholder(s) (NOAA, 2009).

Two of the sections of FM's Unit 3 are: 'one-dimensional isentropic flow' and 'nozzle flow and normal shock waves'. At the end of these two sections, students are able to theoretically analyze the flow inside a one-dimensional pipe of any shape, being the most typical example the converging-diverging nozzle. The very same geometry is a classic problem of turbulence, studied in AFM's Unit 3. Thus, the general topic of the proposed project is the analysis of the flow inside that geometry using CFD, the tool explained in detail in AFM's Unit 4. The particular shape of the duct is to be defined by each working group, composed of 3 students. Some of them chose a simple converging nozzle (Figure 1a), but others analyze real diffusers employed in racing cars (Figure 1b).

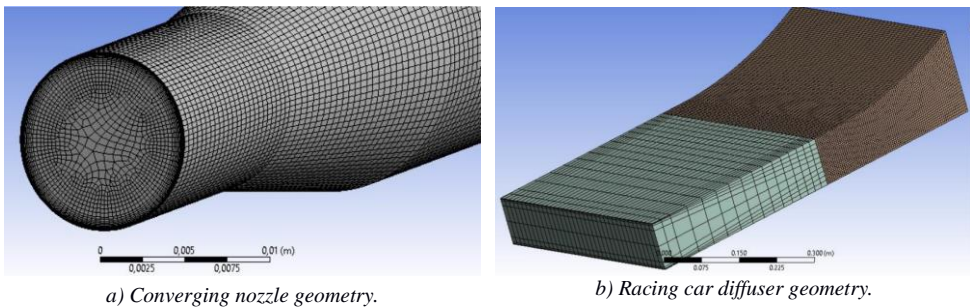


Figure 1. Examples of geometries proposed and analyzed by students.

Together with the project proposal, they are given guidelines to carry the project out successfully, and few examples organized by complexity. The evaluation rubric (Maldini, 2010) used to grade the report is also provided to the student in advance (Tiseria, 2015). It contains 5 criteria (difficulty of the study, formatting, writing, procedure and results) to be

evaluated in 4 different levels of performance, from A (highest) to D (lowest). This grading is later transformed to a numeric mark.

Neither in class nor in the project proposal (or any other document provided to the students) there was a direct reference to FM. However, the standard of attainment (Herman, 1992) in the rubric dimension 'results' explicitly asked for a critical assessment, so that professors expected the students to compare their CFD results with the theoretical ones of the previous course. This would in turn prove that transversal competence '01 - Comprehension and integration' was properly trained.

4. Results

4.1 General analysis

Table 1 sums up the characteristics of both courses described in Section 2. Average number of students per year has been also included, as well as the number of lecturers involved in both theoretical lessons and laboratory sessions. Around 80% of the students who pass MF course choose AMF the next academic year. This high value is probably attributed to fluid mechanics being a basic science very important for aerospace engineers, thus students are highly motivated to learn it.

Table 1. Summary of the characteristics of the courses.

	Academic Year	Semester	ECTS	Number of lecturers	Number of students	Transversal competence
FM	2	2	7.5	5	117±5	01
AFM	3	1	4.5	2	96±10	-

Results obtained by the students are depicted in Table 2, where the average grade for each course and year is given. Only the last two academic years are taken for illustrative purposes. It is important to remark that the groups of students are the same for both courses, in other words, people who pass the first academic year in FM (2014-2015) is the same that those for the first academic year for AFM (2015-2016). The first and obvious result is that the average grade obtained by students is the same regardless the academic year, the course and professors who perform the evaluation. Thus, evaluation system employed in both courses seems to be balanced. Second interesting result involves the project grade. The average grade is reduced more than 20% from one year to the next. This is not related to the quality of the work the students did, but to a change in the evaluation criteria. The first year the project was evaluated by professors, who gave a final result based on their experience after reading the reports. The second year, the project was slightly redefined, introducing a rubric evaluation system (NOAA, 2009). As previously shown by (Tiseira, 2015), the use of scoring rubrics

represents a more objective evaluation, although usually implies a reduction in the average marks when compared to overall assessment of projects.

Table 2. Summary of the results for the last two academic courses.

	Average grade		Median grade		Project average grade	
	1 st year	2 nd year	1 st year	2 nd year	1 st year	2 nd year
FM	66.0%	62.2%	64.1%	65.3%	-	-
AFM	68.8%	68.5%	69.0%	68.3%	86.3%	62.5%

Figure 2 shows the histogram of the final grade in MF for all students. They follow the expected tendency, almost a normal distribution since mean and media are almost the same, as shown in Table 2. As observed, the number of students who fail to pass the course is below 10%. Although only the last two years are shown, results of previous years perfectly match the obtained trend. At this point it is important to remember that the project grade only represents the 25% of the final grade, what explains why the distributions are not exactly the same.

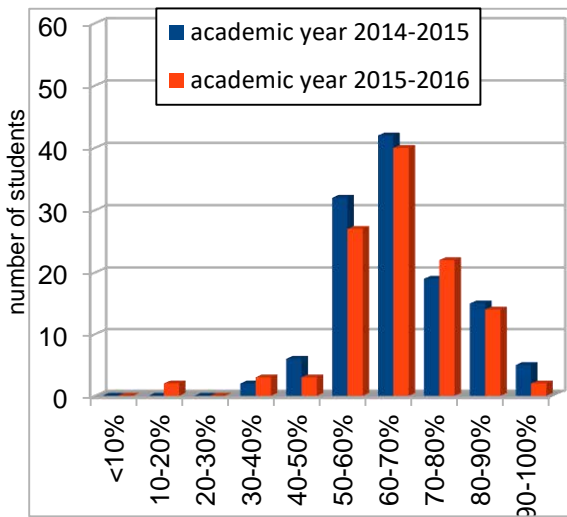
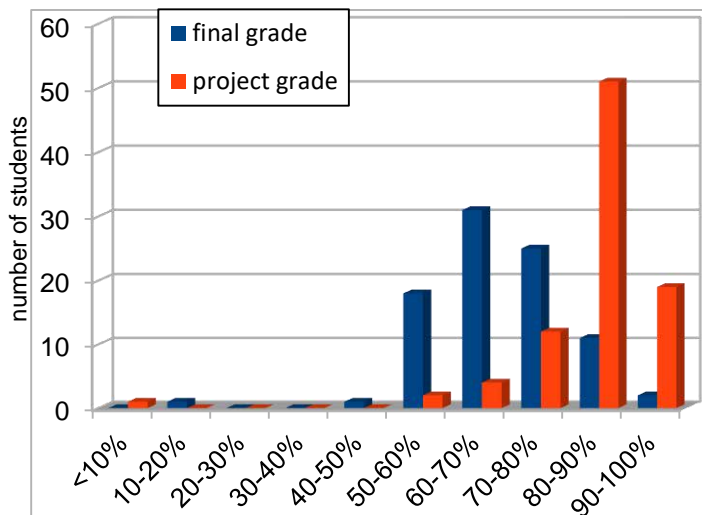


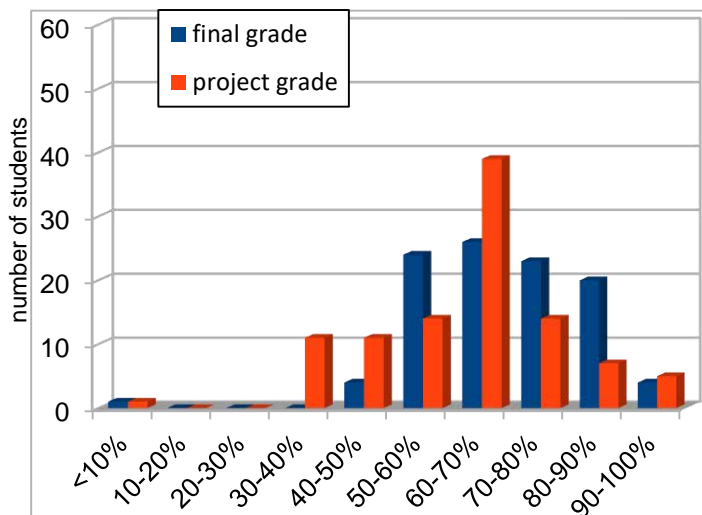
Figure 2. FM results of the two last academic years.

Figure 3 shows the histogram of AFM final and course project grades, Figure 3a for the first academic year and Figure 3b for the second one. Again, almost normal distributions are obtained for all cases. As observed in Figure 3a, the distribution of the project grade did not match the final grade obtained, proving some inconsistency in the evaluation system. This

was corrected in the academic year 2016-2017 (as shown in Figure 3b) by redefining the project to its current state and the use of evaluation rubrics. The number of students who fail to pass the course stays below 10%, which makes sense since the same groups are analyzed in both courses.



a) AFM results from academic year 2015-2016.



b) AFM results from academic year 2016-2017.

Figure 3. AFM results of the two last academic years.

4.2 Analysis of the course project

According to the surveys performed after each course, the course project is, in general, positively valued by AFM students. They find the activity related to the contents of the course, and also that enhances their formation as engineers. The use of scoring rubrics for evaluating it is appreciated as well, though they would like to have more feedback in order to improve their next reports. This proves their motivation on the course and its activities.

The Pearson correlation coefficient (PCC) or bivariate correlation (Fuster, 2003) is going to be used to check whether there is a linear correlation between (1) FM and AFM final grades; (2) project and FM grades; and (3) project and AFM grades. Linear correlation between project and AFM grades is expected since the project grade is included in the calculation of the final AFM grade. Table 3 summarizes the analysis. As expected for social sciences, where there are several unknown factors that can affect the results, the PCC values are low. Also as expected, all PCC values are positive. Authors would like to point out the increase in PCC of the project and AFM from the first to the second academic years. It is another proof that the change in the evaluation system to using rubrics is beneficial. A linear correlation is found between FM and AFM student grades, which is plotted in Figure 4. This result makes sense since, as commented before, both courses share some topics, thus the student who is motivated by FM course remains motivated by AFM. Also, results show a higher slope in the second course, giving evidence of a higher sensitivity of the AFM grade to the FM grade.

It is interesting to see how, although FM and AFM are correlated, the AFM project and FM are not. In that case, the PCC is much lower, meaning that there is a weak relationship between these two grades. This result is surprising because the problem proposed for the AFM project was already solved in the FM course, but using different tools. Analyzing the reports of the projects one by one, only less than 10% of them used the analytic tools given in FM course, and half of those incorrectly applied it, leading to wrong results and conclusions.

Table 3. PCC of FM and AFM for the last two academic courses.

	FM-AFM	FM-project	AFM-project
1 st year	0.460	0.122	0.220
2 nd year	0.544	0.370	0.691

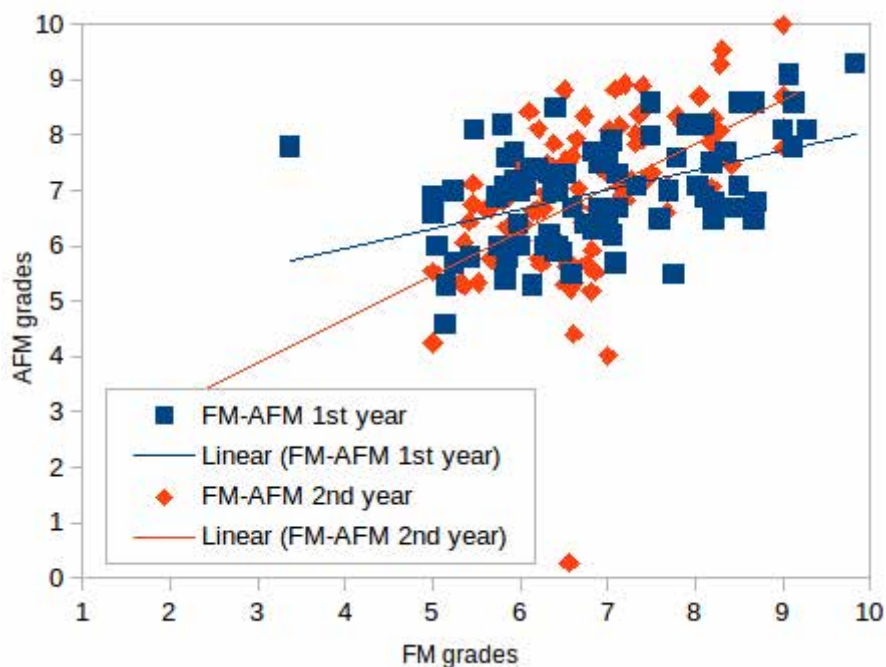


Figure 4. AFM results of the two last academic years.

This shows that the transversal competence ‘01 – Comprehension and integration’, defined as “demonstrate an understanding and the integration of knowledge in both one’s own specialization and other wider contexts”, though trained in FM, needs further training before the end of the degree. The 10% of students who, properly or not, compared the tools explained in AFM to those previously seen in FM also trained other transversal competences such as ‘09 – Critical thinking’ and ‘13 – Specific tools’ since they acquired experience in comparing and selecting the best tool to solve a specific problem.

In order to increase the percentage of students who carry out the comparison between both courses, action should be taken. In fact, two actions are going to be proposed for the next academic year:

- Omitting the relation of the project with FM course seems to be not beneficial for the students. In their third academic year, they seem to be unable to make that relationship by themselves (transversal competence 01 is still not acquired). Therefore, this relationship should be clearly stated in the project proposal. In this way, the transversal competence ‘01 – Comprehension and integration’ would again be trained in AFM, leaving the assessment of the ability of the student to integrate their knowledge without additional help from the teaching staff for subsequent courses.
- When AFM professors explain the proposal, they should use exactly the same teaching material (slides, notes, etc.) than FM professors did to explain the problem to be solved.

This will show to the students that different courses can be complementary, plus it will give an example of what ‘comprehension and integration’ means.

5. Conclusions

The relationship of grades between two courses which are highly correlated is analyzed in this work. In fact, the second course ‘Advanced Fluid Mechanics’ is a direct continuation of the first one ‘Fluid Mechanics’.

Similar but different evaluation processes are used in both courses. Even so, the distribution in final grades of students is almost identical, proving that both systems are correct.

It is shown that students who obtain higher grade in FM do the same in AFM. Nonetheless, high variability in the correlation is found, mainly because professors, methodologies and type of topics (basic vs. specialized) are not the same.

A short course project is proposed in AFM, which is positively valued by students and professors. It allows to directly train up to 3 different UPV transversal competences. Recently, scoring rubrics have been introduced to assess the project, with an increase in the correlation between AFM project and course mark and also a greater correlation between FM and AFM grades. However, those students who obtain high grade in the project are not the same than the ones with higher grades in FM, even though the problem proposed was already solved in that course.

In fact, less than 10% of reported assignments reference the FM course, and not all of them do it correctly. This issue must be solved. Actions proposed are: write in the project proposal that the problem has been already solved in FM and how to take advantage of this; and use the same teaching resources to explain the problem in class.

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Co-Creating the Tourism Identity of Gastronomic Creative City: The Case of Phuket

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Abstract

Gastronomic tourism plays a crucial role as a tourism products and becomes tourism experiences which tourists can perceive, learn, and also consume during their vacations. Phuket, the popular destination related with gastronomic tourism in Thailand, has been awarded by UNESCO as the Gastronomic Creative City in 2015, but there is a little perception about this award. One aspect of this creative city is Peranakan food. Therefore, stakeholders in Phuket have to communicate tourists about gastronomic tourism as a potential tourism product. In representing demand side, authors have conducted the projective technique with 34 tourists who visit Phuket in order to explore how tourists perceive about Phuket gastronomy. On the other hand, 17 stakeholders in regarding to Phuket gastronomy were interviewed and some of them were invited to attend the focus group interview. Tourism identity of Phuket gastronomic creative city are co-created by integrating tourists' insights and stakeholders' rituals, traditions and culture – authenticity, wisdom, and uniqueness. Interestingly, Peranakan is a brotherhood community – informal and no relationship, where plays a role as resource integrator to co-create the myth of Phuket gastronomy.

Keywords: *Gastronomic Tourism, Phuket, Crative City, Food in Tourism.*

Introduction

Gastronomic tourism plays an important role as a tourism products and becomes tourism experiences which tourists can perceive, learn, and also consume during their vacations. As mentioned by many scholars; e.g. Mak et al.)2012(; Chang et al.)2010(, Batat)2013(and so on; gastronomic or food tourism is the consumption of local culture through local food which are an evidence of history, tradition, way of life, and also culture of local destination. It is one of tourism attractions which tourists can experience at the destination. Therefore, food tourism can be viewed through two distinguish definitions: local product *versus* terroir product)Batat, 2013(. Firstly, the local product as demonstrated by Batat)2013(is a product of local community which are available only in the particular area. Secondly, terroir product is a product embedded by identity, tradition, culture, and history of the local place.

Phuket is one of the world destinations where can produce income from tourism more than US \$ 10.0 Billion per year from 13.37 Million tourists in 2015 (Phuket Province, 2016). Majority of tourists in Phuket are international tourists who contribute 90 % of total tourism income. From Pongsakornrunsilp and Chansamran (2014)'s tourism potential of Phuket, there are many potential tourism activities in Phuket which play an important role as tourism attraction to persuade tourists around the world; i.e. beach tourism, cultural tourism, food tourism, spa and wellness tourism. Fortunately, in 2016, Phuket has been awarded from UNESCO to be the UNESCO Gastronomy Creative City to join 18 cities around the world. Moreover, Pongsakornrunsilp and Chansamran (2014) have mentioned about the problem of gastronomic creative city that tourists in Phuket would like to try local food in Phuket, but they do not know about Phuket local food. Moreover, Phuket province has not yet developed strong identity and uniqueness of UNESCO Gastronomic Creative City.

To create tourism identity of UNESCO gastronomic creative city, we have employed the concepts of value co-creation, service dominant logic of marketing (hereafter; S-D logic), and gastronomic tourism in this study. Pongsakornrunsilp and Schroeder (2011) have demonstrated the process of value co-creation which consumers play an important role to co-create their consumption experience with their fellows. Additionally, in developing brand identity and brand experience, Pongsakornrunsilp and Schroeder (2017) provide an example of how consumers and producers co-create brand. This is in line with Vargo and Lusch (2008) that marketers cannot produce value – benefit of using, consuming, and possessing consumption objects, but instead, consumers do. They have extended their first concept of S-D logic in 2004 by proposing that producers cannot produce value, but they can do only to offer value proposition – a statement to inform customers and publics about the benefit of brand, products, and services. Therefore, tourism in Phuket does not only depend on beach tourism or tangible aspects of tourism, but also relies on experiential aspects and value from tourism (Shaw and Williams, 2004). Tourism stakeholders; i.e. Phuket government office, Phuket Provincial Sport and Tourism, and Tourism Authority of Thailand, Phuket Office;

have developed strategy to drive Phuket tourism industry into different activities – cultural tourism, gastronomic tourism, sport tourism, wellness tourism, and so on. It does not only reduce a number of tourists in the popular areas, but also increase the income distribution from tourism to different parties.

Therefore, this paper aims to develop the tourism Identity of gastronomic creative city whereby Phuket has been awarded by UNESCO as creative city in 2016. In order to do that, the concept of value co-creation, brand identity and gastronomic tourism have been employed to co-create the tourism identity of Phuket gastronomic creative city. The data in this paper were collected by qualitative research method – projective technique for exploring the tourists’ perceptions toward UNESCO gastronomic creative city and focus group interviews for co-creating tourism identity of gastronomic creative city. The contribution of this paper is to drive Phuket tourism as gastronomic creative city and persuade tourists around the world to access Phuket.

1. Literature Reviews

1.1. Value Co-Creation

Vargo and Lusch (2004) have mentioned about new framework of marketing in *Journal of Marketing – Evolving to a New Dominant Logic of Marketing* that marketing scholars should change their perspective about marketing concept. They purposed S-D logic as a new marketing paradigm by focusing on the concept of customer value - value as phenomenological (Vargo and Lusch, 2008), is consumers’ benefits from consumption or possession goods and services. However, they are not the first scholars to mention about value and co-creation process; e. g. Wikström (1996) ’s co-production, Prahalad and Ramaswamy (2004) ’ co-creation, Toffler (1980) ’s prosumption, and so on. Like other scholars in the field who discuss about aspects of value, Vargo and Lusch (2008) propose that customers are capable to co-create value for their own sake, and marketers play an important role as facilitators. This is an active role of customers (Pongsakornrungsilp and Schroeder, 2011), whereby customers may concern about price – Value-in-Transaction, or hedonism experience – Value-in-Use. The first one is influenced from Socio-Economic resources, while the latter is influenced by Socio-Cultural resources (Arnould et al., 2006). For example, before paying day, a customer might stay home and cook for himself to save money, while on the pay day, this customer might go to the top restaurant in town and uploads a load of his pictures on Facebook and Instagram. Therefore, in order to co-create tourism identity of Phuket gastronomic creative city, we need to understand about tourist value in regarding to gastronomic tourism.

1.2. Brand Identity

Brand identity is one of brand culture aspects – brand identity, brand culture, and brand image (Schroeder, 2009). In the brand culture model, Schroeder (2009) has mentioned about brand in regarding with culture and he also asks for model or method to make understanding brand – brand culture. The definition of brand in this concept does not only mean to brand name, packaging, label, or ownership, but it also emphasizes in demonstrating meaning, myth, identity, and history of brand (Schroeder, 2009). Within the concept of brand culture, it is in line with value co-creation process whereby consumers play an important role to co-create brand whereby brand identity plays a role as a plot of story for communicating with customers (Pongsakornrunsilp et al., 2011), and brand image is customer perception toward brand. However, in theoretical, it is impossible for customers to perceive all information and message from business – communication noises from mundane life, e.g. TV remote control, works, friends, and so on; trusts between customers and business that customers tend to believe messages from friends or other customers, rather than marketers or sellers (Pongsakornrunsilp and Schroeder, 2011). Therefore, businesses have to allow customers to participate, interact or discuss with other customers in order to co-create strong brand. In the process of brand co-creation, marketers need to develop strong brand identity and communicate to customers in order to increase the perceptions toward value proposition. To develop strong brand identity, marketers need to analyze the history and myth of business and create a plot for story telling (Pongsakornrunsilp et al., 2011), which plays an important role to activate customer desires. It is in line with S-D logic whereby Vargo and Lusch (2004; 2008) demonstrate that marketers cannot create value, but they can only present ‘value proposition’ to communicate the benefits of brand, products and services with customers. By doing this, marketers have to inquire the methodology or technique for understanding what customers value.

1.3. Gastronomic Tourism

Gastronomic tourism is one of creative tourism activities which the Tourism Authority of Thailand (hereafter; TAT) has proposed as one strategy to drive Thailand tourism industry, because tourists can visit, learn, and get new experience through local creative food (TAT, 2016). So, du Rand and Health (2006) demonstrates that promoting and supporting gastronomic tourism is one crucial factor to drive the competitiveness of nation economy, because it is geographical indication (GI) that consists of culture, rituals and traditions, way of life and also local community values. Moreover, gastronomic tourism also contributes to demonstrate identity and uniqueness of local community (Rojanarungsathaya, 2013; Quan and Wang, 2004).

Like Western culture, local food in the East also is fruitful of consumer culture which has long been accumulated the meaning of gastronomy through the history of community and society (Arnould and Thompson, 2005; Batat, 2013). For example, in the Southern Thailand,

local people will cook or buy the tenth lunar month food which consists of 5 menus in different meanings – cloths, boats, jewelries, money, and games (Sornprasit and Buakaew, 2011). During this event, Southerners who live or work in other regions will back home to visit their family that contributes to increase a number of tourists in the region. Ritchie and Crouch (2003) mention that promoting gastronomic tourism is one alternative strategy for government to increase tourism income distribution. Moreover, it is also the social mechanism to conserve local culture and traditions. Therefore, the Royal Thai Government has focused gastronomic tourism as the crucial strategy to drive and connect food industry to tourism industry in order to increase the competitive advantage of the country (Choibamrung, 2014).

It is inevitable to state that food and gastronomy are associated with consumer culture and way of life, because consumers are able to co-create the symbolic meaning of consumption culturally through learning process, and transferring to way of life and consumption. Fonseca (2008) demonstrates that gastronomy is the social practice related to mundane life and consumption. Marketers can understand this meaning process through consumers' identity co-creation and interaction (Arnould and Thompson, 2005). They also point out consumer culture theory as the guideline for studying about cultural food consumption whereby consumers consume and possess the consumption objects. In this meaning, 'food' is employed as a guideline for expressing their identity and symbolic meaning which reflect their social and culture dimensions (Valli and Traill, 2005). Gastronomy is one of the consumption objects as an evidence of consumer culture in term of 'consumer agency' – consumers can independently make their own life projects; e.g. self-identity, experience, and so on (Bhattacharjee et al., 2014). As mentioned by Fonseca (2008), consumers use 'gastronomy' or 'food' consumption as a tool to create self-identity and also in correspondent with market culture. Additionally, consuming local food is the consumption process which consumers express their individual's values and belief, rather than focuses on functional utilities of food (Cova and Cova, 2002; Batat, 2013).

1.4. The Context of the Study: Phuket Gastronomic Creative City

Phuket local food is Baba-Nyonya or Peranakan food which Peranakan cook and consume in their everyday of life (Tanguthai et al., n.d.). The peranakan ancestors were Chinese immigrants who had moved to live in Thailand in 150 years ago and married with local woman in the Southern of Thailand, especially the Andaman coast. Therefore, the social and culture interaction among local people, Chinese immigrants, and Peranakans or Baba-Nyonya causes to the emerging of multi-cultural society. Gastronomy is one of the important activities to co-create food culture from Baba-Nyonyas' way of life, rituals, and traditions (Tanguthai et al., n.d.). With the process of learning, transforming, and developing, Phuket gastronomic culture is accumulated, co-created, and extended within the unique identity of Baba-Nyonya or Peranakan. It is the harmonization process of consumers for adapting

themselves with the nature and society. Therefore, Phuket tourism industry has employed gastronomy as tourism products which require local culture to connect between consumer identity and culture in different contexts)Richards, 2002(.

Phuket has been awarded the UNESCO gastronomic creative city to join other 17 cities around the world – Belém and Florianopolis, Brazil; Bergen, Norway; Burgos and Dénia, Spain; Ensenada, Mexico; Gaziantep, Turkey; Parma, Italy; Rasht, Iran; Tucson, United States of America; Chengdu and Shunde, China; Jeonju, South Korea; Popayàn, Columbia; Tsuruoka, Japan; Zahlé, Lebanon; and Östersund, Sweden. Phuket Municipality)2015(demonstrated that Phuket has been awarded the UNESCO gastronomic creative city for 5 reasons: cultural diversity of gastronomy, strong identity of Peranakan way of life, uniqueness and identity of local Phuket gastronomy, the readiness of Government office for managing local gastronomy, and the friendliness of Phuket.

2. Method

The study employed the qualitative research methods – projective technique and focus group interviews to collect data. As mentioned earlier in literature reviews, this paper aims to develop tourism identity of Phuket gastronomic creative city by employing two data sets, i.e. tourists' value toward gastronomy in Phuket, and gastronomic identity in stakeholders' perspectives; in order to obtain the rich data and full understanding of tourist identity)Wallendorf and Arnould, 1991(. Kozinets)2010(also demonstrates that the good research should come from different ways. In this paper, there are four processes of data collection – secondary data collection, projective technique, in-depth interviews, and developing tourism identity of gastronomic creative city.

First at all, the concepts of value co-creation, brand identity, and gastronomic creative city are reviewed for understanding how tourism identity is developed. Data from this process were benefit to the study by providing basic knowledge and information for conducting the qualitative research. Secondly, the projective techniques were used to collect data from 34 tourists who visited Phuket by asking for the permission to interview. The 20 pictures in different patterns were presented to tourists, and ask them to choose 3 pictures representing Phuket gastronomic creative city. Moreover, tourists were also requested to rank these pictures and provide supported reasons. Thirdly, 17 stakeholders in regarding to Phuket gastronomy; e.g. modern Chef, Peranakan chef, tourism businesses, Peranakan members, Phuket municipal officers, and so on, were purposively invited to interview for 45 minutes in average. Finally, the focus group interview was employed to co-create tourism identity of gastronomic creative city. The participants of the focus group were stakeholders who were interviewed in the third process. The data from the former processes were presented and discussed in order to polish gastronomic tourism identity.

The processes mentioned above were combined for conducting triangulation. During the data collection process, data were transcribed, and analyzed in Thai through thematic analysis

)Attride-Stirling, 2001(. However, content analysis was done for the projective data. Initially, the codes were assigned to transcribed data before rereading all codes in order to confirm that there was no unclear code and meaning. For the further analysis, the codes were grouped into similar themes, and reanalyzed these themes through the iterative process of interpretation)Thompson, 1997(.

3. Results

Tourist Insights: The demographic data of informants were mostly male)62.86 %(and 44.12 % of them are married. Most informants came from Europe)68.57 %(, followed by other Asias)14.29 %(, Oceania and Africa in equal proportion)8.57 %(, respectively. More than a half of them were private company officers)54.84 %(. Interestingly, 41.18 % of informants are higher than 50 years old with average 45.06 years old)SD = 17.90(. 40.00 % of informants came to Thailand in first time, and stayed in Thailand longer than 15 days, while 43.75 % of informants lived in Phuket for 6 – 10 days. Most informants)68.98 %(mentioned that they received information about tourism in Phuket from friends, and 32.14 % of them got the best experience in Phuket from nature and beach, followed by diving)14.29 %(, and Thai smiles)10.71 %(, respectively. However, 10.71 % of them had no extreme experience from tourism in Phuket. One informant mentions about tourism in Phuket as follow:

“...best experience is nightlife and beach. Beach, here, is the best...including food and everything here...”

)Stephen, 24, British(

So, Stephen mentions about his experience in Phuket where nightlife activity is well-known among international tourists. Moreover, the characters of local people; i.e. friendliness of Thais, generous, and Siam smile, are important factors to create the beautiful experience, as mentioned by Sergey, a Russia tourist.

“...very friendly and positive thinking... They always smile and very generous, and these are my expression, and when looking to friendly people likes family...”

)Sergey, 35, Russia(

Interestingly, most informants)80.00 %(do not know that Phuket province has been awarded the UNESCO gastronomic creative city, because it lacks of communication with tourists, and the prominent tourism attraction in Phuket is marine and beach destination; therefore, tourists are interested to visit beach in Patong beach or Rawai beach rather than search for local food. So, the following example from Margarita, a tourist from Russia, to mention about the issue of local gastronomy.

“... as a tourist... we don't know how to find local food... we can't see in typical restaurants. We have never known local food. There is only European food for us. I would like to try local food, but I don't know where I can have local food... Especially, it should be the real local food, not just adapted menu for European...”

)Margarita, 27, Russia(

As mentioned by Margarita, she shares her view in regarding to how she can find local food in Phuket because she cannot find local food. Moreover, it should be the authentic local food related to culture, rituals and traditions – it is not just only food cooked in Phuket. The authenticity of Phuket gastronomy should be able to represent Phuket's way of life, and identity of local people, because tourism is a way for the one who would like to learn and search for new experience from local people, food, culture, and way of life. However, most informants are misunderstanding with Phuket gastronomy.

To develop strong identity of Phuket gastronomy creative city, it requires data from tourist perspectives in regarding to tourists' value toward travelling in Phuket. Informants were asked to choose 3 pictures and ranked them. The results show that firstly, tourists perceive about Sea Food, followed by Nature, Thai Culture, Beautiful, and Marine and Beach, respectively. Informants demonstrate their perception about Phuket gastronomy through international tourists' lens – beautiful through friendly and generous characters of local people.

“... because it is Thailand... it represents the past history... like history of time, history of the country...”

)David, 59, Australia(

So, David focuses on value of Thai culture connecting with history of Phuket as tourism attraction to persuade international tourists to visit Phuket. There, presenting Thai culture is able to attract the attention of international tourists. This is in line with another informant, Stephen who mentions about the authentic of Phuket gastronomy by choosing a picture of Lobster.

“... Lobster here is very fresh, Yeh! Fresh lobster... it is different from Bangkok, Here, it's fresh from the ocean... if you eat sea food in Bangkok, it takes time for delivering to Bangkok...”

)Stephen, 24, British(

Even, Stephen picked a big red Lobster, it does not only mean to Sea Food, but also be interpreted as the 'authenticity'. Stephen mentions that having food in Phuket is different from in Bangkok because 'fresh' represents 'real', and the distance of Phuket and Bangkok makes Sea Food in Bangkok not fresh. This means that eating the real local Phuket gastronomy is authentic.

Identity of Phuket Gastronomy: In developing the strong identity of Phuket gastronomic creative city, stakeholders in Phuket gastronomy play an important role to co-create its identity; therefore, this paper has conducted the interviews and focus group interviews with stakeholders in Phuket. Additionally, authors have attended the 29th BABA NYONYA Convention which Peranakans around the world participate in the convention in order to observe the culture of Peranakans. The study found that the identities of Phuket gastronomy are consisted of 3 components: ‘difficulty’, ‘way of life’, and ‘pride’.

Difficulty One important content of Phuket gastronomy is ‘difficulty’ in cooking local food – Peranakan food because the process of Phuket gastronomy requires the delicate procedures; i. e. materials and ingredients, cooking process, secret recipes, and gastronomy. These procedures lead to the uniqueness and identity of local food. A traditional chef who is the present generation of Peranakan food has mentioned that

“In Phuket, you can find local food both main course and desserts which require different patterns, cooking method, and taste from other places in Thailand... This is the strong identity of Phuket...”

)W, Generation 2, Interview(

Within this perspective, W, a generation 2 Peranakan Chef, mentions about the difficulty of Phuket gastronomy which requires the rituals and traditions of Peranakan culture accumulated from different generation. So, P, a generation 3 Peranakan Chef, has supported that:

“Hokkien fried noodles of our restaurant is unique and different from others because we use special ingredients and materials, for example using shrimp to simmer for soup with secret recipe, and all of ingredient are local supply...”

)P, Generation 3, Interview(

Interestingly, the special recipe for simmering soup needs the local ingredient – shrimp which does only supply from coastal fisheries, and delicate cooking method. Therefore, the difficulty of Phuket gastronomy is consisted of:

- 1) Local ingredients are required by secret recipes from their ancestors which need to strictly follow, for example, one ingredient for simmering soup to cook Hokkien Fried Noodles is clams – small oysters which are only available from the coastal fisheries in Phuket.
- 2) In preparing ingredients for Peranakan gastronomy, Chefs have to do by themselves because there is no finished ingredient available to use. Therefore, traditional Chefs have to spend time more than 1 day for preparing ingredients – soup, sauce, flour, and so on.

- 3) Special or secret recipe of Phuket gastronomy is key success factor for the uniqueness and identity of Phuket gastronomy that has long been transferred from one generation to one generation.

A keyword of difficulty relates to ‘time’ because the most unique and delicate process of cooking Peranakan food consume time; preparing ingredients for one day, but cooking meal for 15 minutes.

Way of life Peranakan gastronomy is the connection of local Phuket culture – multi-cultural society combining with local Thais, immigrated Chinese, local Muslim. Its identity is the integration of way of life and culture of Chefs. Therefore, Peranakan food or local Phuket food are not only the sciences of gastronomy, or local food recipes, but also relates to the art of gastronomy as mentioned by the following quote:

“...it is the art, ...and Peranakan Chefs who are cooking local meals – Peranakan, do not view themselves as a Chef, but they see themselves as ‘Artisans’ who are creative to integrate local culture; legacy of their ancestors, with their everyday of life...”

)T, Focus group interview(

Phuket gastronomy or Peranakan food has embedded its identity with the mundane life; e.g. Vegetarian Festival, Wedding ceremony, Child One Month Celebration, Ancestor Praying, and so on. The characters or shapes of food represent ‘wishes’, they would like to be. For example, in Spirit Festival, Phuket people will make a merit in order to share good spirit to their ancestors who have passed away. They also sacrifice their ancestors with meals and desserts; e.g. Big red turtle dessert – representing long live. It is an evidence of consumer culture co-created through several generations. So, one of the most important reasons for extending Phuket gastronomy is the teaching process of rituals, cultures and traditions to next generation. This lesson has been naturally transferred through their everyday of life – looking, learning, and participating within family. The relationship among family members is presented through Phuket gastronomy that the statement – “Authentic Phuket food are cooked by mum” is raised during the focus group interview with stakeholders in Phuket.

Pride With the difficulty and way of life, Phuket people are proud with the unique Peranakan food which tourists or visitors can only have in Phuket – no substitution product. The differentiation emerges from the accumulation of meanings, rituals, traditions, and culture of Phuket Peranakans or Baba Nyonya. Therefore, Peranakan people do not only view Phuket gastronomy as food, but also the pride of Peranakan which tourists or visitors have to try.

“...tourists who visit Phuket will have a chance to taste the local Phuket – the cultures and authentic root of Peranakan dishes. It is the integration of Nyonya cooking and Peranakan cuisine ...multi-cultural food...”

)P, New Generation Chef(

In this perspective, Peranakan Chefs believe that having Peranakan food is the crucial way to carry on Peranakan food and create a chance to extend Phuket gastronomy to represent their pride – the bonds of ancestors, way of life, rituals, traditions and culture of Phuket people. It is the uniqueness of Phuket gastronomy which cannot find in other places.

4. Discussions and Implications

This paper aims to develop the tourism identity of Phuket UNESCO gastronomic creative city; therefore, the demand and supply sides have been investigated in order to co-create the strong identity. It plays an important role as ‘value proposition’ (Vargo and Lusch, 2008), in order to communicate with consumers how brand or Phuket gastronomy can facilitate tourists to co-create value – benefit or experience during travelling in Phuket. Additionally, to co-create strong brand identity, the concept of brand culture (Schroeder, 2009) has been employed to demonstrate the culture of Phuket gastronomy or Peranakan food within the cultural perspective. Authors have conducted the focus group interview with stakeholders in Phuket gastronomy for developing the strong identity. All data set were shared to participants as an issue of discussions. After 2 hours, the tourism identity of Phuket gastronomy can be summarized as the following statement:

“Tourism destination where there are the prominent and unique local gastronomy in regarding to Baba Nyonya or Peranakan people’ local wisdom and ways of life. Phuket gastronomy requires the delicate preparing, cooking, and eating that has long been transferred through rituals, traditions, and culture. It is passed on through generation. Peranakan people are creative for Phuket gastronomy which use local ingredients and materials in order to co- create unique identity of Peranakan with the unique recipe...”

Gastronomic tourism will be one of important tourism activities in Phuket; therefore, stakeholders in Phuket have to employ the tourism identity above to communicate with tourists. However, this identity needs to comply with tourists’ perceptions toward Phuket gastronomy – data from projective technique. It is worth to noting that tourism identity is consisted of 3 components: Uniqueness, Authenticity, and Wisdom (Figure 1).

Uniqueness It is the identity of Phuket because Phuket gastronomy or Peranakan food have to strictly use local ingredients and materials to prepare delicately precook recipes. The preparation process is very difficult and embeds Phuket rituals, traditions, and culture which contain meanings and wishes in corresponding with its shape, name, and color. This is the Peranakan cultures which has been accumulated for more than one hundred fifty years.

Authenticity Phuket gastronomy is one of social practice to represent Peranakan way of life through local gastronomy which is the pride of Phuket and Peranakans. As roles of Chefs and consumers, Phuket gastronomy chefs see themselves as ‘artisan’ who are proud to create the art of Phuket Peranakan food. Interestingly, it is difficult to get from other destinations,

because, Phuket gastronomy is rich of culture and meaning which Peranakans have co-created, accumulated and passed on from one generation to one generation.

Wisdom As mentioned about the art of Phuket gastronomy, it is also contained the sciences of Phuket gastronomy – knowledge and skills for cooking Peranakan food. These resources are employed to co-create the myth of Phuket gastronomy which integrate guidance, way of life, relationship within family and community, and the bonds of Peranakans. The latter is meant that all Peranakans are brotherhood even they live in different places. Therefore, Peranakan community plays an important role as resource integrator (see also Vargo and Lusch, 2008) which contributes to co-create the culture of Peranakans. It has shed the light on resource integrator which does not necessary to be a formal community where fellow members interact or participate as mentioned in Pongsakornrungrungsilp and Schroeder (2011).

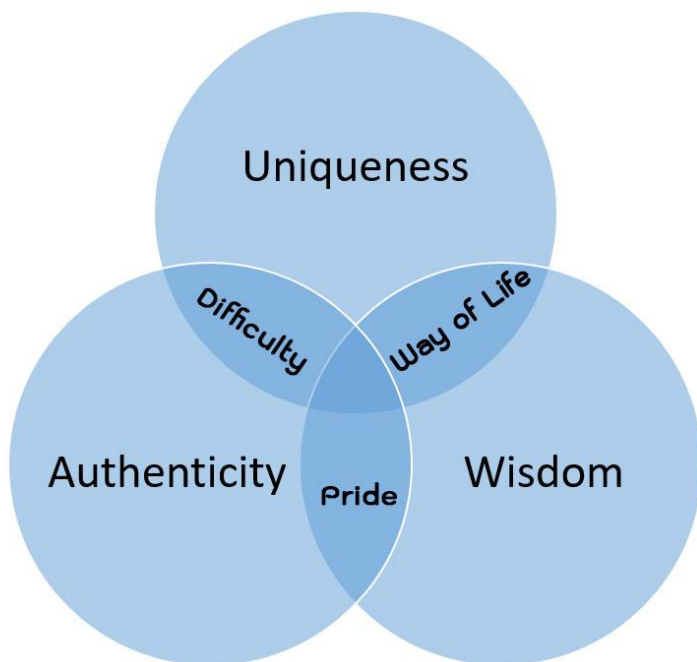


Figure 1. Identity of Phuket Gastronomic Creative City

Therefore, stakeholders in regarding to Phuket UNESCO gastronomic creative city can employ 3 components of tourism identity to communicate with tourists around the world. These three themes can generate into value proposition through the creative design. As mentioned by Vargo and Lusch (2008) and Pongsakornrungrungsilp and Schroeder (2011), marketers can only communicate tourists' benefit from visiting Phuket; therefore,

stakeholders can develop marketing campaign by integrating themes: authenticity, wisdom, and uniqueness to create the storytelling about Phuket gastronomy.

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Presentation Outflow

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Abstract

Many people with intellectual disabilities, by accessing learning and skills provision, should be able to lead actively and fulfilling lives as part of their communities and in employment, in a way that sustains mental wellbeing.

Keywords: *learning provision, skills provision, active teaching, mental wellbeing.*

Introduction

Warm up Video- A small inspirational video that pulls the attention of the audience, settles them, and sets the tone of presentation.

A spotlight on general perspective relating to disability. This will highlight the societal mindset that people with disability cannot be included in the purview of mainstream learning and education. Followed by a series of awareness test, the session will take a deep insight into the ground situation. A myth buster, it questions the traditional status quo on the thinking of general people.

Frame of reference-The session further dives into the general perspective in the society relating to disabilities; clearing the clouds on the ground reality that weakness is a general character and exists in all of us. A video activity that aids to get a fix on our weaknesses and shortcomings.

Centre staging the general mindset on the learning centers.

The session will further take on the learning centers and the inclusive classrooms etc.

Teaching and education the ID people- The session further looks into the idea of education ID people. How we understand the essentials or the needed capabilities to educate ID people? With the help of a video, the presenter strives to interpret the real requisites of educators.

A revelation on ID people and their capabilities and responsibilities. The session will document real stories on empowering disability with ability, how ID people are making a substantial difference by contributing with their gifts, talent and acquired skills. 'A bubble burst' on the stereotype assumptions; representing the vision with a clip that scratches the cognitive response of the audience. A brief video on what inclusion looks like when it wears the mainstream outfit.

Details The last part of the presentation will display how we can bring about a change in the society by cultivating inclusion through our own efforts and commitment.

The article is a comprehensive analysis on the myths and realities of learning skills and the inclusion of people with disability in the main flow of learning and education. It endeavors to illustrate a general climate or a general perspective relating to people with disability. Highlighting some common perceptions in the society and bursting certain myths that surround this viewpoint. It delves into each one of us and scratches the common spectrum of thought that takes a prominent place in the social order or the social make-up we all live in. A radical departure from the old school of thought, the paper attempts to bring into light the conventional thought patterns and undertakes to break through them with a vision that envisages to change the way we think of disability. It challenges the societal mindset that people with disability cannot be included in the purview of mainstream learning and education, diving deep and unearthing an insight into the ground situation. Questioning the traditional status quo on the thinking of general people, it is a humble effort to bring all hands on deck towards a revolutionary change.

1. Breaking the Barriers

The paper goes on cracking and challenging the typed norms or myths that disabled people cannot be educated. How our skeptical viewpoint become hurdles in providing equal platform for the disabled people. Mainly it draws us to challenge our own mindset for disability and the disabled people.

Challenging the common standpoint, the paper attempts to clear the clouds on the ground situation relating to 'Weakness'. It focuses and dissects weakness from every angle and tries to relate it with something common but unique. It defines weakness as a general character. A common trait that exists in everyone. Shortcomings, flaws, vulnerability, disability are some common characteristics that is present in all of us, in some ways or the other. How we perceive our weaknesses is what the paper strives for, bringing on the table the common ways, attitudes and mindset.

The paper takes the help of Bloom's Taxonomy in understanding expertise and the accepted parameters right from the low order thinking skills to the scale of High order thinking skills. The learning style that is commonly implemented through kinesthetic, auditory and visual models.

Emphasizing on how people can have different views on a certain object, structure, place or topic, the paper tries to understand that opinions vary from person to person. A logical mind perceives on a different level, a linguist has a different take and an artist can venture on a diverse landscape, i.e. all opinions are subject to the discernment background of the person. The paper draws a logical attention on how each individual is intelligent in their own ways with the help of Howard Gardner's Multiple Intelligence theory.

Supplementing further, the research goes on busting the myth that “Learning Centers are same as Inclusive Classrooms. Defining in detail the operational set up of Inclusive classrooms and the length and breadth of its constituent.

2. Specialization – A long-winded index

The paper again breaks the pigeon-holed assumption that normal people cannot teach intellectually disabled people. It extends its enquiry to the conclusion that though specialization is important, however, it is not the only benchmark. That normal educators or everyone can come forward and contribute in educating the intellectually disabled.

Underlining the generic approach in the learning centres about people with disability, the paper narrows down to the centres of learning and their approach towards the inclusive platforms etc.

3. Turning disability into ability

Further, the article attempts to concentrate on the road less travelled. Teaching and educating the INTELLECTUALLY DISABLED PEOPLE. Exploring the idea of educating the intellectually disabled people, the paper examines, inquires and turns facts and statistics inside out to present a groundbreaking clue that can alter the way we understand intellectual disability. Tapping into the areas that were never ventured before, the paper aims to lead through the unbeaten path, trailing over the ups and downs of norms and stereotype models that exist among us.

Validating its stand on the same, the paper continues to dismantle the typical school of thought that ‘Intellectual disabled people cannot do jobs’. That their disability impedes their operational and functional characteristics, viewing their unacceptance in the society as the roadblocks.

It steps up further, to something that we have sometimes left unattended. It attempts to research, investigate and inquire into the capabilities and potential of people with intellectual disability. How we identify with disability and how disability can be turned into ability. How weakness can be converted into strengths and empowered into durable attributes.

Foraying deep the paper supports its stand by the understanding that the efficiency and strengths of intellectually disabled can be stated in different ways; quoting personalities who went about becoming the pioneers in their areas and completely redefined intellectual disability. Eventually making disability their strength and changing the world.

Digging into examples who are excelling in their own areas, the paper explores regions where people with intellectual disability are proving to be assets. Places where integrity and high order of procedure is required and where quality systems are in place are some expanses that support the claim that intellectual disabled are competent and efficient in their chosen areas.

Illustrating the point through real life stories who have battled the odds of their disabilities, the article further campaigns on how support and encouragement can prove to be a catalyst in transforming lives.

Example 1. Nipun Sibal

33 years old Nipun Sibal has multiple disabilities including hearing and speech diagnosed at the age of 2 years. But, Nipun's strong will and passion has led him to what he is today. He has conquered the hurdles of disability, setting himself apart from the rest. His exemplary skills in the work of art and graphic designing keeps him at par with rest of his colleagues working in the organization. He has completed multiple designing courses including 3D animation. His positive approach towards assignments and technical knowledge of the designing softwares and other tools beat his non-disabled counterparts. Nipun leads a normal life and drives two wheelers and four wheelers with ease and efficiency.

Example 2. Shashvat Jhingan

30 year old Shashvat is a slow learner. He is an arts graduate with Diploma in Computer operations and programming. Shashvat has exemplary skills in handling and maintaining files and records. He has won several medals in athletics, swimming and cricket. His skills keep him on the list of proficient employees contributing in the growth of the organization. Shashvat leads a happy married life.

Example 3. Ranveer Singh Saini

16 year old Ranveer is one more example that has challenged the challenges of intellectual disability with his metal willed tenacity and 'never give up' attitude.

Ranveer was born autistic with multiple complications of speech, focus, coordination and hyperactivity.

Today he is a world famous figure with his spectacular golf accomplishments and needs no introduction when it comes to taking the bull by the horns and floating his way against the tides of his disability. Scripting history by winning Gold medal at the Special Olympics World Games at Los Angeles in 2015, Ranveer has become an inspirational story for others. His other achievements have made him stronger and taller than the limitation of intellectual disability.

First Indian along with his unified partner Ms Monica Jajoo to win Gold Medal at the World Special Olympics 2015 at Los Angeles on 31st July, 2015.

First Indian to participate in Special Olympics -Asia Pacific Golf Masters, Macau 2013 & to win Level 1 & Level 2 golf competitions.

First Indian to have consecutively been a LIMCA RECORD Holder for his victories at the Asia Pacific Golf Masters tournament for THREE CONSECUTIVE YEARS 2014, 2015 and 2016.

Selected by the World renowned Sports Magazine 'The Sports Illustrated' as the Sports person of the year for his stellar performance at the World Games.

Conferred upon the Indian Achiever's Award by former PM Lal Bahadur Shastri's son, Mr. Sunil Shastri.

Honoured with the PHD Sports Excellence Award by the PHD Chamber of Commerce & Industry-Sports Committee.

Felicitated by the honorable Prime Minister Mr. Narendra Modi on the Haryana Swarna Jayanti.

Was felicitated by the Honourable Governor of Haryana- Kaptan Singh Solanki ji, on 15th Jan'2017.

Was awarded the highest award of the state in sports - 'the Bhim award'

This outlines Ranveer and his enormity in Golf but there is more that keeps him ahead of the game and the rest! Trailing with him are so many attributes that make him the cynosure far and wide. To pick some of them would be:

1. Pianist qualified Initial & Level 1 with the Trinity College of London. Has performed publicly at the Epicentre, India Islamic Centre & other platforms.
2. Received the Lifetime Honorary membership at the Avondale Golf Club, Sydney.
3. Received the Lifetime Honorary membership at the Ambience Greens, Gurgaon.
4. Outstanding cook at 14 years of age.
5. Perfect pitch talent in music.
6. Mathematical genius in calculation of future calendar dates

The paper investigates on how we understand intellectual disability. Digging deep into capabilities and the measurements and standards we employ when it comes to educating intellectually disabled people.

Aspiring for a new outlook and collecting opinions towards a fresh interpretation, the paper takes stock of educators, the requisites taken into consideration and several other criteria that go around in establishing ethos and standards, keeping in mind the big idea –'The Inclusion'.

4. A disclosure of diversity

It attempts to eye-wash certain observations that are prevalent in the society. Breaking the walls of categories and patterns that we practice and bringing in a new wave to ride on. It presents a picture that is seldom missed during our day to day events. A picture that has always been unaccounted. How intellectually disabled people are the integral building blocks of our civilized make up. How with their own unique ways, they are contributing in the growth around us! How their unique gifts, special talents are bringing about a substantial and sizeable difference. How their acquired skills count so much when we think of concepts like equality and equal opportunities for all.

An exhaustive analysis of our cognitive response, the paper strains to burst the bubbles on the age old assumptions and hypothesis. Proposing and putting forward a theory that can drill and dismantle the rulebooks that have been existing without any substantial impact on the society when it comes to bringing inclusion into the center stream. How an inclusive and all-

encompassing approach will facelift the education and learning centers in today's challenging times is what the paper strives to assure.

Moving towards the unexplored landscape, this paper conceives an egalitarian and unrestricted change that has the potential to bring in new and limitless possibilities.

How a society can walk towards a new horizon by cultivating inclusion, by ushering into a revolutionary state through every individual's efforts, commitment and responsibility. It is a blow by blow breakdown of duties, responsibilities that every individual needs to shoulder and participate in an all-inclusive and wholesome plan that can reap immeasurable benefits for all.

In conclusion, the article intends to present a viable change by bringing in the distinctive idea of 'Inclusion' to its core. How we have perceived inclusion according to our own small windows and how we generally miss the complete picture. It represents the realities on the ground and proposes to crumble the limiting boundaries that keep Inclusion away from thriving into a valuable asset. It is an endeavour that strives for the contribution of all in empowering disability into a progressive ability.

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Special Olympics Bharat.

Lean manufacturing philosophy as a tool for the improvement of organizational and teaching quality in the university

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Abstract

Adapting curricula to the European convergence process directly affects the competitiveness of higher education. The University is forced to act as one more organization, and therefore, to demonstrate that it is able to offer the best training at the lowest possible price. The philosophy of Japanese origin known as Lean Manufacturing is oriented to the design and improvement of the processes eliminating "waste" or expenses that do not add value to the customer. The aim of this work was to know the interpretation that the student makes of the 7 basic Lean wastes and 5S in the context of the university. The results show that the time spent on some actions that are done through the secretary and the corresponding response time are some of the main wastes in the administrative processes. On the other hand, the lack of coordination due to the large number of gaps caused by the elective subjects and the excessive quantity of required material are the main wastes identified by the students in the processes of learning. In light of the results, the majority of proposals for improvement are aimed at ordering and standardizing the procedures.

Keywords: Waste, 5S, improvement, Lean

Introduction

After the Second World War, the lack of resources and the economic pressures that Japan suffered, also affected the Toyota Company, which was immersed in serious financial problems. To get out of this situation, the company developed a set of concepts and techniques, based on cost reduction, improvement of process productivity and elimination of those activities that did not add value to the final product. All this is known as the Toyota Production System (TPS). In this way, the company Toyota managed, within a few years, to improve the performance of all its workplaces and the results of the production lines. Since then, the TPS has continuously evolved and improved to what is known today as Lean Manufacturing.

After more than 50 years of application of Lean, it has been demonstrated that its main advantages are: 1. Improved productivity (reducing unproductive processes leads to

significant progress in company performance), 2. Customer satisfaction (Lean Manufacturing focuses on meeting the needs of the customer, ensuring that the product is delivered at the time and place required by the customer), 3. Reduction of costs (at the same time as the inefficiencies in the production processes are solved, the unnecessary costs that are associated with those activities that do not bring benefits to the company are reduced) and 4. Reduction of stocks (this management model seeks to minimize overproduction by reducing "wastes" and allowing savings in stock management).

Although the origin of Lean Manufacturing is set in the industrial sector, specific applications in other fields have been successfully implemented in the last two decades. For example: Lean Health, Lean Construction and Lean Office (Schaeffer, 2017). All these sectors share the principle of providing customers with the highest quality products, using efficient methodologies to improve productivity, eliminating downtime and waste, among others. These methodologies are based on the concept of continuous improvement, meaning that each process can be constantly ameliorated, as well as in the efficient use of all the resources involved in the processes, reducing, in this way, unwanted waste.

1. Objective

This article aims to identify possible points of improvement of the university education in the context of master's training, through the student's interpretation of two Lean tools (the 7 basic wastes and the 5S methodology). The main university estates will be considered: Education, administration and services.

2. Development of Innovation

In the subject of "Management Systems in the Agrofood Industry" of the master of quality management and food safety, the Lean system was introduced to students with practical cases applied to the industrial sector. Due to the complexity of this management system, its fundament was synthetized to the students by explaining "the Lean house" (Figure 1). In this, standardization, waste disposal and 5S form the fundamental basis of Lean activities. Based on this information, the students were asked to identify them in their academic environment.

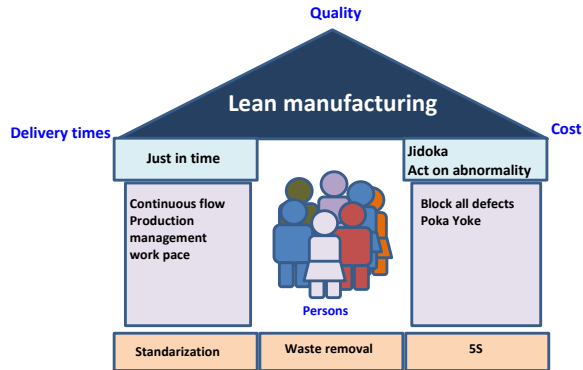


Figure 1. Lean house containing the most important aspects of the methodology

3. Results

Lean Manufacturing is based on the application of a set of techniques in a systematic way to try to reduce or eliminate, as far as possible, all types of "waste". Waste (from the Japanese muda, 無駄) is understood as any activity that does not add any value to the production process. In each of the stages that constitute a productive process, value is added to the product (or, in the case of the services sector, to the document or any other information in question) and then sent to the next stage. The resources involved in each of these steps, personnel and machines, may or may not add value to the process.

Generally, the term MUDA includes 7 types of waste: overproduction, inventory, defects, motion, over processing, waiting and transport. The correct identification of each of them will have a direct impact on the increase in the productivity of both, the workplaces and the performance of the organization.

Table 1 shows the summary of the information provided to the students in the subject for each of these 7 wastes, as well as their interpretation concerning the academic field.

From Table 1 it can be deduced that most of the wastes have been correctly extrapolated from the Lean system to the academic field. This has been the case of waste of over-processing, waiting, defects, overproduction and movement.

It should be noted that the students with respect to the waste of waiting and processing highlighted the importance of the administrative procedures. In their rationale, they consider that both, time needed to conduct a consultation and the time dedicated to its resolution, are excessive.

Table 1. Summary of the 7 Lean wastes and student's interpretation in the academic field.

LEAN WASTE	INTERPRETATION OF THE STUDENT IN THE UNIVERSITY ENVIRONMENT
<p>1. Overproduction</p> <ul style="list-style-type: none"> • Excess in capacity that causes more production than necessary without taking into account the actual demand of the customer • Produce as much as possible in the process, without taking into account the appropriate speed at which the next process can operate 	<ul style="list-style-type: none"> • Repeated content • Subjects with Little applicability • Non-necessary subjects • Little time between exams and remedial exams
<p>2. Over-Processing</p> <ul style="list-style-type: none"> • Processes beyond the standard required by the customer • Extra quality not required by the client 	<ul style="list-style-type: none"> • Too much content studied in little time • secretarial appointments take many days • content studied for subjects too compressed
<p>3. Motion</p> <ul style="list-style-type: none"> • Displacement (people or machines) to look for materials, documents ... • Non-ergonomic activities (catch, sit, crouch ...) 	<ul style="list-style-type: none"> • Little time to go to eat which forces you to bring food from home given that you do not have enough time to go to a cafeteria due to the long queues • Teachers' office are very far and very distributed throughout the campus • Classes and practices in different places and very far away • little time between classes to move to another class
<p>4. Defects</p> <ul style="list-style-type: none"> • Resources used to cover a quality failure. • Rework on products returned by the customer. 	<ul style="list-style-type: none"> • Non-motivated teacher • subjects too theoretical • Few specialties (very generic masters)
<p>5. Transport</p> <ul style="list-style-type: none"> • Referido al movimiento de material o información (documento) de un almacén a un proceso, de un proceso a otro o dentro del mismo proceso. • El transporte como tal no añade ningún valor al producto. 	<ul style="list-style-type: none"> • Not being able to arrive by car later than 10 o'clock due to the little capacity of the parkings • Little time between clases to go to the bathroom/move to the laboratory...
<p>6. Waiting</p> <ul style="list-style-type: none"> • Waiting times between or during the operations of a process that can affect both people and products / services. 	<ul style="list-style-type: none"> • Long standby times waiting for the marks of the exams can cause problems when organizing the Schedule to study the remedial exams • Wait times in the secretary's office or in the international relations office are too long • Waiting times to eat at campus cafeterias. Too long due to long queues
<p>7. Inventory</p> <ul style="list-style-type: none"> • Accumulation of products, information and / or materials in any part of the process. • Non-needed Stock to meet current customer demand. 	<ul style="list-style-type: none"> • Not applied

With respect to the other three points, their interpretations closely resemble the original definition of each waste, associating them with the excessive length of the subject contents, the excessive theoretical approach of the same and the short interval of time between exams. Furthermore, it can be established that the waste of transport has not been fully understood,

since the students have considered the transport of themselves and not that of materials or information used in the academic environment. Their interpretations would be closer to the concept of waste of motion.

As for the waste of inventory, there has been no interpretation, which is understandable, since in the academic field it is difficult to contemplate its equivalent, reason why this ambiguity has generated many doubts during the fulfilment of the class work.

After explaining the 7 wastes, the students received information about the 5S methodology. The application of the latter facilitates of this the standardization in order to guarantee that each person involved has the necessary level of knowledge to fulfil their tasks without problems. The 5S are 5 stages performed in a cyclical way to systematically manage the elements of a workspace according to five phases, which are conceptually very simple, but that require effort and perseverance to maintain them.

Table 2 shows the information that was provided to the students for each of the five stages described above (5S) and the interpretation given by them.

As mentioned before, the methodology of the 5S has a more practical approach than the 7 wastes, so that its interpretation is slightly more difficult. Despite, the students were given the basic notions in order to be able to identify each of the stages correctly.

In the first stage, "classify" the students emphasized that the working groups established at the beginning of the year, to carry out the activities for the different subjects, should be constituted with people who are complementary to each other based on their knowledge and performance.

In the second stage, "order", students have identified certain problems related to the breaks and courses schedules. Concurrently, they detected certain inefficiencies both in the subjects studied and in the dates and distributions of the exams.

In the third step, "cleaning up", the interpretations focused on the content of the different subjects, which are assessed as very theoretical and with low practical applicability.

In the fourth step, "to systematize", the students could not interpret correctly the meaning of this stage, since this refers to ensure the continuous and systematized repetition of the three previous steps.

In the last step, "standardize", despite their ambiguity, the students have succeeded in extrapolating their meaning correctly, since they have focused their interpretations on the opportunities for continuous improvement.

In this line of application of Lean philosophy in the university context, other authors such as Araujo, 2011 and Balzer et al., 2016, reported that it is possible to implement a Lean program in universities provided that all the establishment levels are involved. The main "clients" of the university are its own staff (teachers, researchers, administration and students); however, the end customer is the society, since students who graduate from academic institutions are the human resources of the future, which will directly influence the economy and the state of a country.

Table 2. Summary of 5S methodology and students interpretation in the academic field.

5S METHODOLOGY	INTERPRETATION OF THE STUDENT IN THE UNIVERSITY ENVIRONMENT
<p>1. Sort (from Japanese Seiri, 整)</p> <ul style="list-style-type: none"> • Distinguish between the necessary and unnecessary things in the workplace, discarding the latter. 	<ul style="list-style-type: none"> • Groups should be homogeneous in number and knowledge • Subjects are not well prioritized in the curriculum • Related subjects are taught in very separate courses or semesters which forces teachers to repeat content
<p>2. Set In Order (from Japanese Seiton, 整頓)</p> <ul style="list-style-type: none"> • Put in order the things of the previous point so that they can be accessed easily. 	<ul style="list-style-type: none"> • Set classes only in one part of the day • Subject schedule • Waiting times between classes • Brakes between classes • Exam dates • Sort topics • Analyze where to place 3-hour classes to maximize performance
<p>3. Shine (From Japanese Seiso, 清掃)</p> <ul style="list-style-type: none"> • Clean your workplace on daily basis completely or set cleaning frequency 	<ul style="list-style-type: none"> • Contents are, sometimes, repeated • Subjects with low applicability • subjects are very theoretical and little practical
<p>4. Standardize (From Japanese Seiketsu, 清潔)</p> <ul style="list-style-type: none"> • Extend the concept of cleanliness and order applied before and perform the 3 above-mentioned steps regularly. 	<ul style="list-style-type: none"> • Record of attendance • Methodologies between classes and subjects
<p>5. Sustain (From Japanese Shitsuke, 躰)</p> <ul style="list-style-type: none"> • Develop self-discipline and get used to doing the 5S continuously, trying to improve in each cycle 	<ul style="list-style-type: none"> • Improvement opportunities • Modernize subjects' content

4. Conclusions

This paper concludes that, although the philosophy of Lean Manufacturing was born in the manufacturing industry and is in this area in which it has been developed, it is possible to extrapolate the more global concepts of this methodology to other areas of society as it is the case of higher education. In this area it can be globally applied, however, certain steps must be interpreted and consequently adapted to be effective in the services sector. With this exercise, students were introduced to the Lean management system and were able to understand the essential aspects of two of the most important basic tools of the system: the 5s and the 7 wastes. This paper could be considered as the first step for futures studies in this field.

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CASTELLANO

La utilización de series de ficción para la evaluación de la competencia transversal pensamiento crítico. Análisis de una experiencia en la Universitat Politècnica de València

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Abstract

In this paper, we present the results obtained in teaching innovation regarding to the use of fiction series to evaluate the transversal competence CT09. Critical thinking at the Universitat Politècnica de València. A design of different activities based on various series of fiction known by the students has been made, taking into account as premise the application of the rubric elaborated by the mentioned University, in the different levels of dominion (levels 1, 2 and 3). It is intended that the student in analyzing the fragments can develop a critical activity of the series raised, both at the level of conflict, and providing alternative solutions to the propeaces. In short, it is a question of combining ICTs (new information and communication technologies) with activities so that students can be evaluated in this competition. The methodology used is the viewing of the fragments of the chosen fiction series and the valuation of the activities. The conclusions obtained will serve to reflect on the evaluative model and the convenience or not of using a fiction series as an audiovisual medium with the purpose of using it as a tool for the evaluation of critical thinking competence.

Keywords: *ICTs, Transversal competence, critical thinking, fiction series, evaluation, activities, mastery levels, degree, masters, rubrics.*

Resumen

En el presente trabajo se exponen los resultados obtenidos en la innovación docente referente a la utilización de las series de ficción para evaluar la competencia transversal CT09. Pensamiento crítico en la Universitat Politècnica de València. Se ha realizado un diseño de distintas actividades basadas en distintas series de ficción conocidas por los estudiantes, teniendo en cuenta como premisa la aplicación de la rúbrica elaborada por la citada Universidad, en los distintos niveles de dominio (nivel 1, 2 y 3). Se pretende que el alumno al analizar los fragmentos pueda desarrollar una actividad crítica de las series planteadas, tanto a nivel de conflicto, como aportando soluciones alternativas a las propuestas. Se trata, en definitiva, de combinar las TICs (nuevas tecnologías de la información y comunicación) con las actividades para que el alumnado pueda ser evaluado en dicha competencia. La metodología empleada es el visionado de los fragmentos de la serie de ficción elegida y la valoración de las actividades. Las conclusiones obtenidas nos servirán para reflexionar sobre el modelo evaluativo y la conveniencia o no de utilizar una serie de ficción como soporte audiovisual con la finalidad de utilizarlo como herramienta para la evaluación de la competencia de pensamiento crítico.

Palabras clave: *TICs, competencia transversal, pensamiento crítico, series de ficción, evaluación, actividades, niveles de dominio, grado, máster, rúbrica.*

Introducción

Las innovaciones docentes suponen un avance en la metodología que tradicionalmente se aplica en las asignaturas impartidas (Medina, 2010). En la actualidad, la evaluación de las competencias transversales, en las asignaturas que son punto de control de éstas, supone un esfuerzo para el docente (Villa y Poblete, 2007) ya que tiene que diseñar actividades que permitan al alumnado la adquisición de las citadas competencias, teniendo en cuenta el nivel, grado o máster, en el que se imparta la asignatura (Silva y Rodrigues, 2011; Franco, Almeida y Saiz, 2014).

La utilización de la rúbrica que elabora un grupo de profesores de la Universidad Politècnica de València (UPV, 2016) para cada una de las competencias transversales supone un punto de referencia para el docente, ya que le permite encaminar la actividad que mejor se ajuste a dicha competencia y a su evaluación.

Nos proponemos en el presente trabajo reflexionar sobre lo que ha supuesto el diseño de actividades para evaluar la competencia transversal de pensamiento crítico en varias asignaturas que se han impartido en la Universitat Politècnica de València, y el resultado que hemos obtenido en el alumnado, teniendo en cuenta que hemos aplicado una innovación

educativa para la aplicación del método del caso, superando el modelo tradicional, e incluyendo las nuevas tecnologías de la información y comunicación (TICs) como es la utilización de series de ficción visionadas previamente por al alumnado a la resolución de la actividad, y que han servido de soporte audiovisual a la indicada innovación.

Ello forma parte de la concesión de un Proyecto de Innovación y Mejora Educativa (PIME) «La evaluación de la competencia transversal pensamiento crítico mediante la utilización de series de ficción» del Vicerrectorado de Estudios, Calidad y Acreditación de la Universitat Politècnica de València, 2016-2017. Dicho PIME está coordinado por la Dra. D^a. Francisca Ramón Fernández; y formado por los siguientes profesores Dr. Vicente Cabedo Mallol, Dra. María Emilia Casar Furió, Dr. Vicent Giménez Chornet, Dra. Cristina Lull Noguera y Dr. Juan Vicente Oltra Gutiérrez.

2. La utilización de series de ficción para la evaluación de la competencia transversal pensamiento crítico

Para determinar los resultados de evaluar la competencia transversal pensamiento crítico se han elegido dos series y dos Másteres de la Universitat Politècnica de Valencia, como se puede ver en el Fig. 1.

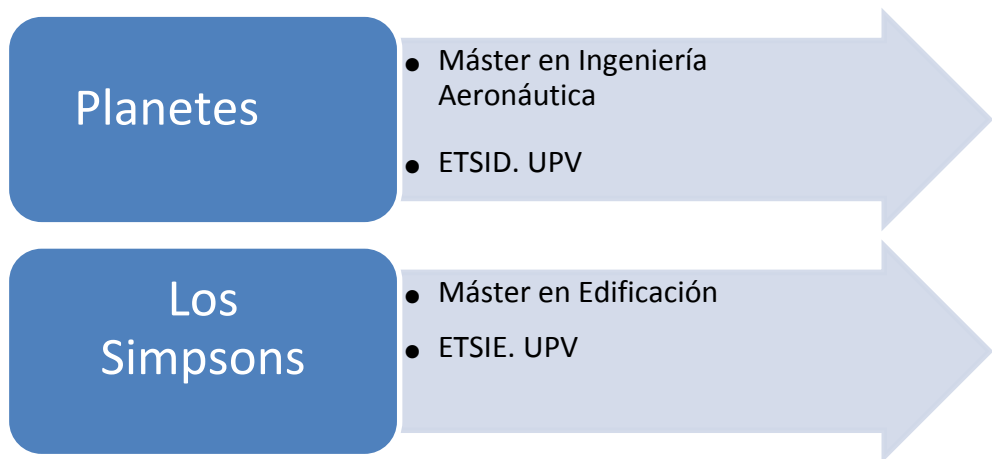


Figura 1. Series de ficción en las que se ha aplicado la innovación docente para la evaluación de la competencia transversal CT09. Pensamiento crítico, en el nivel de Máster. Fuente: elaboración propia.

En la Fig. 2 se observan los niveles a los que se puede aplicar la innovación, y que, como hemos indicado, nos vamos a centrar en el nivel 3 de Máster:

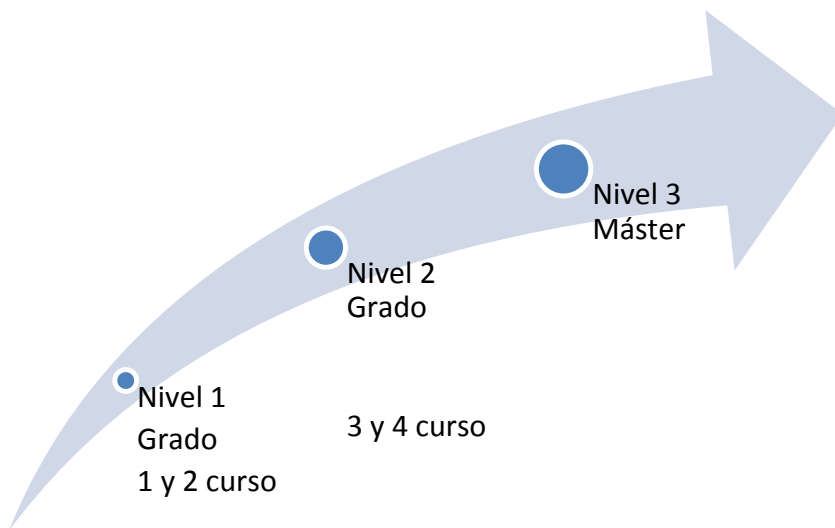


Figura 2. Distintos niveles para evaluar la competencia transversal CT09. Pensamiento crítico. Fuente: Elaboración propia.

Son diversas las asignaturas a las que se puede aplicar la innovación docente, y que son las que se indican en la Fig. 3. De ellas, hemos elegido, dos asignaturas de Máster, la de Derecho Espacial y la de Gestión Empresarial de la Edificación, por considerar que pueden aportarnos resultados interesantes en la aplicación de la innovación. En Derecho Espacial porque el alumnado tiene un perfil muy específico y la serie elegida puede aportarnos una valiosa información sobre la percepción del método del caso con esta innovación por parte del alumnado. En el caso de Gestión Empresarial de la Edificación porque en el episodio elegido se reflejan aspectos que pueden resultar interesantes en el ámbito de la empresa, como es el caso de la protección de datos de carácter personal, o el sistema de información dentro de una empresa, así como la propiedad intelectual e industrial y su protección.



Figura 3. Asignaturas involucradas en la innovación docente. Fuente: Elaboración propia.

3. La experiencia en el Máster de Aeronáutica. Utilización de la serie Planetes relativa a la basura espacial

Se va a explicar la experiencia en innovación docente llevada a cabo en los alumnos del Máster en Aeronáutica, en la asignatura de Derecho Espacial. Se trata de una asignatura de 4.5 créditos ECTS, que se imparte en nivel de Máster. Se aplica a un grupo reducido de alumnos, en el caso del curso académico 2016-2017, han sido 4 alumnos, lo que nos ha permitido observar de forma muy clara los resultados de la innovación.

Se trata de evaluar la competencia transversal de pensamiento crítico a través de la actividad que se diseña para los alumnos: método del caso con soporte audiovisual previo.

Se elige para ello por estar relacionada de forma muy directa con los contenidos de la asignatura, en concreto, con la problemática de la basura espacial, en relación con la órbita geoestacionaria, la serie de ficción, “Planetes”. Se trata de una serie de dibujos animados de la clase anime (Cabedo, Casar, Giménez, Oltra y Ramón, 2016). Sin embargo, la innovación no se circunscribe a dicha serie, sino que también se puede utilizar el episodio de la serie “Doctor en Alaska” referente al accidente del satélite (Cabedo, Casar, Giménez, Lull, Oltra y Ramón, 2017).

Se les pasa a los alumnos el primer episodio, disponible en el canal youtube, en el aula, para que lo visionen y tomen notas sobre todo lo que acontece en el capítulo relacionado con lo visto en la asignatura. Previamente se les ha dado una explicación de los conceptos que van a ver aplicados en el episodio.

Después, trabajan en grupos de 2 personas, redactando los principales aspectos que han identificado relacionados con el Derecho Espacial, principalmente lo relativo a la basura espacial, y la órbita geoestacionaria. Tienen que aplicar la legislación que han visto durante toda la asignatura (Véase: Ramón, 2017) en cada una de las situaciones identificadas, así como manifestar su opinión sobre la observancia o no de la legislación, y la aportación de soluciones al caso.

Es decir, se utiliza el método del caso, pero con la innovación de ver previamente un episodio de una serie de ficción que contextualiza lo que van a aplicar posteriormente.

Los alumnos utilizarán el ordenador para realizar la actividad, ya que podrán localizar información que apoye sus tesis, así como el acceso a poliformat (plataforma de teleformación de la UPV), en el que tienen toda la legislación a su disposición para poderla aplicar.

Los resultados que se han obtenido tras la implantación de esta nueva metodología son altamente positivos, por las siguientes razones:

- a) El alumnado es capaz de verificar si el planteamiento mostrado en una situación de ficción es conforme respecto a una norma jurídica previamente estudiada.
- b) Posibilita que en el foro de opinión que se genera con el caso práctico que se resuelve el alumnado pueda argumentar juicios en función de criterios externos.

c) Determina que pueda el alumnado extrapolar principios o modelos a nuevas situaciones que se puedan plantear (Cabedo, Castelló, Ibáñez, Jiménez y Serra, 2016).

En el presente caso, al ser un número de alumnos inferior al de la otra asignatura en la que hemos realizado la innovación docente, no se pasa una encuesta, por no considerar los resultados como óptimos para la valoración, ya que sólo tenemos 4 alumnos. De ahí, la razón de explicar de forma separada la innovación aplicada en dos asignaturas diferentes, y no realizarla de forma global, ya que así ha permitido obtener unos resultados más individualizados.

4. La experiencia en el Máster en Edificación. Utilización de la serie Los Simpsons relativa a la información y protección de datos en la empresa

Los alumnos del Máster en Edificación trabajaron el episodio de los Simpsons por considerar que reflejaba determinados aspectos relacionados con las materias que se impartían en la asignatura, además de ser una serie muy conocida, teniendo en cuenta que muchos de los alumnos eran Erasmus (Carrasco, 2012).

La encuesta se ha pasado en clase al grupo de alumnos, con el fin de valorar la competencia transversal “Pensamiento crítico”, trabajada con la metodología del Método del caso.

La encuesta la han realizado 33 alumnos, y en la tabla 1 queda recogida la valoración que han hecho éstos de la asignatura.

Tabla 1. Distribución de alumnos y valoración de la asignatura. Fuente: García (2017)

Alumnos	TRABAJAN		VALORACIÓN de la asignatura				
	SI	NO	Nada interesante	Poco interesante	Indiferente	Bastante interesante	Muy interesante
ERASMUS	4	2		1		5	
NO ERASMUS	22	5		2	5	15	5
Total	26	7		3	5	20	5

Se puede observar que la mayoría de alumnos trabajan y muy pocos son Erasmus. Referente a la valoración de la asignatura indican que es bastante o muy interesante (García, 2017).

En cuanto a las preguntas abiertas, se han realizado 8 aportaciones, tres de ellas realizadas por alumnos Erasmus y el resto alumnos no Erasmus. Destacan referente a los aspectos metodológicos, el trabajo en grupo que ha permitido la colaboración, se han complementado muy bien los miembros del mismo grupo e indican que la gente se hace más responsable. Por otro lado, les permite defender distintos puntos de vista y estimula el razonamiento y la comprensión. En definitiva, valoran el carácter innovador de la asignatura (García, 2017).

El cuestionario tiene una rúbrica colectiva, para valorar el trabajo individual de cada miembro del grupo, en ella tienen tres indicadores (Verifica la conformidad de un planteamiento respecto a una norma o estándar; Argumenta juicios en función de criterios externos y extrapola principios o modelos a nuevas situaciones) con cuatro niveles que van desde Muy Mal a Muy Bien. La mayoría de grupos han valorado con 3 y 4 (que son Bien y Muy Bien), por lo que podemos concluir que hay en general una satisfacción del grupo con la metodología que se ha realizado (García, 2017).

5. Conclusiones

La evaluación de la competencia transversal pensamiento crítico a través de la utilización de series de ficción merece una opinión positiva por parte del docente, ya que permite que el alumnado pueda adquirir la competencia y permite la actividad, en este caso, el método del caso con previo visionado de una serie de ficción, que pueda ser evaluado en los ítems indicados en la rúbrica que la Universitat Politècnica de València facilita para dicho fin.

La utilización de las nuevas tecnologías de la información y comunicación (TICs) constituyen una herramienta muy valiosa para dinamizar la docencia, más aún en el caso de asignatura impartidas en titulaciones no jurídicas, pero, con contenido jurídico, en su mayor o menor medida.

Es importante señalar que la evaluación de la competencia transversal pensamiento crítico no es fácil (Molina, Morales y Valenzuela, 2016; Moreno y Villaseñor, 2016), y que se han utilizado por parte del profesorado de otras Universidades distintas actividades para su evaluación (Cfr. Martí y Yepes, 2016).

Tenemos que tener en cuenta que el diseño de los casos son multidisciplinares y también reutilizables por parte de cualquier docente, no sólo de la Universitat Politècnica de València, ya que permite que se pueda utilizar el tradicional método del caso con una innovación pedagógica muy atractiva para el alumnado como es ver un episodio o fragmentos de una serie muy conocida (Véase el repertorio de casos en: Cabedo, Casar, Giménez, Oltra y Ramón, 2016 y Cabedo, Casar, Giménez, Lull, Oltra y Ramón, 2017).

Las asignaturas en las que hemos realizado la innovación docente, Derecho Espacial y Gestión Empresarial de la Edificación permiten obtener unos resultados favorables, pese a que en la segunda, por el número de alumnos, sí que se ha podido evaluar los resultados mediante el pase de una encuesta, que nos ha arrojado unos resultados sobre la opinión del alumnado en la innovación. En la asignatura de Derecho Espacial, los resultados favorables se han obtenido de la actividad en el aula por parte del alumnado, al ser un grupo mucho más reducido, y que ha permitido observar el comportamiento del alumnado ante la innovación realizada.

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Uso de herramientas digitales para mejorar la motivación en el aula universitaria

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Abstract

In the present work, we describe initiatives of educational innovation carried out with the purpose of increasing the motivation of students in the classroom. The innovation has consisted in using different digital tools, among them one of online planning (Doodle), another for the graphical representation of knowledge (Conceptual map), a tool to consult, opine and discuss online (Forum) and autocorrection files of the laboratory practices using a Spreadsheet through the Tasks function located in the tele-education platform of the Polytechnic University of Valencia (PoliformaT). These tools have helped the student to manage their time, search and contrast sources of information, evaluating the quality of the information obtained. After applying the tools, information on student satisfaction was collected through a Questionnaire. In relation to the motivation, the students have positively considered the activities carried out, emphasizing that they have helped them in their learning.

Keywords: *motivation, learning environment, teaching strategies, self-assessment, conceptual map, forum, higher education.*

Resumen

En el presente trabajo, describimos iniciativas de innovación docente llevadas a cabo con la finalidad de incrementar la motivación de los alumnos en el aula. La innovación ha consistido en utilizar distintas herramientas digitales, entre ellas una de planificación online (Doodle), otra para la representación gráfica del conocimiento (Mapa conceptual), una herramienta para consultar, opinar y discutir on line (Foro) y ficheros de autocorrección de las prácticas de laboratorio utilizando una Hoja de cálculo a través de la función Tareas ubicada en la plataforma de teleformación de la Universidad Politècnica de Valencia (PoliformaT). Estas herramientas han conllevado que el alumno haya tenido que gestionar su tiempo, buscar y contrastar fuentes de información, evaluando la calidad de la información obtenida. Tras aplicar las herramientas se recogió

información sobre la satisfacción de los alumnos a través de un Cuestionario. En relación a la motivación los alumnos han considerado positivamente las actividades realizadas, subrayando que éstas les han ayudado en su aprendizaje.

Palabras clave: *motivación, entorno de aprendizaje, estrategias docentes, autoevaluación, mapas conceptuales, foros, educación superior.*

Introducción

La motivación influye en el aprendizaje y por tanto en el resultado obtenido por los alumnos. Los alumnos reflejan que cuando están motivados les es más fácil el aprendizaje. De ahí, que uno de los objetivos de los profesores es motivar a sus estudiantes.

Pero ¿qué es la motivación?. Campanario (2002) (citado en Polanco, 2005) indica que “Motivar supone predisponer al estudiante a participar activamente en los trabajos en el aula. El propósito de la motivación consiste en despertar el interés y dirigir los esfuerzos para alcanzar metas definidas”. Díaz y Quirós (2011) recogen que la mayoría de los especialistas coinciden en definirla como un conjunto de procesos implicados en la activación, dirección y persistencia de la conducta. Nuñez (2009) indica que la complejidad conceptual del término está en delimitar y concretar el conjunto de procesos que logran activar, dirigir y hacer persistir una conducta.

Son varios los factores que influyen en la motivación de los alumnos. Alonso-Tapia y Fernández (2008) recogen entre otros el uso por parte del profesor de novedades, de interrelaciones entre diferentes temas, el estímulo a la participación pública, la organización adecuada de lo que se imparte en el aula, el uso frecuente de ejemplos, el ritmo adecuado de la clase, la retroalimentación de manera regular, el trato equitativo de los estudiantes, el elogio de su progreso, etc. Por otro lado, de la Torre y col. (2010) añaden otros factores como son el fomento de la comunicación entre alumnos, las buenas relaciones entre los componentes del grupo, aplicación de conocimientos a situaciones cercanas para los alumnos, puntuar la asistencia a las clases presenciales y valorar los trabajos complementarios y/o optativos realizados, entre otros. Polanco (2005) destaca que el profesor tiene que hacer que los alumnos se sientan responsables de su proceso de aprendizaje, y el profesor es responsable de ser creativo, crear expectativas y de promover la motivación en sus estudiantes.

Un punto interesante en la motivación es no poner todo el peso en el profesor. Hay que ayudar a los alumnos a tener “control de la motivación”. Panadero y Alonso-Tapia (2014) indican que este tipo de control consiste en auto-motivarse para una tarea y en mantener, durante la ejecución, la concentración e interés. Esto conlleva que el alumno tiene que “querer hacer” y tiene que desarrollar conductas para mantener la motivación. El alumno tiene una mayor motivación cuando comprende lo que se le explica en el aula, cuando se ve capacitado para realizar con éxito las tareas que se le indican. Si el alumno piensa que va a tener éxito estará

más motivado y utilizará las estrategias necesarias (Panadero y Alonso-Tapia (2014)). El alumno tiene que percibir que la tarea le es útil, de ahí que como indican Panadero y Alonso-Tapia (2014) se aconseja que el profesor al proponer una actividad, ayude a percibir la utilidad que ésta puede tener para los alumnos, ya que así los alumnos se implicarán más en la realización de la actividad. Otro factor que influye en la motivación de los alumnos es orientarles a alcanzar metas.

Hay universidades que entre las preguntas de la Encuesta de opinión del alumnado incluyen varias relacionadas con la motivación del alumnado por parte del profesorado. Así, en la Encuesta de la Universidad Politécnica de Valencia (UPV) destacan dos preguntas en este sentido: “Su manera de explicar consigue motivar al alumnado y despertar el interés por la asignatura” y “Contribuye a crear un buen clima de trabajo y anima a los alumnos a participar en las clases”. Otras Universidades incluyen también preguntas relacionadas con la motivación, por ejemplo la Universidad Autónoma de Madrid pregunta si “la actividad del profesor/a ha contribuido a aumentar mi interés por esta asignatura”.

1. Herramientas digitales para mejorar la motivación del alumnado

En la actualidad, el conocimiento y uso de las tecnologías de la información y comunicación (TIC) es fundamental en el proceso de enseñanza-aprendizaje de los estudiantes. Las TIC pueden ser un elemento motivador en las aulas, ayudando a que las clases sean más interactivas, facilitando el acceso a la información, facilitando otras maneras de enseñar y de aprender. Paredes y Días de Arruda (2012) realizaron un estudio en el que observaron que entre el profesorado participante en el estudio, la mayoría creía que las TIC traían motivación al proceso de enseñanza-aprendizaje, pero algunos divergían de esa opinión, diciendo que la motivación debía ser el propio contenido y finalidades de la formación, o, incluso, el propio proceso cognitivo reflexivo que deriva del proceso formativo. El Marco Común de competencia digital docente recoge que la competencia digital no sólo proporciona la capacidad de aprovechar la riqueza de las nuevas posibilidades asociadas a las tecnologías digitales y los retos que plantean, sino que resulta cada vez más necesaria para poder participar de forma significativa en la nueva sociedad y economía del conocimiento del siglo XXI (INTEF, 2017). También indica que “la competencia digital es un pre-requisito para que los estudiantes de todas las edades puedan beneficiarse por completo de las nuevas posibilidades que ofrece la tecnología para un aprendizaje más eficaz, motivador e inclusivo (tal como se indica en “Education and Training Monitor2013”, pg. 19)”.

En este trabajo se describe el uso de distintas herramientas para mejorar la motivación del alumno, entre ellas una herramienta de organización o planificación online (Doodle), una técnica para la representación gráfica del conocimiento (Mapa conceptual), una herramienta para consultar, opinar y discutir (Foro) y una herramienta de autocorrección (Hoja de cálculo) para las prácticas de laboratorio. El Foro es una herramienta incluida en PoliformaT. PoliformaT es la plataforma de formación de la UPV, que facilita el intercambio de

información entre profesores y alumnos y la gestión de las asignaturas a través de diferentes herramientas (repositorio de contenidos, tareas, exámenes, espacio compartido, foro, anuncios, etc.). El mapa conceptual los alumnos lo han presentado a través del espacio compartido de PoliformaT y el archivo de autocorrección se encuentra en la herramienta Tareas de PoliformaT.

Al finalizar el curso se hizo una encuesta individual a los alumnos con la finalidad de conocer si las actividades realizadas habían aumentado su motivación en el aula. Se les indicaba que el Cuestionario tenía la finalidad de mejorar la docencia. Al final de cada pregunta había espacio para que el alumno pudiera hacer comentarios.

1.1. Planificadores online

Hoy en día, existen en la red unas herramientas web llamadas planificadores online, entre ellos se encuentra Doodle, una herramienta automatizada muy sencilla que permite mejorar la organización de un evento. No hay necesidad de registrarse para utilizarla, ni instalar ningún programa. Doodle permite proponer varias fechas y horas posibles para un evento, permite también que los invitados puedan votar una opción o varias y que puedan visualizar las opciones elegidas por el resto de invitados.

En este caso, los alumnos tenían que hacer un mapa conceptual y cada alumno tenía que escoger un tema. Se hizo un Doodle con 47 opciones diferentes y cada alumno eligió el tema que más le interesaba. La utilización de planificadores online facilita la organización de los estudiantes y en el caso de trabajos en grupo facilita la asociación de los alumnos.

1.2. Mapas conceptuales

Seguidamente, se propuso a los alumnos realizar un mapa conceptual del tema que habían escogido. Schroeder y col. (2017) indican que los mapas conceptuales son diagramas utilizados en muchos contextos educativos para representar información verbal o conceptual y que son diagramas de nudo-enlace en el que cada nudo representa un concepto y cada enlace identifica la relación entre los dos conceptos que conecta. Novak (2010) proponen la elaboración de mapas conceptuales como una forma de organizar el conocimiento para expresar la definición e interacción entre conceptos de manera jerárquica.

Los mapas conceptuales le sirven al alumno para organizar y sintetizar el conocimiento de lo que está estudiando y le mantiene activo en la construcción de su aprendizaje. Luna de Luz (2014) comenta que la utilización de mapas conceptuales privilegia la memorización comprensiva y facilita la aplicación del conocimiento.

Los mapas conceptuales pueden hacerse con diferentes herramientas informáticas, puede utilizarse un programa de presentación como Power Point pero hoy en día hay herramientas específicas para realizar mapas conceptuales como por ejemplo Cmap Tools (Murga-Menoyo y col., 2011), Mindomo (Fernández-Márquez y col., 2016), etc.

Para realizar los mapas no se basaron los alumnos únicamente en el conocimiento adquirido en clase sino que también realizaron una búsqueda de información. La finalidad era, además de que el alumno trabajara un tema, que se compartieran todos los mapas conceptuales entre todos los alumnos y así facilitar el estudio y el aprendizaje de todos los alumnos. Así, tras entregar los mapas a través de espacio compartido, el profesor los revisaba y los ponía todos juntos en un único archivo que se ponía a disposición de todos los estudiantes. Los mapas conceptuales tuvieron un peso en la nota del alumno.

De los 47 alumnos que podían contestar el Cuestionario, lo entregaron 27. En relación al mapa conceptual se les preguntó si pensaban que eran una herramienta que ayuda al aprendizaje. El 81% contestó positivamente, a un 15% les pareció indiferente y un 4% no contestaron esta cuestión. Los alumnos destacan que son de una gran ayuda ya que ayudan a sintetizar la información, a aclarar ideas y a hacer más fácil el aprendizaje, siempre y cuando no sean muy complejos.

1.3. Foros online

Otra herramienta que ayuda a motivar a los alumnos es la utilización de los Foros. El profesor inicia el Foro y los alumnos participan, pudiendo tener retroalimentación del profesor y de otros alumnos. En este caso, la motivación se conseguía con el propio tema del foro, que era la búsqueda de información relativa a empresas que se dedican a cualquiera de los temas que se tratan en las clases. Se propuso al alumno su participación en dos foros, uno de ellos sobre los distintos trabajos que realizan las empresas relacionadas con la materia de la asignatura y el otro sobre casos prácticos llevados a cabo por las empresas. En la Figura 1 puede observarse la descripción de una de las entradas del Foro. La finalidad de los foros era la ligazón entre lo impartido en clase y la vida profesional.

Foro 1. Empresas dedicadas a la contaminación y descontaminación de suelos

Este Foro tiene la finalidad de conocer y analizar las distintas empresas que se dedican a contaminación y/o descontaminación de suelos.

¡Bienvenidos al Foro sobre **Empresas dedicadas a la contaminación y descontaminación de suelos!**

La finalidad principal del Foro es **tener contacto con la parte práctica de la asignatura.**

En este Foro vamos a ir viendo las empresas españolas y extranjeras que se dedican a:

- Estudios (histórico, exploratorio y detallado) de suelos contaminados
- Análisis de riesgos para la salud humana y los ecosistemas debido a suelos contaminados
- Empresas certificadas para llevar a cabo análisis de suelos contaminados
- Estudios de Calidad del suelo (certificaciones de suelos no contaminados)
- Elaboración de Proyectos de Descontaminación
- Dirección y ejecución de descontaminación de suelos
- Suministro y fabricación de equipos de descontaminación de suelos
- Sondeos, instalación de piezómetros, toma de muestras
- Software especializado para análisis de riesgos, etc.

Cada alumno añadirá una entrada cuyo título será el nombre de la Empresa elegida y nos contará:

- a. el trabajo que desarrolla la empresa,
- b. la URL donde podemos encontrar la información y
- c. si dispone la página web de casos reales en los que ha trabajado la empresa.

Figura 1. Detalle de la descripción de una entrada al Foro. Fuente: elaboración propia.

En relación a los Foros se hicieron dos preguntas a los alumnos: 1) “La finalidad de la participación en los Foros es que el alumno se de cuenta de que lo que se imparte en clase le puede servir para su vida profesional. ¿Se ha cumplido esta finalidad con tu participación en los Foros 1 y 2?”, 2) “La participación en el Foro 2 tiene una doble finalidad a) por un lado que el alumno conozca casos reales de contaminación o descontaminación de los suelos y b) por otro lado que el día de mañana tenga recursos a dónde acudir para ver casos específicos de descontaminación de suelos. ¿Se ha cumplido esta finalidad con tu participación en el Foro 2?”.

Para el 70% de los alumnos se cumplió la finalidad de los foros (Figura 2). Fue muy valorado por los alumnos el disponer al final de la asignatura el listado de empresas y de casos reales a los que poder acudir en su vida profesional.

El segundo Foro tenía la finalidad de conocer y analizar casos reales de estudio de la contaminación o descontaminación de suelos y que esos casos ayudaran para el estudio de la asignatura. Al 82 % les pareció que esta actividad había cumplido su fin y a una 11% les fue indiferente.

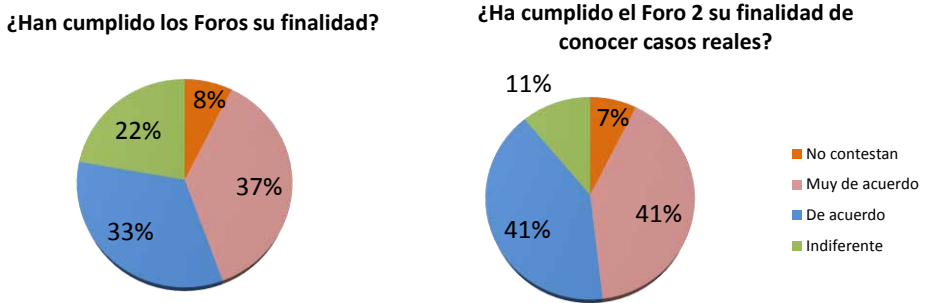


Figura 2. Satisfacción con la participación en el Foro de la asignatura.

En relación al Foro 2, entre los comentarios de los alumnos cabe destacar que proponen que se haga una exposición en clase del trabajo que realizan las empresas del sector y que les ha servido para conocer posibles salidas profesionales. Destacan también que el análisis en clase de algunos casos reales podría ser un elemento motivador para ellos.

1.4. Archivos de autocorrección online

Otra herramienta utilizada con la finalidad de motivar al alumno es el uso de ficheros de autocorrección (Hoja de cálculo) para las prácticas de laboratorio. Dicha hoja de cálculo se encuentra en el apartado Tareas del PoliformaT. Su uso conlleva que el alumno se responsabilice de su propio trabajo, por un lado mediante la entrega del archivo de autocorrección en el plazo establecido (Figura 3) y por otro lado con todos los resultados aceptables. En estos ficheros el alumno introduce los datos y resultados que ha obtenido en las prácticas de laboratorio y de campo. Seguidamente, el fichero indica si los cálculos realizados para obtener los resultados son correctos o incorrectos. El alumno tiene que entregar sus ficheros corregidos en el plazo establecido en la tarea y dispone de tiempo para preguntar al profesor la causa del resultado incorrecto.

Con la utilización de estos ficheros los alumnos interactúan más con el profesor tanto a través del propio PoliformaT como acudiendo a tutorías presenciales (Figura 3). Un mayor número de alumnos superan las prácticas. El alumno refuerza los conocimientos sobre la introducción de datos y el funcionamiento de una hoja de cálculo, realiza una autoevaluación de sus conocimientos y se responsabiliza de concluir la práctica. El alumno también aprende a organizarse. Los profesores pueden apreciar los fallos conceptuales de los alumnos a través de las preguntas planteadas (manejo de decimales, arrastre de errores en los cálculos, cálculos trigonométricos, etc.).

En el Cuestionario se les preguntó si el uso del archivo autocorrectivo es un buen método de corrección de las prácticas de laboratorio. Al 81% de los alumnos les pareció adecuado y a un 19% indiferente (Figura 4).

El alumno acude a tutorías para resolver con el profesor las cuestiones no aceptables

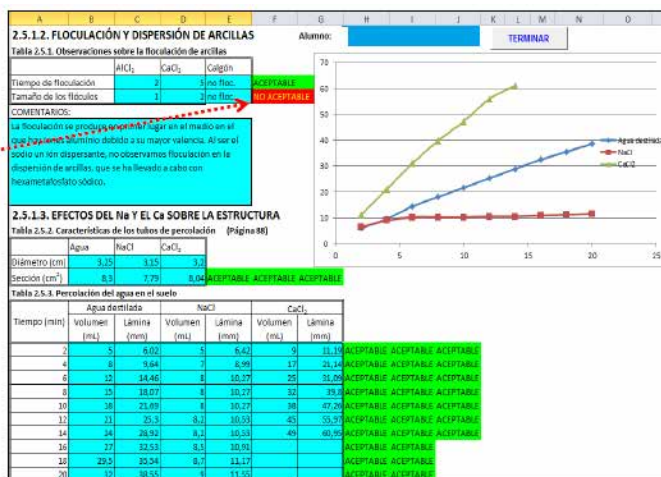
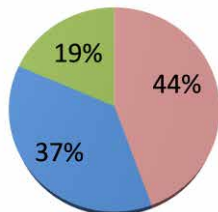


Figura 3. Ejemplo de archivo autocorrectivo. Fuente: elaboración propia.

Comentan los alumnos que los archivos autocorrectivos son una manera práctica, visual y sencilla de corregir las prácticas. Algunos alumnos indican que se podría pedir a los alumnos una breve memoria de la práctica realizada ya que esto ayudaría a fijar los conceptos vistos en la práctica de laboratorio. También destacan la posibilidad que tienen de corregir los resultados que no están bien antes de entregarlos y así obtener mayor nota.

¿El archivo autocorrectivo es un buen método de corrección de las prácticas de laboratorio?



¿Te han facilitado las Cuestiones Previas la posterior realización de las prácticas de laboratorio?

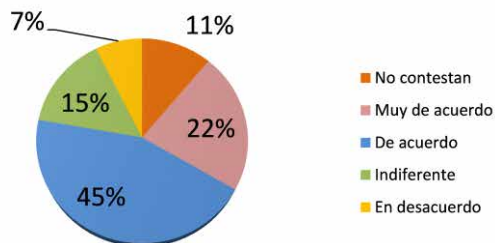


Figura 4. Satisfacción en el uso de archivos autocorrectivos y cuestiones previas a las prácticas de laboratorio.

Dentro de la nota de la asignatura está la realización de Cuestiones previas a las prácticas de Laboratorio. En relación a esta actividad se les preguntó si les había facilitado la posterior realización de las prácticas. Contestaron favorablemente el 67% de los alumnos (Figura 4). Los alumnos indican que las Cuestiones previas a las prácticas son una buena idea para que se lean la práctica antes de realizarla y que realmente les sirve para entender la explicación que da el profesor antes de la práctica. Sin embargo, un 7% está en desacuerdo con la realización de las Cuestiones previas principalmente porque les sustrae tiempo de estudio.

2. Preguntado a los alumnos cómo se puede mejorar su motivación

Se preguntó a los alumnos cómo se podía mejorar la motivación en el aula, no solo en relación a la asignatura en la que se les pasó el Cuestionario sino en general. En la Figura 5 se sintetizan las respuestas. La mayoría de ellos coinciden en la importancia para motivarles de poner ejemplos y en realizar casos prácticos basados en hechos reales. Al pasarse el Cuestionario en la materia Ciencias del Suelo del Grado en Ciencias ambientales los alumnos reflejan la importancia de las clases prácticas, de las salidas al campo y de los programas de simulación informáticos. El uso de medios audiovisuales ayuda también a incrementar su motivación. Destacar la importancia de conseguir una mayor implicación de los alumnos en las clases, invitándoles a hacer participaciones en el aula. Hay alumnos que expresan la cercanía del profesor y la interacción con sus compañeros como factores motivadores.



Figura 5. Propuestas de los alumnos para mejorar la motivación en el aula. Fuente: elaboración propia.

3. Conclusiones

La motivación de los estudiantes es un factor muy importante para su rendimiento académico, tanto para la realización de trabajos académicos de calidad como para los resultados en los exámenes. Aquellas herramientas digitales que estimulen el proceso de enseñanza-aprendizaje por parte de los alumnos pueden ser de gran ayuda para mejorar este proceso al igual que su motivación. La participación en Foros así como el uso de archivos autocorrectivos han sido valorados positivamente por los alumnos, al igual que la realización de mapas conceptuales con herramientas digitales. Además, los alumnos han destacado la realización de casos prácticos así como el uso de ejemplos prácticos como elementos motivadores en las aulas. Consideramos que la introducción de este tipo de herramientas digitales puede repercutir en un aumento del rendimiento académico de los alumnos, aunque de momento no disponemos de datos que permitan evidenciarlo. Por otro lado, los resultados de la encuesta deben tomarse con precaución teniendo en cuenta que para obtener datos fiables se necesitarían encuestas con una mayor población.

4. Agradecimientos

Trabajo realizado en el marco del PIME «La evaluación de la competencia transversal pensamiento crítico mediante la utilización de series de ficción» de UPV, 2016-2017. Este trabajo forma parte de las actividades preparatorias que después se desarrollaron en el PIME indicado, por cuanto se evaluaron distintas herramientas digitales en el aula, para después aplicarlas a las series de ficción que se utilizaron en el diseño de los casos prácticos para evaluar la competencia transversal pensamiento crítico.

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Representando y disfrazando superficies

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Abstract

This paper addresses a teaching experience developed in the academic years 2015-2016 and 2016-2017 in the subject Mathematics 2, present in the first year of the Degree in Engineering of Telecommunication Systems, Sound and Image, taught at the Campus of Gandia, which belongs to the Universitat Politècnica de València. In this subject, the scalar fields of two variables are studied, whose graphic representation facilitates the understanding of concepts such as continuity, differentiability or the existence of tangent plane and its use for obtaining estimates and maximum and minimum values, to calculate triple integrals, etc. During these courses, the Flipped Teaching methodology was used in the practical part of the subject, performing group work during the face-to-face session, which consists of the representation of several surfaces, a solid of revolution and a cylinder. The project is completed by adding a texture to any of the representations obtained. The textures are used to simulate complex surfaces giving them realism and they are important in fields such as industrial design, video game creation, architecture or virtual and augmented reality, among others. In addition, in the academic year 2016-2017, a contest named "Disguise a surface" was organized to motivate students and stimulate their creativity.

Keywords: *Flip Teaching, Mathematics, surface representation, textures.*

Resumen

En este trabajo describimos una experiencia docente desarrollada en los cursos 2015-2016 y 2016-2017 en la asignatura Matemáticas 2 del primer año del Grado en Ingeniería de Sistemas de Telecomunicación, Sonido e Imagen, impartido en el Campus de Gandia de la Universitat Politècnica de València. En esta asignatura se estudian en particular los campos escalares de dos variables, cuya representación gráfica facilita la comprensión de conceptos como la continuidad, la diferenciabilidad y existencia de plano tangente y su utilización para la obtención de estimaciones, obtención de valores máximos y mínimos, cálculo de integrales triples, etc. Durante los citados cursos utilizamos la metodología Flipped Teaching en las prácticas de la asignatura,

realizándose un trabajo en grupo durante la sesión presencial, consistente en la representación de varias superficies, de un sólido de revolución y de un cilindro. El trabajo se completa, añadiendo una textura a alguna de las representaciones obtenidas. Las texturas permiten simular superficies complejas dándoles realismo y son importantes en campos como el diseño industrial, la creación de videojuegos, la arquitectura o la realidad virtual y aumentada, entre otros. Además en el curso 2016-2017 se ha organizado el concurso “Disfrazo una superficie”, para motivar al alumnado y estimular su creatividad.

Palabras clave: *Flip Teaching, Matemáticas, representación de superficies, texturas.*


Introducción

En este trabajo se describe una experiencia docente relacionada con la representación 3D de superficies y la utilización de imágenes como texturas a modo de envoltorio. Esta experiencia ha sido desarrollada durante los cursos 2015-2016 y 2016-2017 en Matemáticas 2, asignatura anual del primer año del Grado en Ingeniería de Sistemas de Telecomunicación, Sonido e Imagen (GISTSI) del Campus de Gandía de la Universitat Politècnica de València (UPV). Tiene asignados un total de 9 ECTS de los cuales 1.7 ECTS se dedican a la realización de 7 prácticas informáticas, de dos horas de duración cada una, en las que se utiliza el programa Matlab. Se aprovechan las prácticas informáticas para impartir la parte del temario más acorde con la utilización de programas de cálculo, como es el caso del estudio del ajuste y la interpolación, la integración aproximada, el estudio de las curvas en forma paramétrica y polar, y la representación de superficies, tanto en forma continua a través de la gráfica de una función o en forma paramétrica, así como en forma discreta a través de diferentes interpolaciones. Uno de los temas que vienen a estudiarse en cualquier asignatura de Análisis Matemático en un primer año de un Grado con perfil tecnológico es el estudio de funciones de varias variables. Según lo habitual, y después de definir el concepto de dominio de una función, se pasa a definir su gráfica y, en el caso particular de funciones de dos variables, se aborda su representación. La representación gráfica de estas funciones facilita la comprensión de conceptos como son la continuidad, la diferenciabilidad, la existencia de plano tangente y su utilización para la obtención de estimaciones, obtención de valores máximos y mínimos, cálculo de integrales triples, etc. Al mismo tiempo que en la clase teórica se estudia este tema, se realiza una práctica informática dedicada al estudio de esta representación. Esta se completa con la representación de las superficies paramétricas que en particular facilitan el cálculo de integrales triples a través de los cambios a coordenadas cilíndricas o esféricas. Durante los cursos 2015-2016 y 2016-2017 se ha utilizado la metodología de la clase inversa (Bergmann y Sams, 2015) en las prácticas de la asignatura (Vidal, Estruch y Boigues, 2016, 2017a, 2017b). *PoliformaT* es el nombre del *aula virtual* de la UPV, en la que profesores y

estudiantes comparten información y recursos de las asignaturas, y permite utilizar herramientas como *Tareas*, *Exámenes*, y *Lessons*. Esta última herramienta, *Lessons*, permite la creación de contenidos digitales e interactivos y con ella se han generado las unidades didácticas de cada una de las prácticas de la asignatura, en particular de la unidad “Representación de superficies: formas cartesiana y paramétrica” (Figura 1).

Como puedes apreciar una superficie no es un cuerpo sólido, pero sí que lo es su *corteza*. Por ejemplo, cuando nos referimos a un cilindro o a una esfera como superficies, no hay que pensar en el sólido macizo, sino sólo en su corteza. Con un simple folio puedes realizar un cilindro, un cono, ... Todas esas formas son superficies.

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◦ Otras superficies vienen dadas a partir de dos parámetros, que denotaremos como u y v , a través de la forma paramétrica

$$\begin{aligned}x &= x(u, v) \\ y &= y(u, v) \\ z &= z(u, v)\end{aligned}$$

u en $[u_1, u_2]$, v en $[v_1, v_2]$

Figura 1. Parte del Lessons “Representación de superficies: formas cartesiana y paramétrica”.

Con la clase inversa, las horas presenciales se han aprovechado para la realización de un trabajo colaborativo, generándose un producto final entre todos los grupos. En dicho trabajo los estudiantes realizan diversas representaciones de superficies, una de ellas con textura. Las texturas permiten simular superficies complejas y darles realismo, siendo importantes en el diseño industrial, en la creación de videojuegos, en arquitectura, en realidad virtual y aumentada, en medicina, para simulaciones, etc. En el caso particular de los videojuegos, las

imágenes tridimensionales se forman mediante una malla de polígonos cubierta por una textura. El número de polígonos en un modelo para videojuegos es limitado y muchos de los detalles no pueden representarse a través de la geometría. En este caso las texturas ayudan a dar la apariencia de detalle donde no lo hay. Según la web de Taringa “Las texturas juegan un papel tan fundamental en un videojuego como los polígonos, ya que estas son la piel de los personajes y entornos, de las plantas, animales, piedras... de todo!”.

En el siguiente apartado se describen los recursos de internet, recopilados a lo largo de varios años, utilizados para el planteamiento del trabajo colaborativo.

1. Recursos utilizados

Desde el curso 2011-2012 se ha buscado información para la realización de listados de superficies paramétricas útiles para el trabajo del alumnado. El programa libre K3DSurf (<http://k3dsurf.sourceforge.net/>), desarrollado por Abderrahman Taha, permite, en particular, la representación de curvas y superficies paramétricas, siguiendo la misma nomenclatura que la utilizada en nuestro curso. Desde la pestaña *Parametric* (Figura 2), se accede a las ecuaciones paramétricas de diversidad de superficies, a partir de las cuales se generó uno de los primeros listados de ecuaciones de superficies.

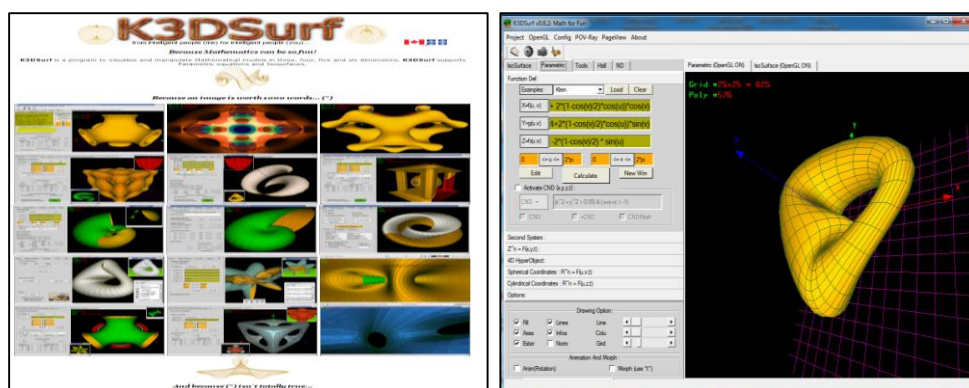


Figura 2, Página principal K3DSurf. Fuente: <http://k3dsurf.sourceforge.net/>

Se generaron nuevos listados con la información obtenida (Figura 3) desde el Área de Geometría y Topología de la Facultad de Matemáticas de la Universidad de Santiago de Compostela (<http://xtsunxet.usc.es/galeria.htm>). Este repositorio contiene las ecuaciones y representaciones de superelipsoides, supertoroides, superficies regladas y de revolución entre otras. Adaptando la información de este repositorio creamos otros listados.

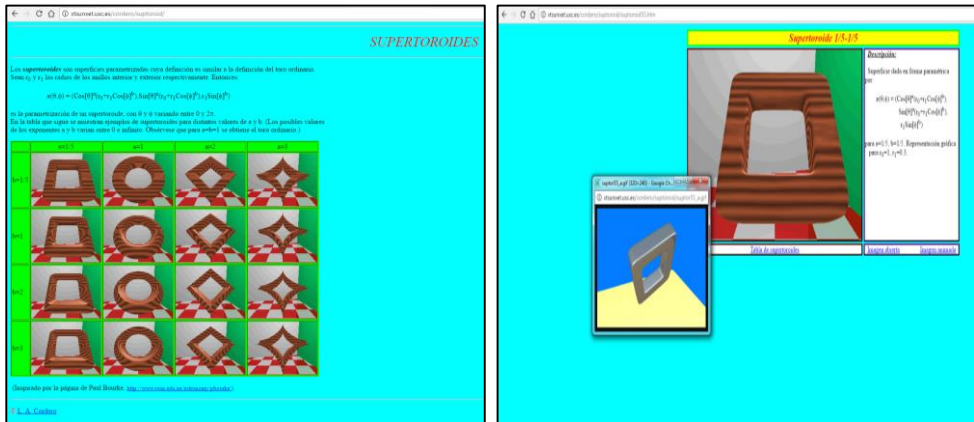


Figura 3. Página del repositorio de la Facultad de Matemáticas de la USC. Fuente: <http://xtsunxet.usc.es/galeria.htm>

Algunas de estas superficies son similares a las de Paul Bourke, <http://paulbourke.net/geometry/>, expuestas en la Figura 4.

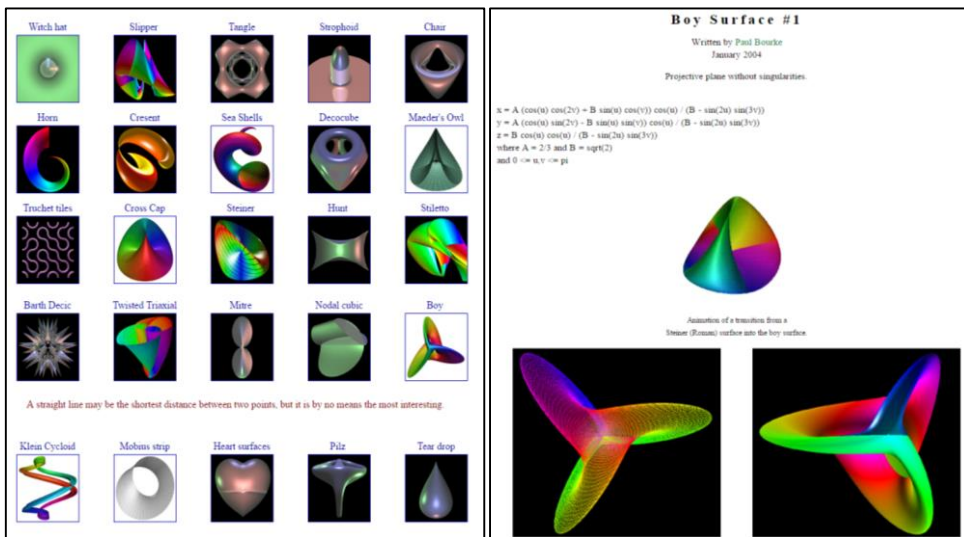


Figura 4. Página de Paul Bourke. Fuente: <http://paulbourke.net/geometry/>

Aunque las fórmulas no sean tan visibles, también ha sido posible incrementar los listados desde http://www.atlantis23.com/ei_parmsurf/parametricsurfaces_catalog.html, (Figura 5).

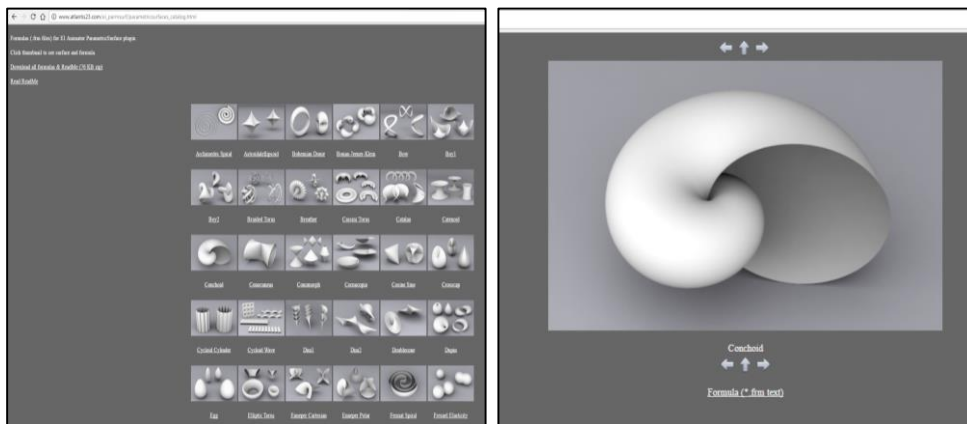


Figura 5. Otro repositorio. Fuente: http://www.atlantis23.com/ei_parmsurf/parametricsurfaces_catalog.html

La Figura 6 muestra la página <http://www.3d-meier.de/tut3/Seite0.html> en la que pueden obtenerse fácilmente las ecuaciones, tanto de las superficies dibujadas como de otras muchas que aparecen en un largo listado. Es la página utilizada para el concurso “Disfraza una superficie” realizado en el curso 2016-2017, al que nos referiremos posteriormente.

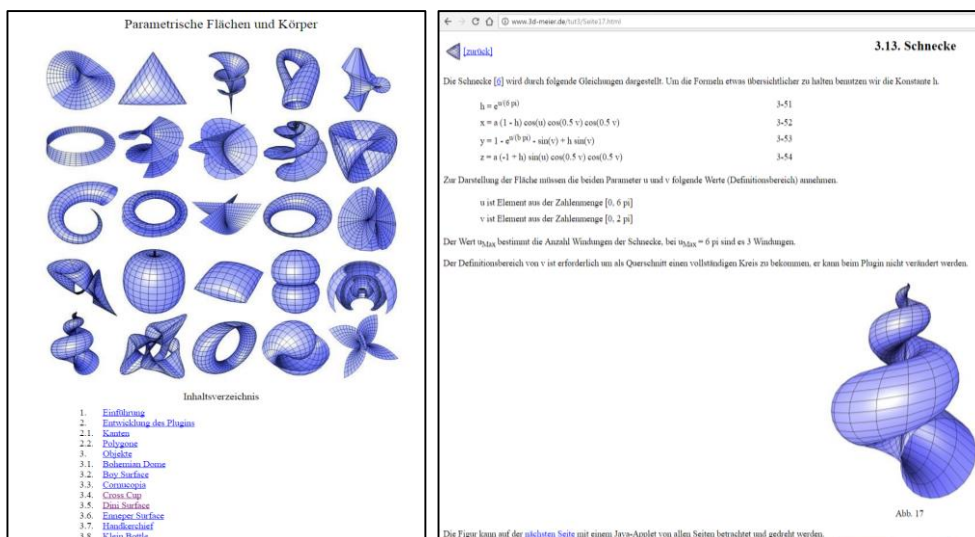


Figura 6. Representación y listado de superficies. Fuente: <http://www.3d-meier.de/tut3/Seite0.html>

Teniendo en cuenta que el trabajo que realiza cada grupo en una práctica es distinto al de otro grupo, en estos dos últimos cursos pensamos en la posibilidad de utilizar durante la sesión práctica algún programa que permitiera al profesorado visualizar, proyectar y compartir con

todos los estudiantes, en tiempo real, el trabajo que cada grupo realiza en el aula informática. Con el programa Italc (Figura 7) visualizamos cada uno de los equipos de la sala, seleccionamos y proyectamos el trabajo de alguno de ellos. Al alumnado le resulta simpático ver que su trabajo es seleccionado y mostrado al resto de compañeros. Ellos califican (positivamente) a este programa como el *programa espía*.

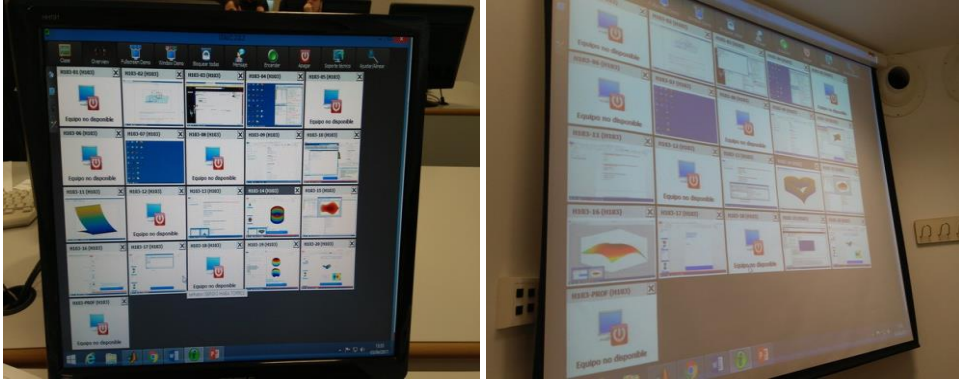


Figure 7. Programa Italc

2. Metodología

En esta sección se describe la metodología seguida durante la práctica docente ligada a la unidad didáctica “Representación de superficies: formas cartesiana y paramétrica”. Esta unidad, generada con *Lessons*, constituye el material sobre el que el estudiante debe trabajar, previamente a la sesión de prácticas. Entre los objetivos destacamos:

- Representar, utilizando los comandos Matlab correspondientes, la superficie que representa la gráfica de un campo escalar de dos variables $f(x,y)$, las curvas de nivel, las líneas de contorno y el mapa de color
- Representar con Matlab superficies en forma paramétrica
- Distinguir las superficies cilíndricas, regladas y de revolución
- Generar superficies cilíndricas, regladas y de revolución, obteniendo sus ecuaciones paramétricas, y a partir de estas proceder a su representación.

Al final del *Lessons* el estudiante debe realizar un test antes de la sesión presencial. Este examen permite comprobar el trabajo previo de cada estudiante, así como valorar la adecuación del material proporcionado. En los 15 primeros minutos de la práctica se realiza un feedback respecto a los contenidos del *Lessons* y del test realizado. En el resto de la sesión presencial los estudiantes, en grupos de dos o de tres, realizan el trabajo colaborativo que en este caso consiste en la realización de 10 transparencias Power Point, siguiendo el modelo o maqueta de la Figura 8, que se les proporciona en una *Tarea* creada exprofeso en *PoliformaT*.

Cada grupo tiene asignadas 4 superficies distintas, de cuatro listados adjuntos, descritas en la *Tarea*. En una transparencia aparece la representación correspondiente y en la siguiente los comandos Matlab utilizados.

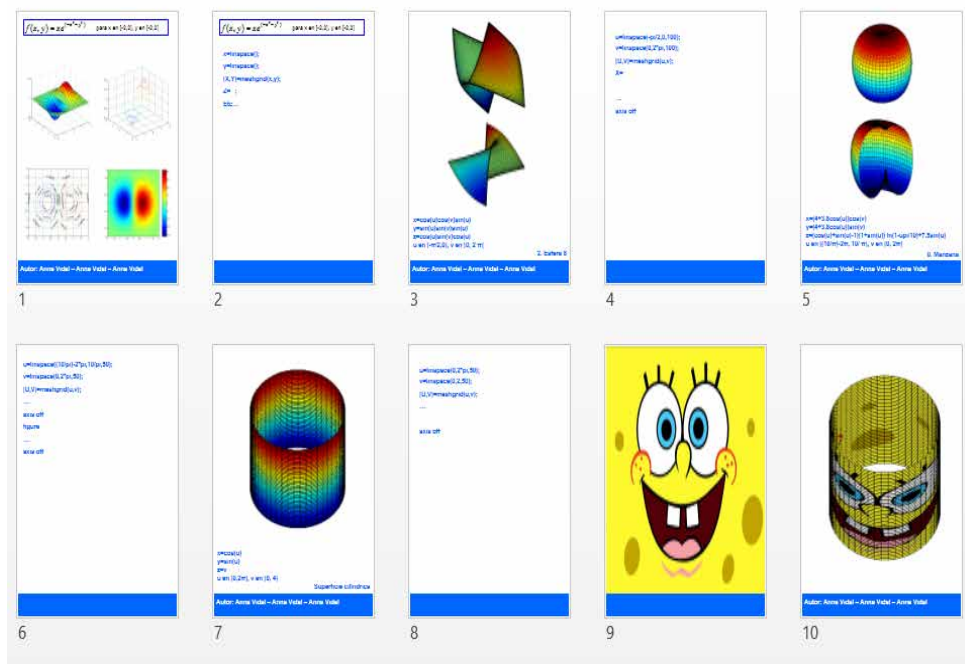


Figura 8. Maqueta para la realización del trabajo cooperativo

En la primera imagen se piden diversas representaciones de la gráfica de una función, $f(x, y)$: la representación 3D de su gráfica con el comando **surf**, la representación de sus secciones transversales o líneas de contorno con el comando **contour3**, la representación 2D a través del mapa de curvas de nivel con **contour** y finalmente el mapa de color con **pcolor**. Es interesante que el estudiante las conozca todas las representaciones puesto que, dependiendo de la magnitud del estudio, se requiere una u otra: en funciones que representan temperaturas, niveles de presión, de ruido, son más usuales las curvas de nivel y el mapa de color. Para el estudio de un relieve es preferible la representación 3D y el mapa de curvas de nivel. La segunda imagen se corresponde a una superficie paramétrica de un listado que se proporciona. En la tercera, a partir de una curva generatriz de otro listado, han de generar y representar un sólido de revolución cerrado y abierto. En la tercera, partiendo de una curva plana que ya representaron en su día en otra de las prácticas de la asignatura, deben generar una superficie cilíndrica. El trabajo se completa añadiendo una textura a una superficie. Como ejemplo, los siguientes comandos Matlab permiten representar una superficie y añadir

una textura (disfrazar) a través de la imagen dahlia-1642457_1920.jpg, obtenida desde el repositorio de imágenes (con licencia Creative Commons CC0) <https://pixabay.com/es/>:

```
%Representación de la superficie
[U,V]=meshgrid(u,v); r=1+0.2.*sin(8.*U).*sin(4.*V);
X=r.*sin(V).*cos(U); Y=r.*sin(U).*sin(V); Z=r.*cos(V);
surf(X,Y,Z), axis equal, axis off

% Añadimos textura
Figure, h=surf(X,Y,Z);
img = imread('C:\Users\avidal\Desktop\dahlia-1642457_1920.jpg');
set(h,'CData',img,'FaceColor','texturemap'), axis equal, axis off
```

El resultado son las dos imágenes de la Figura 9.

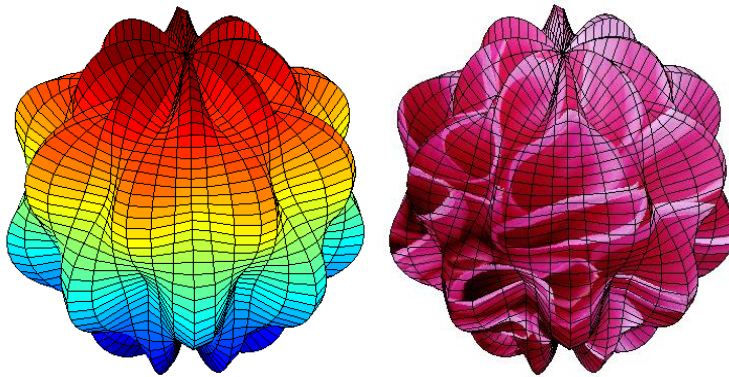


Figura 9. Superficie Matlab y superficie con textura.

3. Concurso “Disfrazar una superficie”

En el curso 2016-2017 se organizó el concurso “Disfrazar una superficie”. El alumnado participante debía representar una de las superficies de la página <http://www.3d-meier.de/tut3/Seite0.html> y añadir, posteriormente, una textura. Para dicho concurso se generó una *Tarea de PoliformaT* con un documento informativo de las bases del concurso y una plantilla. El primer premio consistió en una taza (Figura 10).



Figura 10. Taza diseñada para el primer premio del concurso “Disfraza una superficie”

4. Resultados

Una vez finalizado y corregido el trabajo colaborativo, el profesor selecciona y genera el producto final, una colección de superficies que servirá de referencia para el alumnado del siguiente curso. Las Figuras 11 y 12 muestran una selección de los trabajos realizados durante los cursos 2015-2016 y 2016-2017.

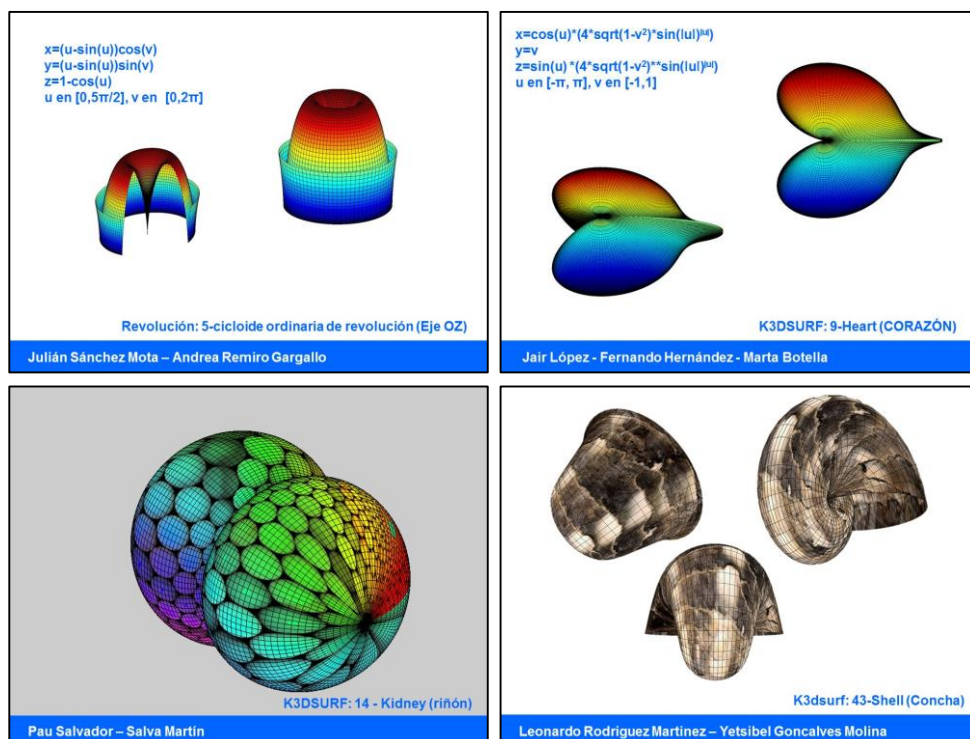


Figura 11. Selección de trabajos del curso 2015-2016

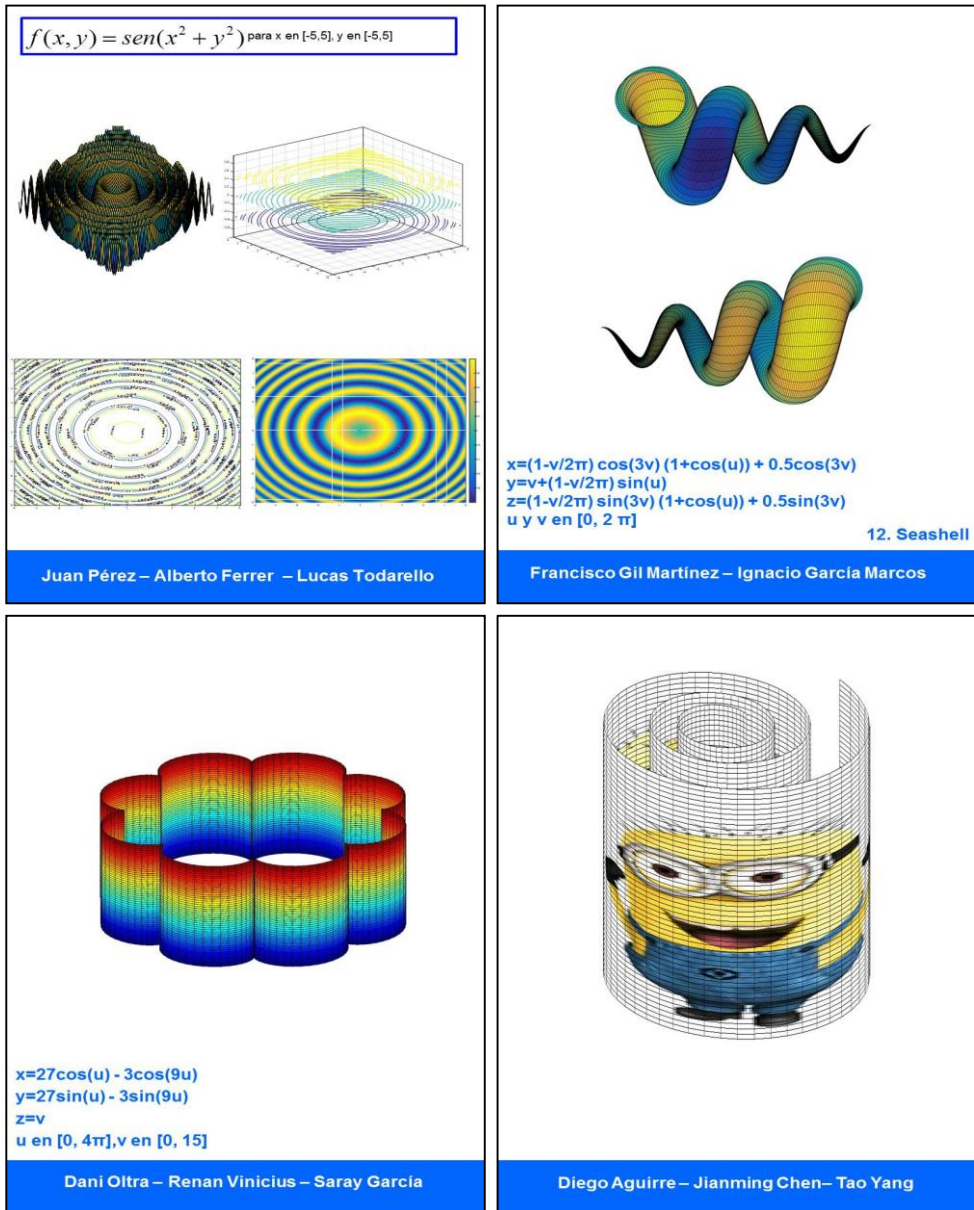


Figura 12. Selección de trabajos del curso 2016-2017

Durante el curso 2016-2017, se diseñó un póster (Figura 13) de la colección de superficies del trabajo colaborativo, junto con imágenes de las superficies presentadas al concurso “Disfraza una superficie”. Todo ello se expuso en los pasillos del centro (Figura 14).



Figura 14. Exposición en el aula

En el concurso, a pesar de motivar la participación con un incremento en la nota de prácticas, solo participaron 9 estudiantes. Tres fueron los premiados, teniendo en cuenta la originalidad en cuanto a la selección de la superficie y la textura utilizada. En la Figura 15 se observan los tres trabajos premiados y la entrega del primero de ellos.

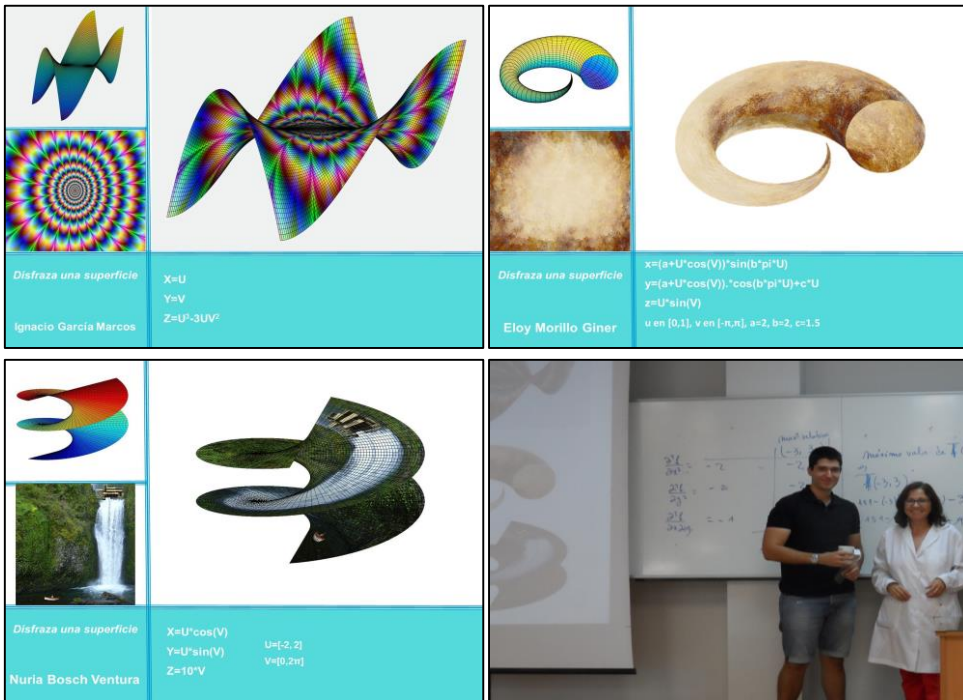


Figura 15. Trabajos premiados en el concurso “Disfraza una superficie” y ganador

5. Conclusiones

Durante los cursos 2015-2016 y 2016-2017 se ha aplicado la metodología del Flipped Teaching en las prácticas de la asignatura de Matemáticas 2, en particular en el estudio y representación de superficies. Durante la sesión práctica, los estudiantes realizan un trabajo colaborativo con el objetivo de obtener una colección de representaciones de superficies, que en el curso 2016-2017 se han aprovechado para la realización de un póster. Durante este mismo curso, varios estudiantes han participado en el concurso “Disfraza una superficie”. Tanto el poster como los dibujos presentados al concurso se han expuesto públicamente. La novedad de añadir texturas a una superficie está sirviendo a algunos alumnos para un trabajo de otra asignatura, Economía de la empresa, en la que han de diseñar la creación de un negocio. Una de las empresas propuestas se dedicaba a los lienzos y el alumno involucrado nos preguntó cómo generar una caja-lienzo a la cual añadir como textura una imagen. Otra empresa propuesta se dedicaba a fabricar y vender botellas decoradas. La ayuda proporcionada al alumno fue la de generar la botella como una superficie de revolución y añadir alguna textura (Figura 16). En base a la experiencia, en el próximo curso intentaremos motivar a nuestros alumnos para que participen más estudiantes en el concurso “Disfraza una superficie”, además de seguir colaborando con Economía de la Empresa para establecer sinergias entre las dos asignaturas.



Figura16. Botellas con diversos decorados para la asignatura Economía de la empresa

6. Agradecimientos

Este trabajo se ha realizado gracias al apoyo del Vicerrectorado de Estudios, Calidad y Acreditación de la UPV al Proyecto PIME 2016-2017 “Puesta en marcha de diversas experiencias con el enfoque Flipped Teaching en asignaturas de Matemáticas y Física”.

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Indicadores de los estudios de administración y dirección de empresas en las universidades valencianas: comparativa entre hombres y mujeres

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Abstract

The aim of this paper is to analyze the main indicators of academic development of the Degree in Business Management and Administration (ADE) student's in the valencian universities. In addition, using statistical techniques it will be study if the sample has significant differences according the gender of the students. The results obtained at the government level shows that it must be concerned about 30.3% of men who drop out of school, while it must be proud about the high success rate of the valencian university students, higher than 90 % in most cases. From the point of view of a potential student who choosing the university to study the Degree in ADE, the Polytechnic of Valencia stands out in comparison to the rest, it has the highest average grades and the best Efficiency, success, evaluation, suitability and performance.

Keywords: *ADE Degree, efficiency, success, evaluation, suitability and performance*

Resumen

El objetivo del artículo es analizar los principales indicadores de desarrollo académico de los alumnos del grado de Administración y Dirección de Empresas (ADE) en las universidades valencianas. Además, mediante técnicas estadísticas se estudia si existen diferencias significativas entre la muestra según el género de los estudiantes. Según los resultados obtenidos a nivel del gobierno debe preocuparle los niveles de 30,3% de hombres que abandonan los estudios, mientras que debe satisfacerle las tasas de éxito tan elevadas que presentan las universidades valencianas superando el 90% en la mayoría de casos. Desde el punto de vista de un potencial alumno que está decidiendo en que universidad estudiar el grado de ADE, destaca la Politécnica de Valencia en comparación con el resto, ya que tiene las mayores calificaciones medias y las mejores tasas de eficiencia, éxito, evaluación, idoneidad y rendimiento.

Palabras clave: *grado ADE, eficiencia, éxito, evaluación, idoneidad y rendimiento*

Introducción

La diferencia de género en los estudios universitarios es un tema muy relevante para conocer en profundidad el perfil del alumno al que actualmente se enfrenta el sistema educativo de nivel superior. Desde el momento inicial de la elección de los estudios ya se perciben diferencias de género, de este modo la titulación técnica es elegida preferentemente por hombres con el propósito de tener un buen sueldo, mientras que la de corte humanístico es seleccionada mayoritariamente por mujeres debido a que les gusta, por vocación y para ayudar a otras personas (Buendía y Olmedo, 2002 y Navarro y Casero, 2012).

Dentro del campo de los rasgos individuales en la inteligencia, las diferencias de género han sido uno de los asuntos más polémicos (Codorniu-Raga y Vigil-Colet, 2003). Muchos investigadores han tratado de encontrar esas diferencias en la medición psicométrica de la inteligencia, ya sea en general o a nivel de habilidades específicas. En las últimas dos décadas aumentó el número de investigaciones que emplearon pruebas psicométricas para evaluar las diferencias entre varones y mujeres en habilidades cognitivas específicas, y en el nivel de inteligencia general (Hedges & Nowell, 1995).

En otros trabajos se ha abordado este tema según diferentes aspectos, Echevarri et al (2007) analizaron las diferencias de género en habilidades cognitivas y su relación con el rendimiento académico universitario y concluyeron que las mujeres lograron, en los tres primeros años de sus carreras, un rendimiento promedio acumulado superior a los de los varones y tienen mayor fluidez verbal. Más recientemente, Cabanach et al (2013) estudiaron las diferencias en el afrontamiento del estrés concluyendo que los hombres recurren en mayor medida a las estrategias de reevaluación positiva y planificación como medidas de afrontamiento de situaciones académicas problemáticas, mientras que las mujeres optan fundamentalmente por la búsqueda de apoyo. En este mismo año, García-Alandete (2013) analizó las diferencias en bienestar psicológico de los universitarios en función de la edad y el sexo, concluyendo que las diferencias sólo fueron significativas en Crecimiento Personal, siendo que las mujeres alcanzaron puntuaciones medias más altas en Relaciones Positivas, Dominio del Entorno, Crecimiento Personal y Propósito en la Vida, y los hombres en Autoaceptación y Autonomía.

Sin embargo, en el ámbito de los estudios de posgrado no se encuentran diferencias de género en el rendimiento académico, tal y como lo analizan Bermudez et al (2011) especificando que los doctorandos beneficiarios de una beca predoctoral tienen el mismo éxito tanto si son hombres como mujeres.

Siguiendo con esta línea de investigación, el objetivo del artículo es analizar los principales indicadores de desarrollo académico de los alumnos del grado de Administración y Dirección de Empresas (ADE) en las universidades valencianas. Además, mediante técnicas

estadísticas se estudiará si existen diferencias significativas entre la muestra según el género de los estudiantes.

La aportación del estudio a realizar tiene un triple interés. En primer lugar, permitirá al sistema educativo de estudios superiores conocer más en profundidad cuál es el comportamiento de los alumnos y en qué aspectos las universidades deben mejorar. En segundo lugar, aportará información clave a los alumnos de bachiller que aún no han elegido en qué universidad van a realizar sus estudios del grado de ADE. Y por último, las conclusiones serán de gran utilidad para las empresas que quieran contratar a especialistas en economía y conozcan de qué universidad proceden sus candidatos.

El resto del artículo se estructura de la siguiente forma. En la sección 2 se analizan los indicadores del grado de ADE. En la sección 3 se realiza un análisis estadístico explicando sus resultados. Por último, en la sección 4 se explican las principales conclusiones.

1. Indicadores de desarrollo académico de las universidades valencianas en el grado de ADE

El Ministerio de Educación, Cultura y Deporte publica anualmente estadísticas sobre los Indicadores Universitarios dentro del Plan Estadístico Nacional. Ellos aportan información de síntesis relativa al sistema universitario español y es muy útil para un profundo conocimiento de la educación superior en el país. A partir del 2015 se han publicado indicadores del desarrollo académico por universidades, permitiendo así realizar comparaciones entre las existentes en la Comunidad Valenciana.

En la realización del estudio se han seleccionado las cinco universidades públicas de la Comunidad Valenciana (U. de Alicante, U. Jaime I de Castellón, U. de Valencia, U. Politécnica de Valencia y U. Miguel Hernandez de Elche) y como universidades privadas (Católica de Valencia San Vicente Martir y Cardenal Herreral Ceu), y únicamente se extraen los datos relativos al Grado en ADE. Al pertenecer todas ellas a una misma Comunidad Autónoma y ofertar el mismo grado supone que son realmente competidoras potenciales entre ellas, y por tanto los indicadores publicados por el Ministerio son muy importantes porque pueden llegar a ser clave para que un alumno se decida en qué universidad estudiar. Además, en el análisis realizado de todos los indicadores se ha distinguido entre hombres y mujeres para incidir en la diferencia de género dentro de los estudios universitarios de un mismo grado.

En primer lugar, el indicador del número de créditos puede ser un reflejo de la magnitud de cada una de las universidades en el grado de ADE y además la distinción de género indica si se trata de un grado homogéneo en este sentido o no (Tabla 1).

Tabla 1. Total de créditos matriculados, presentados y superados Curso 2013/2014

	Hombres			Mujeres		
	Matriculados	Presentados	Superados	Matriculados	Presentados	Superados
Alicante	72.089	65.180	45.023	76.358	71.735	52.864
Jaume I de Castellón	27.213	23.266	18.868	29.566	26.521	21.889
Miguel Hernández de Elche	30.474	25.167	19.992	29.389	25.783	21.157
Politécnica de València	35.639	33.604	29.393	34.903	33.609	30.957
València (Estudi General)	116.464	103.264	91.397	122.124	114.129	105.386
Cardenal Herrera CEU	8190	7044	6.462	5.010	4.644	4.470
Católica de Valencia SVM	14.970	12.630	10.788	7.728	7.020	6.180
Total	305.040	270.156	221.924	305.080	283.442	242.905

Fuente: Coordinación y Seguimiento Universitario. Ministerio de Educación, Cultura y Deporte.

La cifra de matriculados es muy similar entre el total de hombres y de mujeres (solo hay 40 alumnos de diferencia), indicando una gran homogeneidad según el criterio de género. Si se enfoca esta idea en lo que está pasando actualmente en el mercado laboral se percibe que la tendencia de las empresas es contratar indiferentemente a hombres y mujeres, intentando además que los puestos directivos se mantengan bastante equilibrados. Todo ello es un gran avance en el campo de la discriminación que ha visto unos exitosos resultados por parte de determinadas políticas. Al comparar los créditos matriculados entre universidades en la Tabla 1 se aprecia como la más importante para el grado en ADE es la U. de Valencia quizás por su antigüedad (funciona desde 1966), seguida de U. Alicante y en tercer lugar lo ocupa la Politécnica de Valencia.

Los alumnos del grado de ADE tienen un plan de estudios con una programación de cuatro años, la información sobre la duración media indica si realmente cumplen o no con lo establecido a priori (Tabla 2).

Tabla 2. Duración media de terminación del grado en ADE

	Hombres	Mujeres
Alicante	4,00	4,00
Jaume I de Castellón	4,23	4,16
Politécnica de València	4,00	4,00
València (Estudi General)	4,13	4,14
Católica de Valencia SVM	4.51	--.

Fuente:S.G. de Coordinación y Seguimiento Universitario. Ministerio de Educación, Cultura y Deporte.

Los datos de la Tabla 2 indican que la U. de Alicante y la Politécnica de Valencia son las que más se ajustan a la duración de 4 años en la terminación del grado de ADE, mientras que la Católica de Valencia tiene un peor indicador llegando los hombres a tardar medio año más de lo establecido previamente. No obstante, ninguna supera en media los 5 años, por lo que en general se podría establecer como un buen indicador del desarrollo académico.

En el transcurso de los 4 años de estudios del grado los alumnos van superando las asignaturas con una nota superior a 5 sobre 10 en cada una de las materias. Una vez terminan todos los estudios del grado pasan a denominarse “estudiantes egresados”. La comparación en el nivel de las calificaciones será un indicador de la presencia de los “buenos o aplicados estudiantes” o de alumnos más mediocres. Este es un dato interesante para las empresas, ya que son el potencial de colocación en el mercado laboral, las organizaciones sabrán valorar si un posible trabajador proviene de una universidad donde predominan las notas medias altas o por el contrario la universidad donde estudió el candidato no le aporta valor añadido a su curriculum.

Las calificaciones medias y máximas de las mujeres superan en la mayoría de las universidades a los hombres, teniendo en cuenta que la proporción entre hombres y mujeres era muy similar, es un indicativo de que las mujeres se esfuerzan más por obtener una mejor nota en las materias del grado. A nivel comparativo entre universidades destaca la calificación media de la Politécnica de Valencia (7,56 y 7,49 entre hombres y mujeres respectivamente) así como también su máximo (9,6 y 9,3). Siendo peor las calificaciones de las privadas que de las públicas.

Tabla 3. Media y máximo de la nota del expediente de los estudiantes egresados de Grado. Curso 2013/2014

	Hombres		Mujeres	
	Media	Máximo	Media	Máximo
Alicante	7,05	9,19	7,1	9,23
Jaume I de Castellón	6,97	8,8	7,11	8,74
Miguel Hernández de Elche	7,3	8,94	7,29	9,02
Politécnica de València	7,56	9,6	7,49	9,3
València (Estudi General)	7,2	9,33	7,21	9,12
Cardenal Herrera Ceu	.	8,17	.	8,4
Católica de Valencia SVM	6,97	9,26	7,12	9,21

Fuente: S.G. de Coordinación y Seguimiento Universitario. Ministerio de Educación, Cultura y Deporte.

Por otra parte, a nivel de gobierno valenciano, el indicador de abandono es muy importante para saber si son necesarias políticas que incentiven los estudios superiores. En el ámbito de la propia universidad la tasa de cambio será un indicativo de si están haciendo suficientemente atractivo el grado para el estudiante, o por el contrario prefiere optar por otro tipo de estudios (Tabla 4).

Tabla 4. Tasa global de abandono y de cambio del estudio

	Tasa global de abandono		Tasa global de cambio	
	Hombres (%)	Mujeres (%)	Hombres (%)	Mujeres (%)
Jaume I de Castellón	33,3	25,0	18,2	15,0
Politécnica de València	..	42,3	..	15,4
València (Estudi General)	30,8	24,1	5,8	4,5
Católica de Valencia SVM	20,0	..	11,4	..

Nota: Tasa global: Suma de las tasas parciales de abandono o de cambio del estudio en primer, segundo y tercer año.

Fuente: S.G. de Coordinación y Seguimiento Universitario. Ministerio de Educación, Cultura y Deporte.

Solo dos universidades públicas han proporcionado datos de abandono y de cambio para ambos géneros resultando que es mayor para el caso de los hombres. En concreto la U Jaime I de Castellón con una tasa de 33,3% para hombres mientras que el 25% mujeres, suponen cifras algo preocupantes siendo similares para la U. de Valencia. Las tasas de cambio no son tan elevadas y además están garantizando que el alumno sigue siendo universitario.

Siguiendo con el análisis de los estudiantes del Grado en ADE, es interesante analizar tres tipos de tasas:

- "Tasa de eficiencia": Relación porcentual entre número de créditos superados y número de créditos matriculados desde el inicio del estudio.
- "Tasa de éxito": Relación porcentual entre número de créditos superados y número de créditos presentados desde el inicio del estudio.
- "Tasa de evaluación": Relación porcentual entre número de créditos presentados y número de créditos matriculados desde el inicio del estudio.

En la Tabla 5 se presentan los resultados de dichas tasas que servirán a las distintas universidades para potenciar aquellos aspectos en los que son superados por sus competidoras.

Tabla 5. Tasa de eficiencia, éxito y evaluación de los egresados en el Grado. Curso 2013/2014

	Hombres (%)			Mujeres (%)		
	Eficiencia	Éxito	Evaluac.	Eficiencia	Éxito	Evaluac.
Alicante	98,41	98,75	99,64	97,24	97,58	99,65
Jaume I de Castellón	94,62	95,77	98,79	94,65	95,51	99,09
Politécnica de València	98,77	98,85	99,92	98,70	98,80	99,90
València (Estudio General)	95,04	96,15	98,84	95,06	96,16	98,85
Católica de Valencia SVM	83,40	87,63	95,17	..	..	..

Fuente:S.G. de Coordinación y Seguimiento Universitario. Ministerio de Educación, Cultura y Deporte.

Las mujeres superan a los hombres en la tasa de evaluación, manifestando su mayor cumplimiento en presentarse a los exámenes que previamente se habían matriculado, llegando a rozar casi el 100% en la Politécnica de Valencia. En las otras dos tasas hay cifras muy similares entre géneros, pero ocupando el primer puesto nuevamente la Politécnica de Valencia y como peor la única privada que aporta datos. No obstante, todas las tasas analizadas están por encima del 80% indicando un buen éxito y eficiencia del grado en ADE en la Comunidad Valenciana.

Otros indicadores que son importantes para conocer el comportamiento de los universitarios en el grado de ADE son:

- "Tasa de idoneidad": Porcentaje de estudiantes que finalizan la titulación en el tiempo teórico previsto o antes.
- "Tasa de rendimiento": Relación porcentual entre número de créditos superados y número de créditos matriculados.
- Tasa de renovación: Proporción de estudiantes matriculados que son de nuevo ingreso ese curso.

Tabla 6. Tasas de idoneidad, rendimiento y renovación

	Idoneidad		Rendimiento		Renovación	
	Hombre (%)	Mujer (%)	Hombre (%)	Mujer (%)	Hombre (%)	Mujer (%)
Alicante	5,4	10,8	62,4	69,2	18,1	15,2
Jaume I de Castellón	11,5	22,3	69,3	74,0	26,7	19,2
Miguel Hernández de Elche	6,8	16,4	65,5	71,9	31	28,3
Politécnica de València	15,4	32,3	82,4	88,6	16,9	20
València (Estudi General)	26	41	78,4	86,2	24,2	25,1
Cardenal Herrera CEU	..	..	78,9	89,2	21,4	29,9
Católica de Valencia SVM	31,8	56	72,0	79,9	21,9	31

Fuente: S.G. de Coordinación y Seguimiento Universitario. Ministerio de Educación, Cultura y Deporte.

La tasa de idoneidad de las mujeres duplica la de los hombres, indicando que ellas suelen ir superando un curso tras otro sin tener asignaturas pendientes y así consiguen cumplimentar la carrera en el tiempo previsto, aún así esta tasa sigue siendo bastante baja en todos los casos. Por el contrario, la tasa de rendimiento es buena en general, el máximo lo alcanza la Politécnica de Valencia con un 82,4% en hombres y un 88,6% en mujeres, en todas las universidades las mujeres superan a los hombres. Se sigue cumpliendo en esta generación de 2015 la teoría de que existe una superioridad femenina en el rendimiento académico de los estudios universitarios

Por otra parte, la tasa de renovación será un buen indicador de qué universidad está creciendo más en el grado de ADE. En este caso ocupa el primer puesto la universidad Miguel Hernández de Elche, mientras que la U. de Alicante se sitúa en la posición menor. Quizas las de más reciente creación son las de mayor tasa de renovación.

Por último, se analiza qué hacen los estudiantes una vez que han terminado los estudios de grado, es decir, qué proporción siguen estudiando con un master. Y para ello se calculan dos indicadores:

En la Tabla 7 se observa que el Ministerio no aporta casi información de este indicador, tan solo la U. de Valencia como pública y la Católica como privada han suministrado algo de datos relativos a dichas tasas.

Tabla 7. Tasa de transición de Grado a Máster por universidad, Curso 2013/2014

	Hombres		Mujeres	
	Tasa global de transición	Tasa en la propia universidad	Tasa global de transición	Tasa en la propia universidad
València (Estudi General)	22,3	15,7	12,2	9,8
Católica de Valencia SVM	..	..	25	7,1

Fuente: S.G. de Coordinación y Seguimiento Universitario. Ministerio de Educación, Cultura y Deporte.

En ambos centros es interesante detectar como son los hombres los que ganan a las mujeres en cantidad de alumnos que siguen estudiando master. Aún así estas cifras en un futuro se verán más altas porque la tendencia es que exista una mayor oferta de masters y la competitividad del mercado laboral obliga a los alumnos a seguir con los estudios post-universitarios.

2. Diferencias de género en las tasas de rendimiento, éxito y evaluación a nivel de toda España: análisis estadístico

En el ámbito de los estudios de grado de ADE, no sólo para la Comunidad Valenciana sino también para el conjunto del país se ha querido comprobar si realmente son significativas las diferencias entre hombres y mujeres de los principales indicadores de desarrollo académico. A partir de los datos de las tasas de rendimiento, éxito y evaluación de 70 universidades (públicas, privadas, presenciales y no presenciales) se ha aplicado el test de Kruskal-Wallis que determinará si la muestra de hombres es estadísticamente distinta a la de las mujeres.

Tabla 8. Resultados del Test de Kruskal-Wallis

	Media hombres	Media mujeres	Chi-cuadrado
T. rendimiento	73,099	80,078	20,598***
T. éxito	83,198	87,260	13,298***
T. evaluación	87,705	91,682	16,040***

Fuente: Elaboración propia

Según se observa en los resultados del test de Kruskal-Wallis (Tabla 8) los tres indicadores han resultado estadísticamente significativos entre la muestra de hombres y mujeres. Los datos de los valores medios demuestran que a nivel de toda España las mujeres superan a los hombres en el rendimiento, éxito y evaluación igual que ocurría en la muestra donde se incluían sólo a las universidades de la Comunidad Valenciana.

A continuación se calcula el coeficiente de correlación de Spearman para conocer el tipo de interdependencia que existe entre estos tres indicadores y si hay similitud por género (Tabla 9 y 10).

Tabla 9. Correlación del rango de Spearman. Hombres

	T. Rendimiento	T. Éxito	T. Evaluación
T. Rendimiento	1		
T. Éxito	0,844	1	
T. Evaluación	0,816	0,431	1

Fuente: Elaboración propia

Tabla 10. Correlación del rango de Spearman. Mujeres

	T. Rendimiento	T. Éxito	T. Evaluación
T. Rendimiento	1		
T. Éxito	0,852	1	
T. Evaluación	0,774	0,420	1

Fuente: Elaboración propia

Según los resultados de correlación de las Tablas 9 y 10 se aprecia como existe una interdependencia positiva y con un elevado coeficiente entre el rendimiento y el éxito que le refuerza la vinculación entre ambos indicadores en las dos muestras. En el caso del éxito y la evaluación la correlación es más débil ya que una cosa es superar los créditos y otra presentarse a los exámenes.

En resumen, la muestra de los estudios del grado de ADE en el conjunto de las universidades españolas muestran que las dependencias entre las tasas de rendimiento, éxito y evaluación se comportan de forma similar sin distinción de género, pero sus valores sí que son estadísticamente distintos en mujeres que en hombres.

3. Conclusiones

El estudio ha tratado de analizar los indicadores de desarrollo académico de los alumnos del grado de ADE en siete universidades valencianas (5 públicas y 2 privadas) para el curso 2013-2014. Se han utilizado los datos publicados por el Ministerio en sus estadísticas de 2015.

A nivel del gobierno debe preocuparle los niveles de 30,3% de hombres que abandonan los estudios, mientras que debe satisfacerle las tasas de éxito tan elevadas que presentan las universidades valencianas superando el 90% en la mayoría de casos. Desde el punto de

vista de un potencial alumno que está decidiendo en qué universidad estudiar el grado de ADE, destaca la Politécnica de Valencia en comparación con el resto, ya que tiene las mayores calificaciones medias y las mejores tasas de eficiencia, éxito, evaluación, idoneidad y rendimiento. En concreto la Politécnica, es una universidad muy vinculada al mundo empresarial donde los profesores tratan cada año de mejorar sus estrategias docentes y están en continúa formación para mejorarlas.

Por último, el estadístico de Kruskal-Wallis ha demostrado unas diferencias significativas entre los indicadores según el género a nivel de toda España, reforzando la importancia de separar el estudio entre hombres y mujeres para obtener mejor conocimiento sobre el desarrollo académico de los universitarios.

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Impacto de las TIC en las organizaciones educativas

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Abstract

The information society is undoubtedly proposing new forms of communication, coexistence and construction of knowledge. Therefore, our Universities can not be located on the outskirts of the information revolution and for this our societies must make available high quality information systems that can be implemented in the Institutions of Higher Education, investing properly in the ICT To feel at the forefront of this revolution and, in this way, obtain its benefits. In order for universities to become learning organizations, they have to determine what changes are necessary and, for this to happen, these institutions should take into account the main characteristics of learning organizations, deciding how they could be addressed for their transformation. In this opportunity, we will analyze the impact of ICT in educational organizations, reflecting on what should be the organizational model of the Centers and the means for the adequate incorporation of these technologies. In the same way, we will expose the main changes that are generated in the Educational Centers by incorporating information and communication technologies, finally suggesting a proposal for the success of such incorporation in Universities.

Keywords: *incorporation-ICT-E-learning-University-changes.*

Resumen

La sociedad de la información está planteando indudablemente nuevas formas de comunicación, de convivencia y de construcción del conocimiento. Por lo tanto, nuestras Universidades no pueden ubicarse en las afueras de la revolución de la información y, para ello, nuestras sociedades deben hacer disponible sistemas de información de alta calidad que puedan ser implementados en las Instituciones de Educación Superior, invirtiendo adecuadamente en las TIC para sentirse al frente de dicha revolución y, obteniendo, de esta forma sus beneficios. Para que las Universidades se transformen en organizaciones de aprendizaje, tienen que determinar qué cambios son necesarios y, para que esto ocurra, estas instituciones deberán tomar en cuenta las principales características de las organizaciones de aprendizaje, decidiendo cómo las mismas podrían ser atendidas para su

transformación. En esta oportunidad, analizaremos el impacto de las TIC en las organizaciones educativas, reflexionando acerca de cuál debe ser el modelo de organización de los Centros y de los medios para la adecuada incorporación de estas tecnologías. Además, expondremos los principales cambios que se generan en los Centros Educativos al incorporar las tecnologías de la información y de la comunicación, sugiriendo finalmente una propuesta para el éxito de dicha incorporación en las Universidades.

Palabras clave: *incorporación-TIC-E-learning-Universidad-cambios.*

Introducción

Disponer de sistemas de información de alta calidad que puedan ser implementados en las Universidades, es un reto muy importante para nuestras sociedades. De esta forma, las Instituciones de Educación Superior responderán a unas condiciones ambiciosas, las cuales implicarán su renovación constante, para lograr que la incorporación de las tecnologías generen procesos formativos creativos e innovadores (Rodríguez, Varela e Iseni, 2013).

En los últimos años se han realizado estudios acerca de la integración de las TIC en el sistema escolar español (Marcolla, 2006; Meneses Fábregues, Jacovkis y Rodríguez-Gómez, 2014; Sigalés, Josep, Mominó, Meneses y Badía, 2008;), sin embargo a pesar de ello no podemos afirmar con certeza el impacto de las tecnologías en las escuelas, ya que los resultados arrojados por estos estudios, aunque no son contradictorios, se caracterizan por inferencias poco convincentes e inconsistentes que dificultan la generalización de conclusiones, reduciendo significativamente su impacto (Mama y Hennesey, 2013, p. 380). Sin duda alguna la adecuada incorporación de las tecnologías a los procesos docentes puede generar la transformación de los procesos tradicionales de la enseñanza, por lo tanto, “la Universidad debe sentirse obligada a explorar en qué sentido, con qué finalidad y de qué manera pueden contribuir las TIC a provocar la innovación dentro de sus aulas” (Alonso y Blázquez, 2012 p.12).

1. El impacto de las tecnologías de la información y de la comunicación en las organizaciones educativas.

Las TIC inciden de forma significativa en todos los niveles del sistema educativo, “conformándose una nueva cultura tecnológica que ha generado importantes esfuerzos en cuanto a la formación y adaptación a estos nuevos medios” (Rodríguez y González, 2013, p. 364).

La incorporación de las TIC en los Centros Educativos no es una tarea fácil, ya que la misma no se limita únicamente a la presencia de unas máquinas.

Es importante resaltar que el problema para los Centros de Formación no es apostar por las herramientas, sino lograr que sean un elemento que faciliten la promoción y el cambio,

debiéndose reflexionar sobre la finalidad que se persigue a través de las mismas y el problema educativo que se pretende resolver. Por lo tanto, el reto de la educación será incorporarlas con su potencial liberador y multiplicador y evitar que sean o se conviertan en instrumento más del proceso reproductor al que a veces sirve la educación, se trata de aprovechar su ayuda en el proceso más constructivo y potenciador de la autonomía de la persona y de las redes sociales cooperativas (Gairín, 2008, p. 2).

Cabero (2002) sostiene que las relaciones que pueden establecerse entre las TIC y las organizaciones educativas, pueden verse a través de tres niveles o perspectivas diferentes:

- La necesidad de contar con unos principios y estructura organizativa para facilitar la incorporación y la utilización eficaz de los recursos audiovisuales, informáticos y nuevas tecnologías en los sistemas de formación.
- Las ayudas que los medios pueden aportar al desarrollo de la organización y administración del Centro.
- La posible influencia que las TIC pueden tener en las organizaciones educativas.

Según este autor, la organización de los recursos no será independiente del modelo de organización del Centro en los cuales se desenvuelva, repercutiendo ello no sólo en la información y los valores transmitidos, sino también en como los materiales se integran en el proceso de E-A, las funciones que se le atribuyen, espacios que les concede, quién los utiliza y diseña, a quiénes se les pone a su disposición, entre otros aspectos.

En cuanto al segundo nivel de relación que puede establecerse, es muy usual que algunos medios tecnológicos, especialmente los informáticos, vayan aportando sus posibilidades a la organización y administración de los Centros y en las diferentes tareas a realizar por los docentes en el proceso de E-A, caso típico es el de la informática, que cada vez es más usual que se utilice para diferentes tipos de gestiones: académica y administrativa de los estudiantes en cuanto al curso que se encuentran cursando y los exámenes que van superando, o simplemente económica (Cabero, 1998, p. 5).

El tercer nivel de relación expuesto por Cabero (1998), resalta que una de las influencias más significativas de las TIC en las organizaciones educativas se va a producir, como consecuencia de las posibilidades que éstas tienen para superar y romper las variables espacio-temporales en las cuales tiende a desenvolverse la formación actual, tanto la presencial como a distancia. Igualmente las TIC permiten hoy día la posibilidad de la interacción entre los participantes en el acto de E-A, tanto sincrónica como asincrónica, trayendo innumerables ventajas como la individualización y la potenciación de la enseñanza flexible y a distancia, el acceso a fuentes de información no cercanas al estudiante, entre otras.

Podemos afirmar que las dimensiones alrededor de las cuales tienden a girar la organización de nuestras instancias educativas reclamará la exigencia de nuevos modelos

organizativos y de la consideración de otras estructuras para su puesta en funcionamiento...variables que irán desde la reconversión espacial de los centros, con menos aulas y más espacios tecnológicos y virtuales para encuentros personales, intercambios de experiencias y tutorización; hasta de búsqueda de nuevas medidas para el seguimiento y control de los estudiantes: número de horas que invierte el sistema, rutas elegidas en la formación, grado de aprovechamiento... (Cabero, 1998, p. 6).

1.1. Modelo de organización de los Centros y los medios

Llevar a cabo el modelo de la organización de aprendizaje no va a ser una tarea nada fácil, uno de los principales obstáculos será superar la resistencia de los directivos quienes por lo general se han movido siempre en el modelo organizativo tradicional con éxito (Hitt, 1995). Sin duda alguna la razón más importante por la que directivos de instituciones deben aceptar este cambio, es para alcanzar la excelencia y mantenerla, y esto se obtendrá gracias a la renovación organizativa.

Es importante que los medios no funcionen en el vacío, sino en un contexto cultural, psicosocial, efectivo y político, ocupando una posición más o menos precisa, esta posición la afirma San Martín (citado en Duarte y Cabero, 1993), cuando señala que “los recursos didácticos, cualquiera que sea su naturaleza, deben ocupar un espacio preciso en el marco organizacional, tanto en la estructura del centro como en el espacio que ocupa en el desarrollo curricular” (p. 8). Por lo tanto, el modelo organizativo del Centro en el que se mueva el medio, condicionará su posible eficacia.

Igualmente la elección de un modelo u otro no sólo condicionará el tipo de información transmitida, valores y filosofía del hecho educativo, sino igualmente cómo dichos materiales se integran en el proceso de E-A, las funciones que se les atribuyen, espacios que se les concede, quién los utiliza y diseña, etc.

Duarte y Cabero (1993) afirman que al hablar de medios y de su organización no sólo nos referimos al “hardware” y “software”, sino también a una serie de diferentes tipos de elementos: los recursos materiales, las personas que los utilizan, los espacios donde son utilizados y los tipos de utilización. La organización de estos elementos requiere una serie de actividades las cuales Vidorreta e Igualada (citado en Duarte y Cabero, 1993) las sintetizan en las siguientes:

- La concreción de la serie de normas de documentación y uso.
- Especificación de las funciones y las tareas del coordinador y de los miembros del equipo.
- Existencia de espacios coordinados para el uso.
- Distribución del tiempo en función de la demanda de los profesores y los alumnos en una programación del uso.

En el modelo de organización tradicional, los medios, por lo general, cumplen funciones exclusivas de transmisión de información y de motivación a los estudiantes y, por otro lado,

sirven también de apoyo, como es el caso del medio informático, a la gestión y administración del Centro. Igualmente en este modelo las funciones del profesor consisten en la selección del material y su distribución.

En el modelo versátil de organización, se tiende a integrar los medios en la propia práctica del profesor, facilitando la intervención de los mismos en el proceso de selección y adquisición, y de esta forma se le atribuyen funciones más amplias que las anteriormente expuestas como transmisor de información, instrumento de conocimiento, evaluador del aprendizaje, entre otros.

1.2. Cambios que generan las Tecnologías de la Información y de la Comunicación en los Centros Educativos

Indudablemente la organización de las TIC en los Centros Educativos tiene más importancia que la que pudiera parecer. Las Tecnologías de la Información y Comunicación transforman las formas, los espacios, los modos, los tiempos y las modalidades de interacción de los diferentes protagonistas de la acción educativa, por ello requieren respuestas organizativas completamente diferentes a las que demandaban tecnologías pasadas para incorporarse a situaciones donde existían una coincidencia espacio-temporal entre el profesor y el estudiante, y además este último por lo general era contemplando como receptor pasivo de información, o mejor dicho un depositario de la misma (Cabero, 2004b, p. 2).

Según este autor, existen diferentes formas de organizar y administrar los medios en las instituciones educativas, esto dependerá de una serie de variables, del modelo organizativo del Centro, la cultura escolar en la que se desenvuelva, el nivel educativo y la diversidad de tecnologías que puedan ponerse en funcionamiento.

Existen algunos aspectos según Cabero (2004b) que se deben tomar en cuenta en los Centros Educativos para facilitar la incorporación de las TIC en los mismos, ellos son los siguientes:

- a) Presencia física de las TIC.
- b) Existencia de Centros Dinamizadores, es decir, centros de recursos que ayuden a la penetración de las TIC en los contextos educativos.
- c) Creación de una cultura de utilización de las TIC.
- d) Superar las incertidumbres que todo cambio provoca.
- e) Diversidad funcional.
- f) Comunidades de profesores.
- g) Alfabetización digital o formación del profesorado y personal de administración y servicios.

Por su parte Salinas (2004a) hace referencia a cuatro cambios significativos, que se dan en las instituciones de Educación Superior con la incorporación de las TIC:

- **Cambios en el rol del profesor:** son los que conducen a plantear un cambio de rol del docente y la función que desempeña en el sistema de E-A. El profesor deberá actuar primero como persona y después como experto en contenido, promoviendo el crecimiento personal del alumno y haciendo énfasis en la facilitación del aprendizaje antes que la transmisión de información. Por lo tanto “el profesor debe pasar a actuar como guía de los alumnos, facilitándoles el uso de los recursos y las herramientas que necesitan para explorar y elaborar nuevos conocimientos y destrezas...” (Salinas, 2004, p. 7).
- **Cambios en el rol del alumno:** el papel del alumno es diferente al que siempre se le ha adjudicado, ya que los alumnos en contacto con las TIC se benefician de varias maneras avanzando en esta nueva visión del usuario de la formación, esto requiere de “una serie de acciones educativas relacionadas con el uso, selección, utilización y organización de la información, de manera que el alumno vaya formándose como un maduro ciudadano de la sociedad de la información” (Salinas, 2004, p. 7).
- **Cambios metodológicos:** muchos de los conceptos asociados con el aprendizaje en la clase tradicional, se pueden reacomodar para utilizarse en las redes para la enseñanza. Por lo tanto, no se inventan nuevas metodologías, sino que la utilización de las TIC en la educación nos conduce a nuevas posibilidades para una enseñanza mejor, apoyada en entornos de línea (Mason, 1998). En definitiva, diseñar un entorno de formación, supondrá participar de un conjunto de decisiones basadas en un equilibrio entre el modelo pedagógico, los usuarios (dependiendo el rol de profesores y alumnos) y las posibilidades de la tecnología desde la perspectiva de la formación flexible (Latona, 1996).
- **Implicaciones institucionales:** dejando a un lado la metodología empleada, se está dando una transición desde la metodología convencional empleada en el campus a la clase en el ciberespacio. Tanto los profesores como los alumnos, actuarán de diferente manera en los dos tipos de clase ya que los productos de aprendizaje son también diferentes. Las instituciones educativas por lo tanto necesitarán involucrarse en procesos de innovación docente apoyada en las TIC, presionadas, entre otros factores por el enorme impacto de la era de la información, que hace que la compartimentación de los sectores profesionales, de ocio y educativo sea superada de tal forma que, al mismo tiempo que se han generado nuevos mercados para la Universidad, ésta también pierde el monopolio de la producción y la transmisión del saber por la comercialización del conocimiento (Salinas, 2004, p. 9).

Indudablemente son muchos los cambios a los que se ven sometidos los Centros Educativos en el momento que incorporan las Tecnologías de la Información y Comunicación en su práctica educativa, lo importante es tomar en cuenta todos estos aspectos que serán básicos para el éxito de esta incorporación.

2. Conclusiones

Al hablar de la integración de las TIC en los Centros de Formación, es necesario entender el proceso de cambio que suponen las mismas. Por una parte, se encuentran las modificaciones que se producen a nivel de infraestructura tecnológica, y por otro lado, los cambios que se generan a nivel del profesorado y de los alumnos (Vera, Torres y Martínez, 2014).

Consideramos tal y como señalan Cabero y Marín (2014), que para la incorporación de las TIC en los Centros Educativos, no es suficiente con un determinismo tecnológico o pedagógico, sino que podríamos necesitar uno de carácter sistémico, que asuma la complejidad del fenómeno educativo, y la diversidad de variables que deben ser contempladas en dicho proceso.

Existen algunas propuestas y recomendaciones importantes realizadas por diferentes autores, para lograr el éxito de la integración de las TIC y del E-learning en las Universidades.

Según González Sammamed (2005), deberán ser analizadas y redefinidas las siguientes dimensiones en los centros educativos al incorporar las Tecnologías de la Información y la Comunicación:

- **Organizativa:** es necesario revisar y acomodar todos los elementos organizativos de una institución al ser integradas las TIC, decidiendo y diseñando las estrategias a seguir. La capacidad de la institución y de las personas que la integran se deberá tomar en cuenta de la misma forma, para aplicar posteriormente los cambios y los medios necesarios (personales, formación, apoyos...) y garantizar así la viabilidad del proyecto.
- **Tecnológica:** la revisión de los recursos tecnológicos disponibles y la necesidad de su actualización constante será igualmente necesario para la integración de las TIC. Disponer de los medios adecuados es una condición imprescindible según González Sammamed (2005) aunque no suficiente, cuando de lo que se trata es de diseñar y desarrollar procesos educativos en los que habrá que prestar atención a cada uno de los elementos del acto didáctico.
- **Profesional:** la existencia de personas capaces para impulsar los cambios será indispensable, igualmente se requerirá de profesionales que se responsabilicen de la toma de decisiones afrontando los problemas que se puedan presentar. El docente protagonizará la implementación de los diferentes proyectos e incorporará las TIC a su actividad docente y de investigación. De esta forma, su comprensión del proceso de innovación, su valoración positiva y su grado de implicación van a determinar los resultados que se obtengan.
- **Cultural:** mediante la incorporación de las TIC en las instituciones educativas se generará una cultura que determinará en gran parte unos modos de comportamientos, diferentes relaciones, y unos mecanismos aprendizaje. Por lo tanto, se necesitará un

liderazgo eficiente que permita establecer unas relaciones adecuadas entre los medios que se emplearán y los fines propuestos, y un profundo conocimiento del proceso de cambio y sus consecuencias. Para ello, habrá que cambiar diversas funciones como la planificación, coordinación, gestión de recursos, dirección, impulso... (González Sammamed, 2005), requiriéndose un trabajo conjunto por parte de los profesionales que están en contacto con la práctica diaria.

- **Estratégica:** la incorporación de las TIC debe formar parte del Plan Estratégico de la Universidad. El proceso de incorporación de las TIC se recogerá en un plan, en el que se tienen que reflejar los objetivos que se buscan, las estrategias que se van a adoptar, los recursos y la temporalización.

Por su parte Sangrá (2008), recomienda que la integración de las TIC en las Universidades, deberá basarse en un equilibrio apropiado entre la tecnología, la organización y la pedagogía, proponiendo el “Triángulo TOP”, para lograr con éxito esta incorporación. Según este autor, cualquier cambio como la integración de las TIC dentro de la Universidad implicará un proceso de pensamiento estratégico, para redefinir los roles de los diferentes agentes, crear nuevas funciones y departamentos, y desarrollar un nuevo concepto para el modelo educativo, lo que conllevará a la reorganización de rutinas y procesos administrativos, así como a una reestructuración de producción y procesos de diseño educativo.

Consideramos tal y como señala Sangrá (2008), que debe existir un equilibrio apropiado entre la tecnología, la organización y la pedagogía, debiendo ser analizadas y redefinidas a su vez, tal y como propone González Sammamed (2005) las dimensiones: estratégica, cultural y profesional en la Institución.

Por lo tanto, al ser integradas las TIC en una institución será imprescindible revisar todos los **elementos organizativos** de la misma, los **recursos tecnológicos** que se disponen y el desarrollo de un nuevo concepto para el **modelo educativo**, el cual conllevará a una reestructuración del diseño educativo del Centro.

Sin duda alguna esta integración de las TIC deberá formar parte del Plan Estratégico de la Universidad, el cual reflejará como señala González Sammamed (2005) los objetivos que se buscan, las estrategias que se van a adoptar, los recursos y la temporalización.

De la misma forma, la integración de estas herramientas en la Institución generará una **cultura** de cambio, requiriéndose un liderazgo eficiente como plantea González Sammamed (2005), que enfrente las consecuencias que pueda generar este proceso de cambio en la Institución.

Por este motivo se requerirá de la misma forma, la existencia de **profesionales** capaces de impulsar estos cambios, y que cómo señala González Sammamed (2005), se responsabilicen de la toma de decisiones afrontando estos problemas que se puedan presentar.

Finalmente consideramos al igual que Sangrá (2008), la necesidad de reflexionar sobre el perfil que deben cumplir los diferentes líderes y gerentes universitarios, debiendo los mismos de alcanzar una gran capacidad para implementar planes estratégicos completos, gerenciando los aspectos organizacionales y económicos, para posteriormente incorporar los aspectos tecnológicos en un contexto pedagógico adecuado.

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Uso y ventajas de la Realidad Aumentada en el aula

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Abstract

Based on the importance of web 2.0, the reduction of equipment costs, and the strong penetration of mobile devices, among others, there have emerged some technologies that are undoubtedly being increasingly driven in our times. One of these technologies is "augmented reality" (RA). The main interest in this study was to know and analyze the perceptions of a group of twenty teachers of the Faculty of Informatics of the University of A Coruña on the use of the RA, the advantages that this tool provides in the classroom and the needs for its incorporation. The results of the study showed that most of the teachers did not implement the AR in the classroom, considering that some of the advantages of incorporating such a tool would be the increase of student motivation, the development of learning in real contexts, The power to perceive an object from different points of view and the improvement of the formative action, among others. Finally, all teachers surveyed indicated that they had not attended training courses to implement the RA in the classroom.

Keywords: *Technology, augmented reality, innovation, ICT, advantages, classroom.*

Resumen

A partir de la importancia que ha ido adquiriendo la web 2.0, la reducción de costes de los equipos, y la fuerte penetración de los dispositivos móviles, entre otros, han emergido algunas tecnologías que sin duda alguna están siendo cada vez más impulsadas en nuestros tiempos. Una de estas tecnologías es la "realidad aumentada" (RA). El interés principal en este estudio fue conocer y analizar las percepciones de un grupo de veinte profesores de la Facultad de Informática de la Universidad de A Coruña sobre el uso de la RA, las ventajas que proporciona esta herramienta en el aula y las necesidades para su incorporación. Los resultados del estudio arrojaron que la mayoría del profesorado no ha implementado la RA en el aula, considerando los mismos que algunas de las ventajas de la incorporación de dicha herramienta serían el aumento de la motivación del alumnado, el desarrollo del aprendizaje en contextos reales, el poder percibir un objeto desde diferentes puntos de vista y la mejora de la acción formativa,

entre otros. Finalmente, todos docentes encuestados indicaron que no han asistido a cursos de formación para la implementar la RA en el aula.

Palabras clave: *tecnología, realidad aumentada, innovación, TIC, ventajas, aula.*

Introducción

En nuestros tiempos han emergido algunas tecnologías como la Realidad Aumentada (RA) debido a la fuerte penetración de los dispositivos móviles, la reducción de costes de los equipos y la importancia que ha ido adquiriendo la web 2.0.

Según Azuma (1997) la RA consiste en la incorporación de datos e información digital en un entorno real, por medio del reconocimiento de patrones que se realiza mediante un software, es decir, es una herramienta interactiva que ha pasado de dar sus primeros pasos y que ya vamos viendo en multitud de ámbitos y disciplinas, trayendo el mundo digital a nuestro entorno real. Combina elementos reales y virtuales, es interactiva en tiempo real y está registrada en 3D.

La RA puede emplearse en una diversidad de campos tales como el arte, la publicidad, el marketing y ventas, entretenimiento y juegos, educación, entre otros (Kipper y Rampolla, 2013). Con relación al área educativa, esta tecnología sin duda alguna, constituye un nuevo recurso en el aula, ya que ofrece múltiples posibilidades y planteamientos novedosos para ser implantado en diversas áreas del conocimiento, presentándose con fuertes posibilidades de aplicación en las Instituciones Educativas (Durall, Gros, Maina, Johnson, y Adams, 2012; Cabero, García y Barroso, 2016; Johnson, Becker, Cummins, Estrada, Freeman, y Hall, 2016; Johnson, Becker, Gago, García, y Martín, 2013).

La RA tiene como objetivo enriquecer la información existente en la realidad con información disponible en los dispositivos tecnológicos (Cabero y Barroso, 2016). Por lo tanto, permitirá a los alumnos la adquisición de experiencias y aprendizajes, relacionando los contenidos de aprendizaje a sus propias experiencias y comprendiendo el cómo los conceptos adquiridos en el aula se aplican para resolver problemas en situaciones del mundo real.

Por lo tanto, la RA facilitará el desarrollo de una metodología constructivista de enseñanza-aprendizaje, ya que el alumno se convierte en una persona activa, controlando el proceso de aprendizaje al combinar lo real y lo virtual, realizando sus propios descubrimientos, relacionando conocimientos previos, generando ideas y realizando experimentos, entre otros.

Es importante destacar, tal y como señala Cabero (2017) que sobre estas posibilidades educativas también nos encontramos con algunos inconvenientes y limitaciones para la incorporación de esta tecnología en la enseñanza, como la falta de experiencias educativas, la carencia de marcos conceptuales que aporten bases para la toma de decisiones para su

incorporación a los procesos de enseñanza-aprendizaje, la ausencia de investigaciones educativas y la falta de publicaciones científicas y académicas.

1. Método

El interés principal en este estudio fue conocer y analizar las percepciones de un grupo de profesores sobre la Realidad Aumentada, determinando las ventajas que otorga dicha tecnología y las necesidades para su incorporación.

En este estudio participaron 20 docentes (7 mujeres y 13 hombres) que imparten docencia de la Facultad de Informática de la Universidade da Coruña. El procedimiento de muestreo fue no probabilístico, accidental o incidental, condicionado por la disponibilidad de los sujetos a participar en el estudio. Este tipo de muestreos, aunque no permiten «extraer muestras representativas de la población, sí facilitan el estudio cualitativo en profundidad del tema que interesa dentro de un contexto determinado» (Martínez, 2007, p. 56).

Se utilizó un cuestionario que nos permitió obtener una visión general del pensamiento docente sobre la Realidad Aumentada. Los apartados que incluyó el cuestionario se elaboraron en torno al objetivo que nos marcamos para esta investigación y, por supuesto, teniendo en cuenta toda la fundamentación teórica expuesta anteriormente. Este cuestionario fue revisado por 2 expertos en la materia, con el fin de validar su contenido y su inteligibilidad para el participante. Teniendo en cuenta las correcciones realizadas, se aplicó el instrumento a una muestra piloto de 5 profesores, con la finalidad de detectar problemas de funcionamiento de los ítems antes de su aplicación a la totalidad de la muestra (Expósito, Navarro, Thoilliez y López, 2010), pero el resultado fue óptimo y no se necesitó realizar más cambios.

Finalmente, el cuestionario constó de 7 preguntas, de las cuales dos pretenden recoger información sobre la implementación de la Realidad Aumentada en el aula con relación a las ventajas de esta técnica, otra relacionada con los elementos que son necesarios para dicha implementación, y la siguiente sobre los recursos tecnológicos de los que dispone el docente. Por último, se plantean dos preguntas relacionadas con la formación en esta temática. Cada una de las preguntas contenía una serie de ítems, de los cuales el profesorado debía marcar los que considerase oportunos (en las preguntas ya se les indicaba si la respuesta era única o podía ser múltiple). Para analizar los datos obtenidos se halló el porcentaje del profesorado que marcó cada ítem en el cuestionario.

El cuestionario se administró a los participantes a principios del curso académico 2016/2017 a través de correo electrónico. La participación fue voluntaria y se garantizó el anonimato y la confidencialidad de los datos obtenidos. Para responderlo, se les concedió el tiempo que ellos consideraron oportuno, pero recordándoles que esta información era necesaria para poder avanzar en la investigación. Una vez respondido el cuestionario, lo entregaron de la misma forma que lo recibieron.

2. Resultados

A continuación, se exponen los resultados obtenidos en cada una de las cuestiones de las que se componía el cuestionario.

El 70% del profesorado reconoce no haber implementado la RA en sus aulas, aunque ese mismo porcentaje sí conoce experiencias universitarias donde se ha implementado (figura 1). Cabe destacar que el 30% sí que lo implementó alguna vez en sus aulas, pero el 15% dice desconocer experiencias sobre la RA.

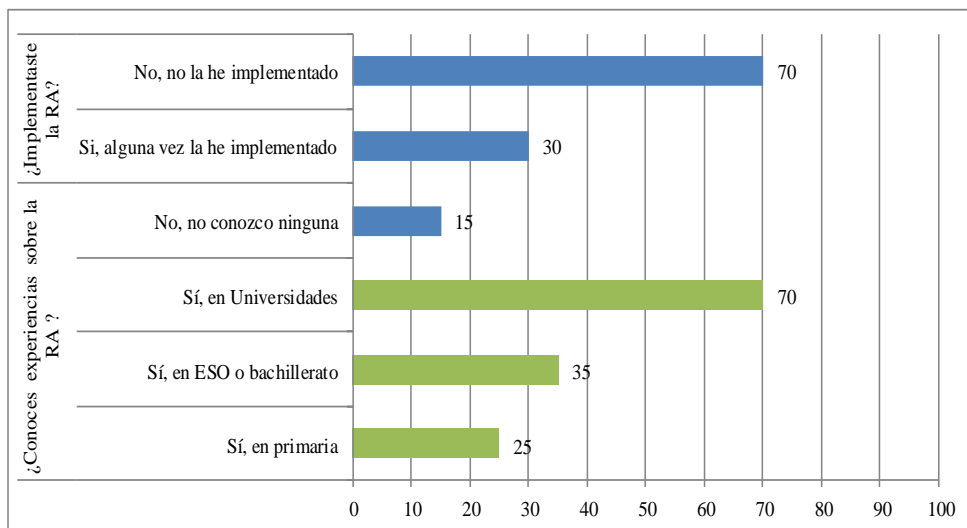


Figura 1. Respuestas del profesorado sobre sus experiencias e implementación en relación a la RA.

Fuente:elaboración propia.

Según los encuestados, implementar la RA en el aula conlleva una serie de ventajas (figura 2). Así, para el 100% la mayor ventaja es que aumenta la motivación del alumnado, seguido de que favorece el desarrollo del aprendizaje en contextos reales (60%), que permite la percepción de un objeto desde diferentes puntos de vista (60%) y que mejora la acción formativa ya que los alumnos aumentan los niveles de aprendizaje mediante la creación de estos escenarios tecnológicos (55%). En menor medida, el profesorado también se refiere a la capacidad de los alumnos de interactuar con los objetos virtuales en una forma directa y natural mediante la manipulación de objetos reales (45%) y a la facilidad de la comprensión de fenómenos complejos ya que la RA permite al alumno descomponer un objeto o fenómeno en sus fases o etapas (40%). Solo un 10% del profesorado señala como ventaja el que favorece el aprendizaje autónomo y colaborativo del alumnado.

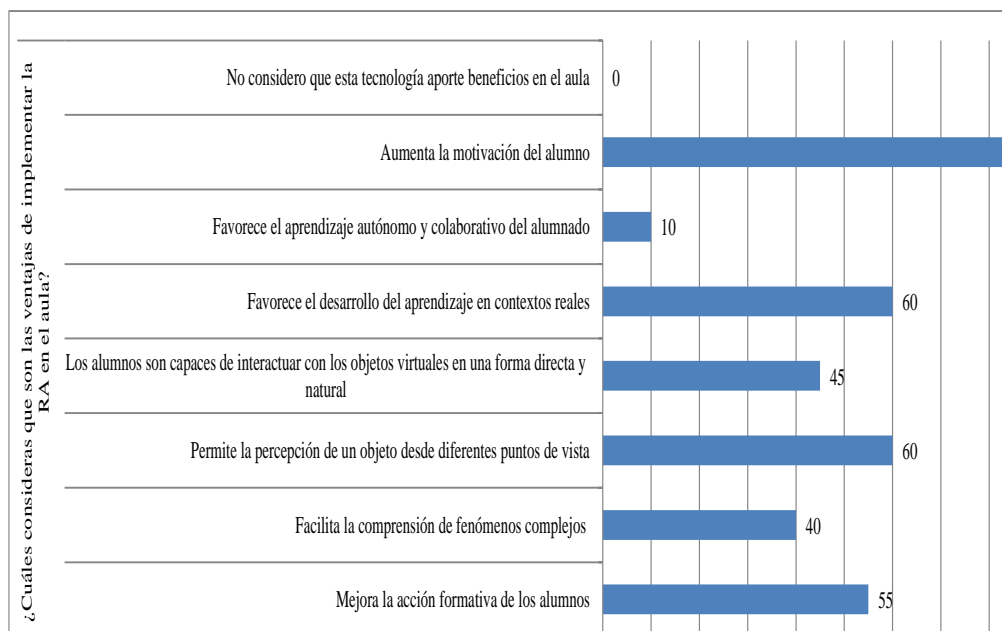


Figura 2. Respuestas del profesorado sobre las ventajas de implementar la RA en el aula.
Fuente:elaboración propia.

En relación a los recursos tecnológicos para desarrollar proyectos de RA en educación, el 50% de los encuestados indica desconocer dichos recursos (figura 3). En cuanto al profesorado que sí reconocer algunos de ellos, la mayoría hace referencia a BuildAR (marker AR) (30%), EspiRA (geolocation AR) (30%) y Aumentaty (marker AR) (20%). En menor medida (10% en cada caso) se refieren a Google Gogles (Visual Search), AR-Media (marker AR) y ConectAR (marker AR). Ningún docente dice conocer Eduloc (geolocation AR), pero hay que destacar que el 30% de los docentes propone otros recursos a mayores de los que se les aportó en el cuestionario (Fiducial Market / Vuforia / ARToolkit).

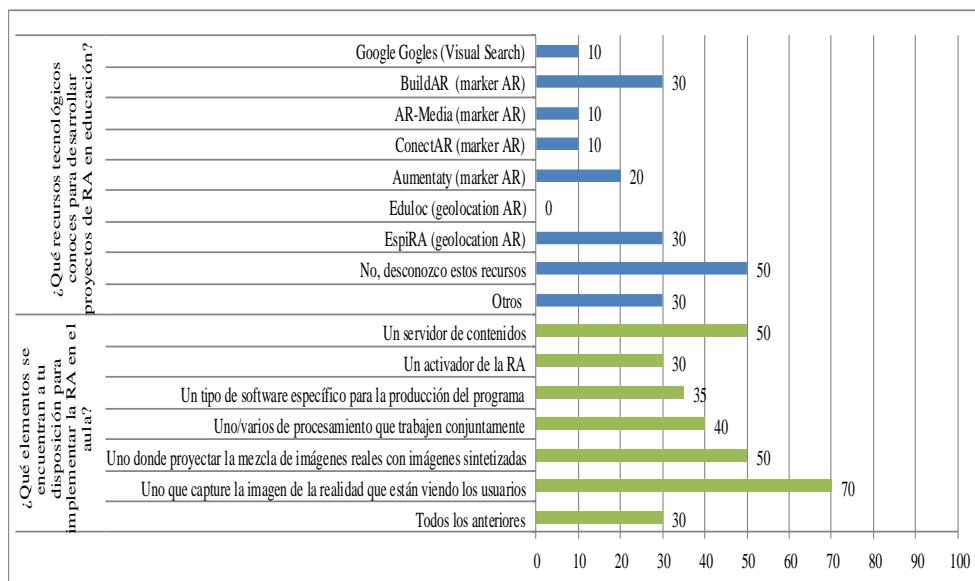


Figura 3. Respuestas del profesorado sobre los recursos tecnológicos que conoce para desarrollar proyectos de RA en educación y sobre los recursos de los que dispone. Fuente: elaboración propia.

En relación a la formación docente, ningún participante ha asistido a cursos de formación y un 20% piensa que no se necesita formación pues con los conocimientos tecnológicos que posee ya es suficiente (figura 4). Por otra parte, pero la mayoría del profesorado considera que sí es necesaria esa formación. En concreto, el 70% opina que se requiere formación no solo en función de la tecnología sino en los contenidos que se transmiten, el 45% considera que es importante la formación para incorporar la tecnología en el aula y el 15% piensa que es necesario contar con un buen asesoramiento de expertos, de una empresa desarrolladora de soluciones de Realidad Aumentada o el apoyo de un grupo de investigación que comparte experiencias y recursos.

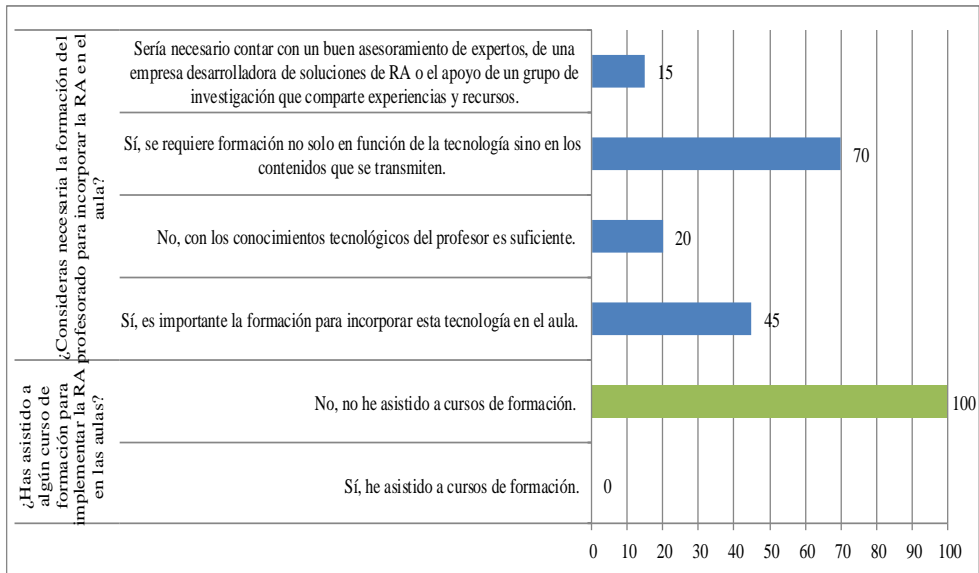


Figura 4. Respuestas del profesorado sobre las necesidades formativas en relación a la RA.

Fuente:elaboración propia.

3. Conclusiones

Con nuestro trabajo de investigación hemos pretendido conocer y analizar las percepciones de un grupo de profesores de la Facultad de Informática de la Universidad de A Coruña sobre el uso de la RA, las ventajas que proporciona esta herramienta en el aula y las necesidades para su incorporación. De los resultados obtenidos, podemos extraer una serie de conclusiones como son las siguientes:

- La mayoría del profesorado consultado no ha implementado la RA en sus aulas, aunque conoce experiencias universitarias donde se ha incorporado. Sin embargo, un porcentaje menor del profesorado sí ha implementado alguna vez en sus aulas esta herramienta.
- La mayoría del profesorado consultado señala una serie de ventajas acerca de la utilización de la RA en el aula. Estas ventajas están relacionadas principalmente con el aumento de la motivación del alumnado, el desarrollo del aprendizaje en contextos reales, el poder percibir un objeto desde diferentes puntos de vista y la mejora de la acción formativa, ya que los alumnos aumentan los niveles de aprendizaje mediante la creación de estos escenarios tecnológicos. Estos resultados coinciden con lo expuesto por Cabero y Barroso (2016), quienes señalan que la RA permite a los alumnos la adquisición de experiencias y aprendizajes, comprendiendo el cómo los conceptos adquiridos en el aula se aplican para resolver problemas en situaciones del mundo real, y relacionando los contenidos de aprendizaje a sus propias experiencias.

- En relación a los recursos tecnológicos para desarrollar proyectos de RA en educación, un porcentaje significativo de los profesores encuestados indicaron desconocer dichos recursos. En cuanto al profesorado que sí reconocen algunos de ellos, la mayoría hizo referencia a BuildAR (marker AR), EspiRA (geolocation AR) y Aumentaty (marker AR).
- En relación a la formación docente, ninguno de los profesores consultados ha asistido a cursos de formación para el uso de la RA, aunque sí consideran que es necesaria la misma para incorporar esta herramienta en el aula, no solo en función de la tecnología sino de los contenidos que se impartirán. Por otra parte, un porcentaje minoritario del profesorado consultado señaló que no se necesita formación para dicha implementación, ya que indicaron que con los conocimientos tecnológicos que posee el docente sería suficiente.
- Finalmente consideramos que la formación de los docentes en las TIC es hoy en día una necesidad incuestionable “si queremos incorporarlas de manera educativa y significativa a los procesos de enseñanza aprendizaje, y no meramente como un añadido que funcione independiente del resto de variables curriculares (contenidos, estrategias, metodologías,...)” (Cabero, Marín y Castaño, 2015, p. 13).

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Desarrollo de unidades temáticas basadas en mapas

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Abstract

The structuring of the thematic units should be addressed within the general framework of teaching, especially at a university level where coordination and internationalisation among teachers is not always the most appropriate.

A thematic unit must Always adhere to a diagram, which must include prior knowledge and goals to achieve, but based on a few dynamic and adaptable maps, at least by examples and practices associated with the environment of origin or of possible actions adapted for students.

The concept map should begin with a simple outline including the various interrelated concepts included in the Thematic Unit and should gradually expand. In the first place, in order to include the interest shown by the students and later with the cross-cutting concepts correlated with them. Then it will be documented with graphic material both the initial concept map and as the future reviews students will be asked for collaboration with graphics and documentation that will be incorporated to the map. Later, the online links considered interesting, as well as links to technical and scientific articles will be added.

At another time active documents how technical videos of short duration will be included for the better development of the theme.

In conclusion, I will include links to graphics and even fragments of commercial films that students will be able to view in small groups outside the classroom, and always within private activities that do not involve public display, in case we don't have permission to do so.

Keywords: *Methodology, conceptual map, graphic documentation.*

Resumen

La estructuración de las Unidades Temáticas debe plantearse siempre dentro del esquema general de las enseñanzas, máxime en el nivel universitario donde

la coordinación e internacionalización entre docentes no siempre es la más adecuada.

Siempre una Unidad Temática debe atenerse a un diagrama en el que deben figurar conocimientos previos y objetivos a conseguir, pero basándonos en unos mapas conceptuales dinámicos y adaptables, al menos mediante ejemplos y prácticas relacionadas con el entorno de origen o de posible actuación facilitada del alumno.

El mapa conceptual debe empezar con un esquema sencillo incluyendo los distintos conceptos interrelacionados incluidos en la Unidad Temática y progresivamente se irá ampliando. En primer lugar, para incluir los intereses mostrados por los alumnos y posteriormente con los conceptos transversales correlacionados con ellos. A continuación, se documentará con material gráfico tanto el mapa conceptual inicial como el desarrollado posteriormente, se pedirá la colaboración de los alumnos con gráficos y documentación propia que será incorporada al mapa, posteriormente se incluirán los enlaces on line considerados interesantes, así como enlaces con artículos técnicos y científicos relacionados con la temática en desarrollo.

En otro momento se incluirán documentos activos como videos técnicos de corta duración para el mejor desarrollo de la temática.

Para finalizar, se incluirán enlaces con documentos gráficos e incluso fragmentos de películas comerciales que los alumnos podrán visualizar en pequeños grupos fuera del aula y siempre dentro de actividades privadas que no supongan exhibición pública, si no se dispone de permiso para ello.

Palabras clave: *Methodología, mapa conceptual, documentación gráfica.*

Introducción

Los mapas conceptuales permiten integrar de forma conjunta el conocimiento de un tema concreto en desarrollo con otros documentos externos y utilizarlos como un sistema para recordar o para asentar las ideas consensuadas en un broinstorning.

Los mapas conceptuales (Novak, 1984) son un medio que permiten la descripción y comunicación de conceptos dentro de la teoría de asimilación (Ausubel *et al*, 1978). En una teoría evolucionar basada en un modelo constructivista que permite mediante los mapas conocer lo que el alumno sabe y relacionarlo con las situaciones reales y con los conocimientos básicos previos y unos objetivos que se buscan.

Los mapas de conceptos son el mecanismo perfecto para crar y entrelazar módulos independientes (Cañas, 2000) que permitirán un estudio más dinámico de cada área a tratar. A la vez que permiten intreconectar cada una de las áreas que vamos a desarrollar.

Los conceptos son inicialmente estructurados desde la base de un texto lineal, donde este actúa de mediador y guía con la información que se está adquiriendo en el aula y con su

trabajo individual o en grupo por parte de los alumnos. (Costamagna, 2001). Muchos autores creen en la alta eficacia de estos mapas como instrumento evaluador de la comprensión de los alumnos de los conceptos más importantes (González y Jauregui, 1992) en desarrollo.

Al igual que ocurre con la información que el alumno encuentra en internet, donde es evidente que cada vez puede encontrar más información en unos casos adecuada pero en otros más o menos sesgada, es necesario que esa información esté organizada, jerarquizada y autenticada. Tarea esta última responsabilidad del profesorado. Por este motivo, proponemos establecer las unidades temáticas mediante el uso de mapas conceptuales que permitan no solo organizar la información necesaria para cada unidad temática, sino que la mismo tiempo esta unidad y su información se encuentren jerarquizadas y en contexto de la documentación de otras universidades y que así permitan una más rápida y amplia conceptualización por parte de los alumnos.

El objetivo es lograr que el alumno a partir de un mapa conceptual básico de cada Unidad Temática, lo vaya ampliando hasta incorporar toda la información considerada necesaria y recogiendo la máxima documentación posible. Posteriormente, lograremos que interrelacionen todas las Unidades Temáticas mediante mapas conceptuales interunidades.

Es importante evaluar la idoneidad de uso de mapas conceptuales en las asignaturas de carácter teórico-práctico que impartimos, en los sectores en que desarrollamos nuestras actividades.

Para evaluar nuestro objetivo, no propusimos describir y establecer un sistema de evaluación concreto para conocer los logros de los alumnos en las áreas de técnicas de cultivo de viticultura y olivicultura, así como en antropología técnica.

1. Materiales y métodos

Los mapas pueden ser definidos como diagramas bidimensionales que muestran relaciones jerárquicas dentro de los conceptos de una disciplina y su origen está en la existencia de esa propia disciplina (Moreira y Buchwitz, 1988).

Las técnicas de cultivo utilizadas y explicadas en las asignaturass de olivicultura y viticultura son claramente ramas de la agricultura cuyo inicio se centra en la elección del material vegetal, desarrollo del propio cultivo con la clara intervención del agricultor, en recolección y procesado por ejemplo y recogiendo la tarea y evolución de estas técnicas con el paso de las épocas y las civilizaciones.

Teniendo a la vez, un aprovechamiento no solo directo del producto obtendid sino también de la biomasa obtenida durante y al final del proceso. Es por lo tanto necesario desarrollar un recurso didáctico que le permita al alumno hacer una integración conceptual, dejando siempre un orden jerárquico natural, a la vez, que consiga una teoría explicativa y pueda comprender cuál es el papel de cada uno. Cuál es su nivel de intervención de cada parte en el funcionamiento del conjunto.

Los mapas conceptuales serán usados dentro del dominio específico de la agronomía y su evolución en el que básicamente trabajamos, representando de forma gráfica todos los conceptos a estudiar. Pero principalmente su relación con temáticas de origen de los productos agrarios y sus usos posteriores.

De forma general realizaremos un test previo, al comienzo de la asignatura, y otro al final de la misma mediante el cual podamos comprobar con preguntas cortas de respuesta cerrada tipo test la consecución de los objetivos buscados y la integración esperada de los principales conceptos.

Los diferentes pasos que son necesarios para realizar un mapa conceptual puede realizarlos cada alumno o de forma grupal. Esto último permite establecer una mayor interrelación entre los distintos alumnos del grupo pero será medida la implicación de cada uno mediante la existencia en el grupo de un controlador de carácter rotatorio y por la presentación final del proyecto. Dado que esta forma de realizarlo potencia el trabajo en equipo pero puede difuminar el conocimiento individual de las situaciones en estudio.

Esta práctica la podemos realizar tanto para cada unidad temática como para interrelacionar las unidades temáticas entre ellas. De esta forma mejoramos y enriquecemos las unidades básicas de la asignatura. Nos referimos a aquellas unidades que hablan de una técnica de cultivo concreta y que cuando se interrelacionan entre sí, mediante el uso de un mapa conceptual conseguimos que el alumno capte mejor la temática y las posibles alternativas existentes en el pasado y en la actualidad. Además mejoramos la memorística de los conceptos de la unidad o del conjunto de la asignatura o asignaturas.

Al inicio del curso se informa y recuerda al alumno la temática de los mapas conceptuales para recordarle su funcionamiento. Para desarrollar el trabajo se facilita al alumno un mapa base sobre uno de los temas iniciales del temario, principalmente relacionado con materiales vegetales, su origen y su historia, dado que estos temas siempre resultan menos atractivos para él y nos sirven como guión y prueba del formato de trabajo.

Establecemos un mapa conceptual básico en el cual presentamos con nodos rotulados los cinco o seis principales conceptos de la Unidad Temática. Y mediante arcos rotulados conectaremos cada nodo.

Estableceremos un mapa mudo en parte del mismo, para poder ser utilizado como sistema evaluador. Este podrá realizarse con parte del contexto en el caso de las técnicas de agronomía. O bien, no interrelacionar conceptos y permitir al alumno que escoja todos los elementos formadores del mapa.

Sin embargo, la evaluación final viene promovida por la propia programación didáctica de la asignatura. Se establecerá una evaluación que abarque todo el proceso desarrollado y permita hacer una síntesis del conjunto. De esta forma lograremos saber si el alumno es capaz de identificar una relación entre conceptos, a la vez que interrelacionar de forma transversal las Unidades Temáticas tratadas.

Se ha planificado una evaluación de los mapas. Como decía Ontoria (1993) hay que basar la evaluación de mapas en sus tres ideas principales: cómo se organiza la estructura del conocimiento, cómo se establece la diferenciación progresiva y por último una reconciliación integradora de todos los temas tratados y su evolución en el tiempo.

Por lo tanto, se establece la evaluación bajo las siguientes premisas:

- Se mejora el aprendizaje a lo largo de los diferentes momentos del sistema. Lo que implicaría una reconciliación integradora del aprendizaje.
- Se consigue que el alumno relacione conceptos o proposiciones hechas, por tanto, habremos obtenido una organización de la citada estructura del conocimiento.
- Lograremos establecer una evolución en la información adquirida para lograr una diferenciación progresiva.

Por lo tanto, la evaluación la haremos de dos formas. Primero elegimos un concepto clave en nuestra asignatura y pedimos al alumno que realice un mapa conceptual donde se encuentre reflejado ese concepto y cuantos más puedan relacionarse con él.

Y en segundo lugar seleccionamos conceptos de un mismo tema y le pedimos que establezcan el mayor número posible de relaciones entre ellos, para lograr conectar perfectamente los temas al final del curso.

El sistema de corrección se basará en aclarar los nexos mediante oraciones nodales como ya dijeron (Cillibert y Galagovsky, 1999). También debemos corregir y expresar las ideas erróneas que están incluidas en la selección de conceptos a interrelacionar como ya plantearon Costamagna *et al*, 2001.

Se valorará claramente el uso de ejemplos en cada uno de los mapas, dado que con ello lograremos aumentar la visibilidad del trabajo, así como la comprensión de este.

2. Resultados

Se ha desarrollado el trabajo con un total de 30 alumnos de 4º curso de grado universitario, no logrando la participación activa de todo el grupo principalmente por su reticencia personal a dejarse evaluar por un sistema dinámico y que desde nuestro punto de vista, permite retroalimentar el sistema de enseñanza sobretodo en temas tan complejos como los que impartimos.

Sin embargo, de entre los alumnos evaluados podemos concluir que el 44% ha obtenido un mayor valor de jerarquización, seguida de la autocorrección del mapa. Por otra parte, les resulta mucho menos interesante y por lo tanto, con menor valor en el cómputo de evaluación en la profundización del tema y el desarrollo de nexos explicativos. (Fig. 1).

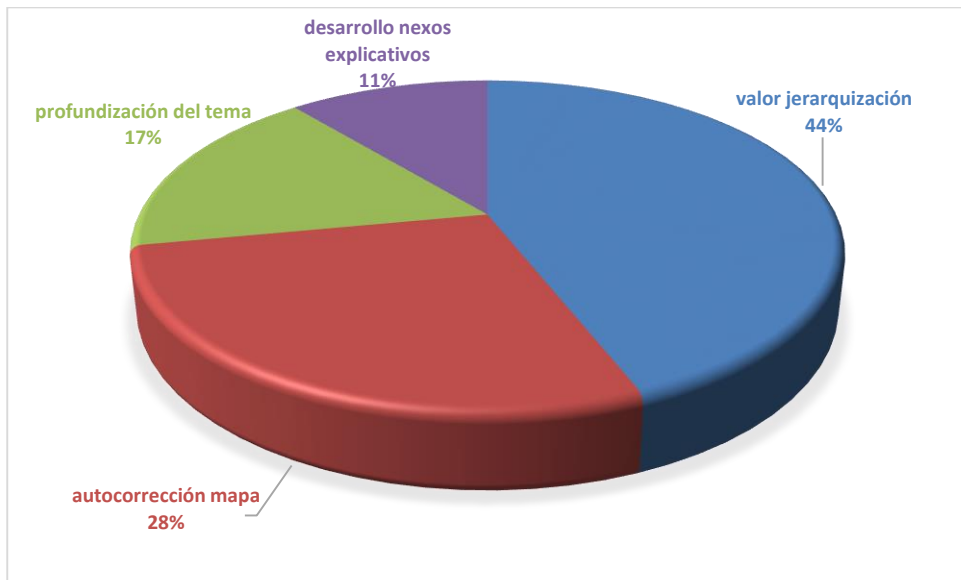


Figura 1. Distribución de resultados obtenido en la evaluación de los mapas conceptuales.

3. Conclusiones

Logramos construir un nuevo conocimiento y un manejo más de ese conocimiento. Pero ante todo logramos mediante el trabajo colaborativo de los estudiantes en el aula, el desarrollo no solo de una Unidad Temática sino la comprensión de dicha unidad dado que el estudiante tiene obligatoriamente que organizar los recursos mediante el uso de mapas y como ya es sabido esto no se logra sin un buen dominio del tema.

La máxima anotación obtenida por un alumno de entre los evaluados no ha sido significativa en los apartados evaluados. Sin embargo, los métodos expositivos del mapa han resultado útiles y apreciados en la evaluación final de la asignatura.

Aunque se ha obtenido un valor bajo en la profundización del tema, este apartado ha ido mejorando a lo largo de los tres momentos de evaluación realizados. Por lo que se presupone una mejora en el establecimiento de los conceptos por parte del alumnado.

También se obtuvo información interesante con los tests realizados al alumno antes de comenzar este trabajo y al finalizar el mismo comprobando una gran diferencia cuantitativa entre un momento y otro.

En principio podemos comparar estos resultados con los de otros cursos académicos, lógicamente con la precaución de tener en cuenta el origen y predisposición diferente en cada grupo de alumnos. Y podemos observar mejores resultados de forma global en el curso en el que se aplica la metodología de mapas conceptuales. Solo se trata de una observación cuantitativa, pero a lo largo de este curso hemos podido apreciar una mejor predisposición

de los alumnos al final del curso, cuando realizamos las clases prácticas en las que se pone a prueba la relación de conceptos adquiridos en el desarrollo del curso.

4. Agradecimientos

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La clase dinámica en la docencia aplicada a enseñanzas superiores

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Abstract

The approach to be established in a dynamic class is clearly different to the masterclass accompanied by the corresponding practices commonly used in the teaching of engineering and archaeogenetics.

In our field, memorization of quantitative data is neither dynamic nor successful in the medium term. Given this situation, we set to substitute the monitoring and development of classes in which the memorization of quantitative data is needed, by a dynamic classroom with project type examples. To do this, we will build on examples put into practice in the classroom, with morphometric data and estimates. In this way, we **achieve (a greater)** interaction with the student by carrying out more dynamic classes. In these classes, after the bibliographic and newspaper research of a topic, the student responds to questions in an exhibition phase of the acquired information. Following their presentation, supported initially in digital material, a battery of questions and clarifications is generated firstly by class peers and secondly by the team of teachers in the classroom or on the network. The presentation and the answers to the clarification will be structured by conducting a support video, film or any other digital media and/or dynamic which is considered appropriate.

This generates the need to be up to date on new plant materials, referring to material from nurseries, as well as new techniques for the management of waste and/or by-products. On the other hand, students get to know and participate in the most modern research on adaptation to climate change, as well as current legislation and its amendments. In this way, we allow a continuous updating on the part of the student in a changing agronomic and engineering environment.

Keywords: *Methodology, dynamism, memorization, materials, plant.*

Resumen

El planteamiento a establecer en una clase dinámica es claramente diferente a la clase magistral acompañada de las prácticas correspondientes habitualmente empleadas en las enseñanzas de ingeniería y arqueología genética.

En nuestra docencia la memorización de datos cuantitativos no resulta ni dinámica ni exitosa en el medio plazo. Ante esta situación nos planteamos sustituir el seguimiento y desarrollo de clases donde sea necesaria la memorización de datos cuantitativos, por clases dinámicas con ejemplos de tipo proyecto. Para ello nos basaremos en ejemplos puestos en práctica en aulas de docencia, con datos morfométricos y estimativos. De esta forma, hemos logrado la interacción con el alumno aplicando clases más dinámicas. En estas clases tras la búsqueda bibliográfica y hemerográfica de un tema, el alumno responde a preguntas control con una fase expositiva de la información adquirida. Tras su exposición apoyada inicialmente en material digital, genera una batería de preguntas y aclaraciones por parte, primero de los compañeros y después del equipo de profesores en el aula o por la red.

La presentación y las respuestas a las aclaraciones se estructurarán mediante la realización en soporte video, film o cualquier otro medio digital y/o dinámico que estime oportuno.

Con ello se genera la necesidad de estar al día en nuevos materiales vegetales, consultando material de viveros, así como nuevas técnicas para el manejo de residuos y/o subproductos. Por otra parte, se conoce y participa en las investigaciones más modernas de adaptación al cambio climático existentes, así como a las legislaciones actuales y sus modificaciones. De esta forma permite una puesta al día continua por parte del alumno en un entorno agronómico e ingenieril cambiante.

Palabras clave: *metodología, dinamismo, memorización, materiales, vegetales.*

Introducción

La memoria es un conjunto de procesos y sistemas que actúan conjuntamente, pero al mismo tiempo con independencia (Pelegrina y Lenclínez, 2009). Ello ha estado muy presente siempre en el sistema educativo sin embargo, no puede aplicarse siempre y a cualquier tipo de conocimiento.

Son conocidos los diferentes tipos de memoria existentes en relación al ámbito educativo. La memoria operativa nos permite llegar a almacenar información en pequeñas cantidades como la lectura de un documento o las pequeñas aportaciones de las exposiciones (Pelegrina y Lenclínez, 2009). Sin embargo, en asignaturas de carácter morfológico en las que es elevado el número de conceptos, este tipo de memoria pierde su gran utilidad. Por lo tanto,

necesitamos aumentar la información adquirida mediante actividades más dinámicas y fluidas.

La memoria a largo plazo obliga a desarrollar más el almacenamiento de información y documentación, para su recuerdo posterior (Pelegrina y Lenchínez, 2009).

Aprender es relacionar lo estudiado con lo anteriormente adquirido de forma que esa interrelación suponga un sistema de almacenamiento permanente a medio y largo plazo.

Al igual que en otras materias en el área de conocimiento agrario y arqueológico, en los últimos años las teorías cognitivas nos ayudan a percibir el aprendizaje como una constante reconstrucción del conocimiento (Jiménez, 1998). Al mismo tiempo es interesante el uso de enfoques comunicativos que permitan una comunicación y retroalimentación del sistema formativo.

En este tipo de enseñanza, dado que se trata del desarrollo de temáticas memorísticas puras, es más necesario implementar técnicas que logren un mayor éxito entre nuestros alumnos. Para ello es interesante usar una memoria sensorial que facilite y refuerce esa memorística.

Este tipo de trabajo tiene como grandes ventajas que su capacidad es totalmente ilimitada, con ella puedes retener la nueva información y reforzar su presencia en nuestro entorno. Pero sobretodo permite la comprensión del entorno en el que nos movemos mediante la resolución de cuestiones de situaciones específicas y de problemas.

1. Materiales y métodos

Se realizará la búsqueda de información por parte del profesorado pero que podrá ser adicionado por parte del alumno coordinador, tras el planteamiento del guión del tema.

Conocida la temática de la unidad el alumno dispone de bibliografía y hemerografía propuesta por el profesorado, además de las bases de datos existentes en las diferentes webs y en las propias bases de la Universidad.

No olvidemos que las plataformas de enseñanza permiten un entorno más dinámico que favorecen la evaluación y retroalimentación en el sistema educativo. Se plantean una serie de preguntas que no esperan una respuesta inmediata sino que serán un guión o camino a seguir para completar la temática buscada.

Localizadas las respuestas a todas las preguntas planteadas deben ser contestadas de forma expositiva. De esta forma no solo se refuerza el conocimiento que es necesario adquirir en este tipo de asignaturas sino que además logramos desarrollar el carácter expositivo en el alumnado.

La fase expositiva es necesario que se realice con diferentes técnicas o soportes como son fotografías seriadas, films, videos, o cualquier otro medio digital y/o dinámico que el alumno estime oportuno.

El material que puede usarse es variado pero debe utilizarse teniendo clara su funcionalidad. Los mensajes audiovisuales (Beno *et al*, 2010) ofrecen una posibilidad de percibir la

información por todos los sistemas de percepción del alumno, oído, vista y por supuesto llegar a ser reproducido por un soporte técnico.

Sin embargo, la fotografía exhibe en el enfoque que el fotógrafo quiere mostrar, lo cual implica en nuestro caso la visión particular del alumno. Esa opción facilita la evaluación por parte del docente dado que le permite comprobar si su percepción es correcta o si por contra necesita una revisión que puede realizarse rápidamente.

Esta exposición suele acabar con una batería de preguntas y por supuesto aclaraciones en primer lugar entre los propios alumnos de la clase y posteriormente con la intervención del profesorado.

En la memorización de una nueva información y habilidades son necesarios dos aspectos que son (Pelegrina y Lenchínez, 2009) el cómo se aprende y cómo se fija y mantiene la información. Por lo que se establece un protocolo en aula, el cual consistirá en los siguientes hitos:

- Es necesario establecer cuáles son los conocimientos previos existentes mediante la realización de un breve seguimiento del alumno.
- Establecemos guiones que permiten un seguimiento en el momento se exponga el tema y con posterioridad, en el momento de refresco y refuerzo de la información.
- Desarrollar en el aula los contenidos con poco peso de información, presentando los contenidos de forma ordenada y coherente.
- Dispondremos de una exposición de los hechos, situaciones y conceptos mediante diferentes soportes, utilizando las plataformas disponibles y cuantos soportes informáticos sean necesarios. De esta forma el alumno dispone de distintas formas para recordar y estudiar la misma información. Podemos lanzar la información mediante textos, audios o breves grabaciones que refuercen y expongan la misma temática.
- Establecido el esquema de trabajo y la temática a desarrollar en la asignatura, realizaremos repeticiones de la temática a lo largo del curso. Se pretende con ello no agotar la asimilación de información, sino que cuando el alumno recibe los mismos contenidos en diferentes momentos, interioriza más la información y consigue interrelacionarla mejor con la información previamente adquirida.

El seguimiento de las unidades temáticas la realizaremos con preguntas en aula que nos permita asiduamente realizar el seguimiento del sistema y permitir una retroalimentación del modelo utilizado.

Resulta interesante plantear preguntas regularmente sobre temas estudiados no con el objeto de evaluar sino como sistema para recuperar la información del grupo de alumnos (Pelegrina y Lenchínez, 2009).

Utilizaremos la pizarra digital como sistema de refuerzo de la información verbal. Realizando al final de la sesión un resumen de la información más relevante que nunca podrá estar por encima de las seis ideas más importantes.

2. Conclusiones

Es necesario no solo generar el comienzo para un sistema permanente de aprendizaje, en cualquier tipo de enseñanza, pero en el caso de las asignaturas como las que nos ocupan nos resulta totalmente necesario.

Por una parte, el ya mencionado dinamismo de estas áreas obliga a practicar y conocer con nuevos materiales de esta forma conseguimos generar un sistema que permite conocer el nuevo material de forma continua y dinámica, a la vez que como hemos comentado aprovechar esa memoria operativa que es tan necesaria para asignaturas de marcado carácter memorístico por el tipo de conocimiento que abarcan.

No pretendemos abandonar la memorística en nuestra docencia pero sí pretendemos pasar de una memorística pasiva a una clara memorística activa.

No es necesario un cambio estructural o de sistema, ya mucho tiempo establecido, lo que supondría cambios muy bruscos y nada deseables. Es necesario reutilizar los medios existentes con un objetivo claro distinto.

Es necesario estar al día en nuevos materiales vegetales y de otro tipo en el entorno profesional en el que nos desenvolvemos. Pero la inmediatez con la que se producen estos cambios en nuestro sector nos obliga claramente a no basarnos en el sistema memorístico clásico para desarrollar esta faceta formativa, sino valernos del dinamismo en el aula para lograr la difusión entre nuestros alumnos del material vegetal y nuevos hallazgos y técnicas. Necesitamos generar un contexto activo y atractivo para el aprendizaje que estamos realizando, para ello contextualizaremos el conocimiento del material docente y de la realidad del entorno con los usos y nuevas técnicas de manejo, en las que poder usar y con las que poder trabajar con estos nuevos o clásicos materiales vegetales y documentarlos.

Nos basaremos en técnicas alternativas como el uso de biomásas agrarias, el cambio climático, el aprovechamiento de residuos agrarios y nuevas técnicas de investigación. Como formas de entender la aplicabilidad de estos materiales, de esta forma conseguimos usar más la memoria sensorial que la memoria operativa.

Una vez trabajadas y expuestas las Unidades Temáticas a desarrollar en cada una de las asignaturas de las que nos encargamos habremos logrado una asociación de ideas, así como una percepción de imágenes o temas que consigue hacer trabajar a la memoria a corto y largo plazo (Jiménez, 1998).

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Acercando la realidad al aula. Propuesta de innovación docente en las prácticas de la asignatura “*El Proceso Cinematográfico*”

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Resumen

La presente comunicación está basada en la experiencia práctica llevada a cabo por los alumnos de la asignatura “El Proceso Cinematográfico” impartida en 3º de CAU del Campus de la Universitat Politècnica de València en Gandía. El objetivo de las clases prácticas ha sido el de acercar al aula lo más fielmente posible la realidad con la que dentro de poco tiempo estos mismos alumnos tendrán que lidiar. Con este planteamiento de partida, a lo largo de los meses de docencia de la asignatura, se establece un calendario de clases y de prácticas relacionadas con el proceso de creación de una obra audiovisual (en este caso, un largometraje).

En este sentido, los alumnos repartidos en grupos, debían proponer un argumento original a partir del cual tendrían que afrontar una serie de casos muy relacionados con el proceso real de creación, distribución y exhibición al que tradicionalmente se someten los proyectos audiovisuales de esa entidad en los circuitos comerciales cinematográficos.

Palabras clave: *proceso cinematográfico, comunicación audiovisual, producción, gestión, formación, competencia, nuevas tecnologías, docencia.*

Introducción

Trasladar la presión de un entorno profesional a un aula universitaria con el fin de que los alumnos se vayan familiarizando con el entorno laboral con el que muy probablemente muchos de ellos vayan a tener que desenvolverse a medio y corto plazo. Ese es el principal objetivo académico planteado en la asignatura de 3º de CAU Gandía, *El Proceso Cinematográfico*. Desde esa perspectiva, la estrategia docente prevista se apoya en la realización de una serie de prácticas o casos que los alumnos deben tratar de resolver y exponer en clase en parecidas condiciones a las existentes fuera del entorno universitario.

1. Objetivos

Los objetivos de esta experiencia docente son diversos. Por una parte, lo que se pretende conseguir es dotar o entrenar al alumnado en una serie de competencias tan variadas como autoconfianza, seguridad, experiencia profesional, expresión oral y escrita, relaciones públicas, gestión, producción, trabajo en equipo, responsabilidad, empatía, persuasión, creatividad, etc.

Todas estas competencias, más o menos regladas, podrían venirles muy bien dentro del entorno laboral al que se encaminan, tanto por la orientación de los estudios realizados, como por la vocación que se les adivina y que ya despunta en muchos casos. Para la “objetivación” empírica, tanto de la asimilación práctica como la implementación y mejora de dichas competencias, este trabajo se ha servido de la elaboración de una exhaustiva encuesta a la que ha contestado un elevado porcentaje de alumnos (60%) y cuyas principales conclusiones se exponen más adelante en la presente comunicación dentro del epígrafe dedicado a los resultados de la investigación.

Por otra parte, se trataba de fijar los conceptos teóricos dados en las clases y ver si los alumnos eran capaces de llevarlos a la práctica. Al mismo tiempo, dentro de la obligada metodología establecida previamente a un estudio de estas características, con la referida encuesta se ha planteado como objetivo fundamental dar voz a los estudiantes implicados, conocer de primera mano su opinión acerca de estas prácticas docentes, del nivel de transformación que su desarrollo puede suponer y, por fin, de su utilidad futura.

2. Desarrollo de la innovación

Los 81 alumnos matriculados en la asignatura fueron divididos en tres grandes grupos de 27. Cada grupo fue dividido en 5 subgrupos de entre 5 y 6 alumnos con el fin de concentrar la práctica y evitar que hubiera estudiantes que pudieran aprovecharse de la labor de los demás componentes. De esta forma, el trabajo se podría repartir más equitativamente ya que habría para todos. Todos los grupos, 18 en total, tenían asignado un nombre elegido por los propios miembros con el que a partir de ese momento serían identificados y evaluados más fácilmente: Hackers, Cromatic, Butaca 8, Podemitas Cinematographers, Els Verds, El Pan Producciones, MXF Producciones, etc.

2.1. Prácticas 1 y 2

Como se ha comentado en la introducción, todos los casos prácticos estaban basados en la teoría dada en las clases previas. En esta fase, los alumnos habían repasado la fase de preproducción en la que se llevan a cabo los primeros pasos necesarios en el proceso creación de un largometraje. Es la fase en la que el proyecto comienza a cobrar vida; en ella se fundamentan las directrices principales (tanto económicas como artísticas) y se trazan sus rasgos

generales: financiación, equipo técnico-artístico, realización de un plan de trabajo, elaboración y desarrollo del guión, fijación de un presupuesto determinado, plan de rodaje, etc.

Un buen trabajo en esta fase suele o debe conllevar (no siempre es así) un rodaje fácil o sin excesivas complicaciones (aunque siempre surgirán problemas imprevistos e inoportunos¹). En la primera de las prácticas previstas, se trataba de realizar una reunión previa en la que cada miembro del grupo (formados por 6 alumnos) debía aportar un resumen de una idea o un posible argumento para la elaboración de un largometraje de entre 90' y 120' de duración. Una vez expuestos las posibles tramas, los alumnos debían dialogar y valorar cuál de las propuestas sería la que, en base a unos criterios estudiados en las clases teóricas de la asignatura, tendría más posibilidades de ver la luz.

Una vez decidido el tema, los alumnos debían redactar un documento descriptivo que resumiera no sólo el argumento y las posibles subtramas sino, además, un primer perfil tanto físico como psicológico de sus personajes principales. Esa primera práctica finalizaba con una breve exposición de la idea ante el resto de la clase en la que debían participar todos los componentes de los diferentes grupos. A continuación, se sometían a las preguntas que el resto de alumnos pudiese plantearles.

En la segunda de las prácticas propuestas, se trataba de comprobar si los alumnos habían asimilado los conceptos teóricos repasados en clase unos días antes. En el aula se había hablado de la fase de valoración y evaluación de todo proyecto audiovisual dentro del proceso de generación de un largometraje. En este sentido, los grupos debían responder a un exhaustivo cuestionario que incluía preguntas como las que se exponen a continuación.

Tabla 1. Cuestionario para la fase de evaluación y valoración de un reportaje. Fuente Elaboración Propia

Público: ¿A qué público va dirigido?, ¿Apta para toda la familia?, ¿Otras parecidas en cartel?
Tema: ¿Cuál es?, ¿Es claro el tono y el género de la historia?, ¿Es interesante?, ¿Hay un final feliz?
Personajes: ¿Cuántos protagonistas hay?, ¿Qué motivaciones tienen?, ¿Es interesante el antagonista?
Producción: ¿Resultará cara de rodar?, ¿Necesitará mucha postproducción?, ¿Hay escenas de riesgo?

La finalidad de esta práctica en la que los alumnos debían responder a todas estas cuestiones, era la de aportar datos sobre la viabilidad futura de ese proyecto, es decir, comprobar las mayores o menores posibilidades de que pudiera salir adelante y consiguiese, por fin, ser proyectado en salas comerciales. Los diferentes grupos realizaron una intensa labor de investigación para tratar de responder a todas las preguntas teniendo en cuenta el tema o argumento original propuesto por cada uno de ellos.

Uno de los trabajos mejor realizados y que mayor aceptación tuvo entre los propios alumnos fue el realizado por el grupo denominado Horyzon y cuya propuesta titulada “Boogie Aliens”

¹MOLLÁ, D. (2012). La producción cinematográfica. Las fases de creación de un largometraje. Barcelona: UOC

mezclaba humor, ciencia ficción y música de las décadas de los setenta/ochenta en un combinado que podía resultar comercialmente exitoso.

2.2. Práctica 3

Una vez estudiada la viabilidad futura de los diferentes proyectos, los alumnos deberían tratar de ponerse en la piel del productor de la futura película planteando el carácter general del film en sus cuatro niveles principales: Argumental, Visual, Artístico y Económico. Los diferentes grupos deberían defender el proyecto ante el resto de la clase. Durante 10 minutos, mediante la utilización de un lenguaje lo más persuasivo posible y, apoyados en los recursos tecnológicos más diversos, los alumnos trataron de “vender” la idea a los supuestos financieros, inversores y distribuidores. Se trataba de convencerles de que apostar por esa película era prácticamente un negocio seguro que les habría de reportar enormes beneficios en taquilla.

Mientras unos grupos resaltaron la calidad literaria del guión y la importancia y actualidad del tema elegido, otros se centraron más en lo acertado de la elección de la pareja protagonista como gancho promocional. Hubo, incluso, algún grupo que apostó casi todo su “escaso” presupuesto a la contratación de un director consagrado como garantía de su rentabilidad futura en taquilla.

De nuevo, el grupo Horyzon destacó por su propuesta, fresca e innovadora, que supo apoyarse en las nuevas tecnologías que la red ofrece también en el mundo académico para realizar una exposición brillante y cautivadora, como puede apreciarse en el link: <https://prezi.com/iuxsrl-rsdlo/boogie-aliens/>

2.3. Práctica 4

El siguiente caso práctico adentraba a los alumnos en la fase de producción o ejecución del proyecto. Se les planteaba la necesidad de escoger una determinada secuencia de la futura película. Basándose en ella, y con los fundamentos y nociones aprendidas en las clases teóricas de la asignatura, los alumnos debían desarrollar tres herramientas fundamentales dentro del proceso de creación de una película: Guión literario, Storyboard, Hoja de desglose.

La fig.1 expuesta a continuación, resume la siguiente secuencia del guión literario:

Tras el choque frontal contra un árbol, la puerta del copiloto está entreabierta y la del conductor se ha caído. DAMIÁN y RAFA permanecen inmóviles, con contusiones en la cabeza y el rostro ensangrentado. DAMIÁN abre los ojos y se encuentra con una figura borrosa que se acerca a él. La MUERTE, una mujer con la piel nívea, el pelo largo, liso y negro, y vestida con un largo vestido de su mismo color le observa con curiosidad. Se acerca poco a poco a DAMIÁN, le mira pensativa, y se da la vuelta en dirección a RAFA, quien respira con dificultad con los ojos entreabiertos. Se acerca lentamente a RAFA y le besa en la frente. RAFA deja de respirar.

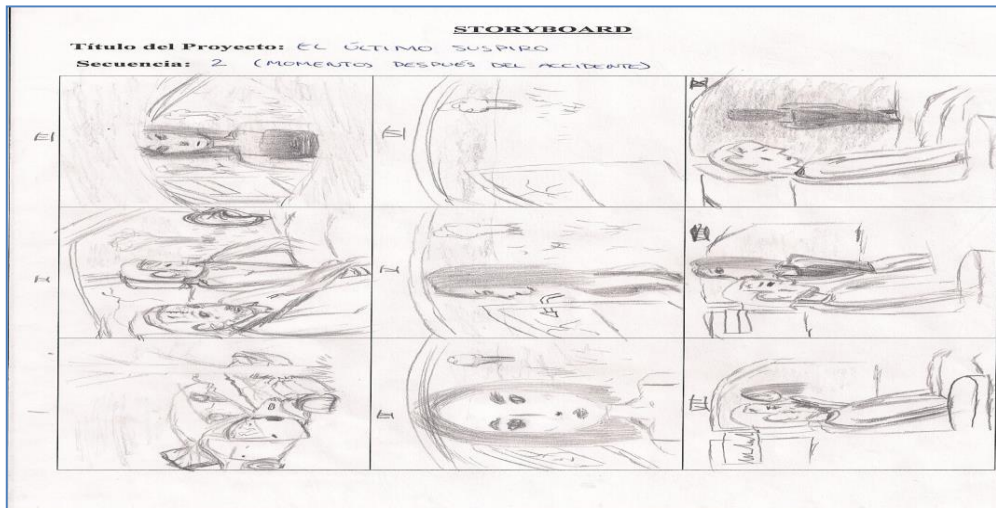


Figura 1. Story Board de una escena de la película First Eye presentada por el grupo Kiwi

2.4. Prácticas 5 y 6

La fase de producción es clave dentro del complicado proceso de creación de una obra audiovisual. La localización de espacios donde rodar la acción es otro de los muchos retos a los que todo profesional de la producción cinematográfica debe saber afrontar también desde el ámbito administrativo. En este sentido, los alumnos de la asignatura recibieron unas clases teóricas en las que se les explicó cómo realizar una solicitud de un permiso de rodaje en localizaciones tanto públicas como privadas. La práctica 5 les proponía la redacción de esta clase de solicitud para una determinada secuencia del film que cada grupo había escogido. La siguiente etapa (práctica 6) ponía a prueba los conocimientos adquiridos por los alumnos en las clases teóricas previas en cuanto a la realización de documentos fundamentales cuando está a punto de iniciarse la fase de rodaje: Listado de personajes y localizaciones y Plan de trabajo.

2.5. Práctica 7

Una vez que se han determinado todas las necesidades de producción, así como su distribución temporal, se está en disposición de elaborar un presupuesto estimativo, cuya función es determinar los costes sobre los que se ha de valorar si la producción es viable. En la última de las prácticas previstas en el desarrollo docente de la asignatura *El proceso cinematográfico*, los alumnos deberían realizar un primer presupuesto aproximado del coste del film. Para ello, tendrían como base el documento más utilizado en el ámbito de la producción española para realizar un presupuesto: el modelo oficial que se utiliza en el Instituto de Cinematografía y de las Artes Audiovisuales (ICAA), dependiente del Ministerio de Cultura. Este modelo podía ser descargado de la página oficial del Ministerio en siguiente link:<http://www.mecd.gob.es/mecd/cultura-mecd/areas-cultura/cine/informacion-servicios/in/procedimientos-administrativos/presupuesto-coste-pelicula>
El modelo contiene 12 capítulos que los alumnos debían revisar y cumplimentar aplicándolo en su propio proyecto:

Tabla 2. Capítulos del Modelo Oficial de Presupuesto del ICAA. Fuente: Ministerio de Educación, Cultura y Deporte

Capítulos del Modelo Oficial de Presupuesto del ICAA	
■	CAP. 01.- GUIÓN Y MUSICA
■	CAP. 02.- PERSONAL ARTISTICO
■	CAP. 03.- EQUIPO TECNICO
■	CAP. 04.- ESCENOGRAFIA
■	CAP. 05.- EST. ROD/SÓN. Y VARIOS. PRODUCCION
■	CAP. 06.- MAQUINARIA, RODAJE Y TRANSPORTES
■	CAP. 07.- VIAJES, HOTELES Y COMIDAS
■	CAP. 08.- PELICULA VIRGEN
■	CAP. 09.- LABORATORIO
■	CAP. 10.- SEGUROS
■	CAP. 11.- GASTOS GENERALES
■	CAP. 12.- GASTOS EXPLOTACION COMERCIO Y FINANCIACION

3. Resultados de la Investigación²

Con la única excepción de los alumnos que tenían aceptada la dispensa académica, prácticamente todos los matriculados en la asignatura *El proceso cinematográfico* asistieron a las prácticas semanales con asiduidad. Este hecho es fácilmente constatable al repasar las hojas de asistencia registradas y firmadas por ellos en cada una de las sesiones.

El primer resultado verificable en este tipo de innovación educativa expuesta en esta comunicación es el refuerzo que para su desarrollo han supuesto las diferentes herramientas tecnológicas presentes en la red y que, en este como sin duda en otros muchos casos, se han puesto al servicio de la docencia universitaria.

El segundo resultado de esta práctica docente ha sido el de constatar una evidencia empírica al poner a los alumnos en situaciones de una cierta tensión profesional/competitiva similar a la que se encontrarán en un corto periodo de tiempo ya que son estudiantes de tercer curso de Comunicación Audiovisual.

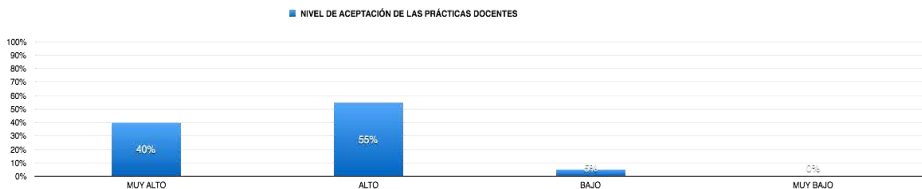


Figura 2. Nivel de Aceptación de las Prácticas docentes. Fuente: Elaboración Propia



Figura 3. Nivel de Rechazo de las Prácticas docentes. Fuente: Elaboración Propia

Desde esta perspectiva, resulta muy ilustrativo el elevado porcentaje de alumnos, un 40% que han señalado como “Muy elevado” el nivel de aceptación de esta clase de prácticas docentes, mientras que para un 55% el nivel ha sido “Alto” y, sólo un 5% lo ha considerado “Bajo”.

En la misma línea se han manifestado los alumnos al ser preguntados por el nivel de rechazo de las prácticas docentes. Un porcentaje mayoritario (65%) consideró el trabajo realizado en

² Todas las gráficas que se exponen en este apartado han sido realizadas a partir de un cuestionario realizado *ad hoc* y que se expone en el anexo 1, al final de la presente comunicación

el aula como con un “Muy bajo” nivel de rechazo mientras que el 35% restante lo consideró “Bajo”.



Figura 4. Nivel de Utilidad de las Prácticas. Fuente: Elaboración Propia

La encuesta permite constatar el hecho de que durante las jornadas en las que se han desarrollado, tanto las sesiones prácticas como las teóricas, los alumnos han adquirido una serie de conocimientos que, muy probablemente, les serán de utilidad en su futura vida laboral. Esa parece ser, al menos, la opinión generalizada de los estudiantes de la asignatura *El Proceso Cinematográfico* de 3º de CAU en el Campus de Gandía. Para un 50% de los encuestados las prácticas realizadas en clase tienen un nivel de utilidad futura muy alto mientras que para un 45% ese nivel es intermedio. Tan sólo un 5% piensa que es bajo.

Los principales aspectos que se han visto reforzados gracias a la realización de las prácticas docentes son los siguientes.

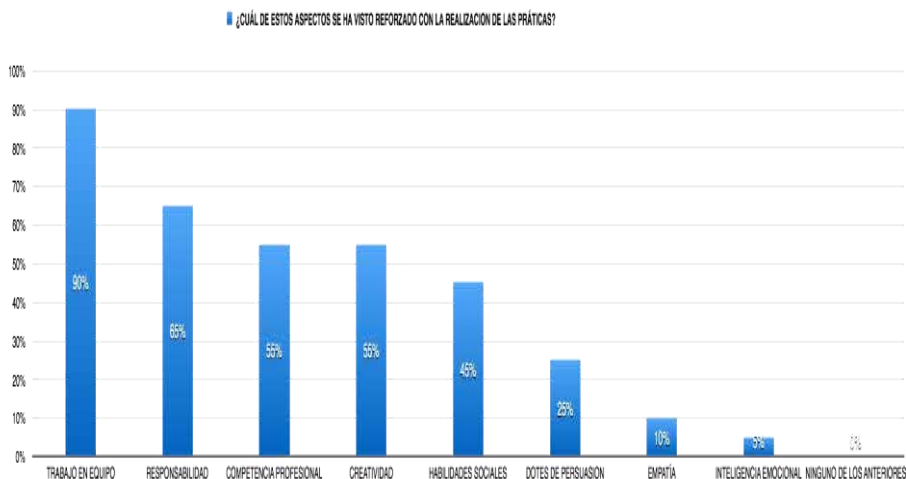


Figura 5. Aspectos reforzados con la realización de las prácticas. Fuente: Elaboración Propia

Cada una de las prácticas que se han expuesto a lo largo de la presente comunicación han tenido un diferente nivel de aceptación en el aula, como se puede apreciar en la siguiente gráfica.

Las prácticas docentes también han ayudado a reforzar y mejorar toda una serie de competencias como las que se indican en la gráfica siguiente y que son resultado de las opiniones vertidas por los alumnos.

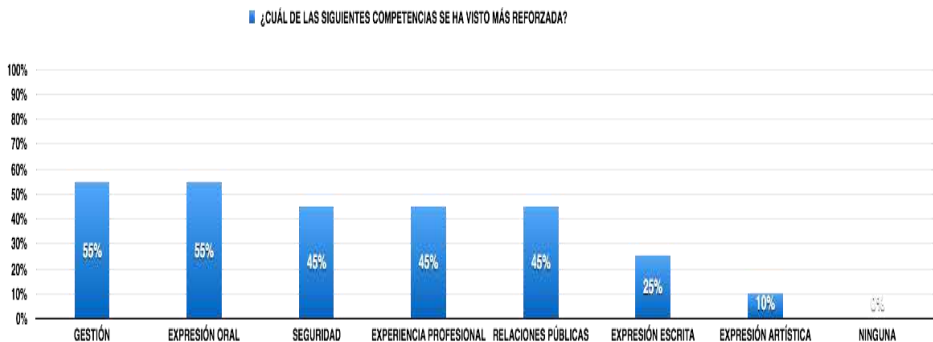


Figura 6. Competencias reforzadas con la realización de prácticas. Fuente: Elaboración Propia

El nivel de aceptación de cada una de las fases de las que se compuso el proyecto transversal de 3º de CAU del Campus de Gandía fue ciertamente elevado. La gráfica que se expone a continuación muestra las preferencias de los estudiantes por cada una de las fases de la elaboración del proyecto transversal (la elaboración de un cortometraje de ficción).

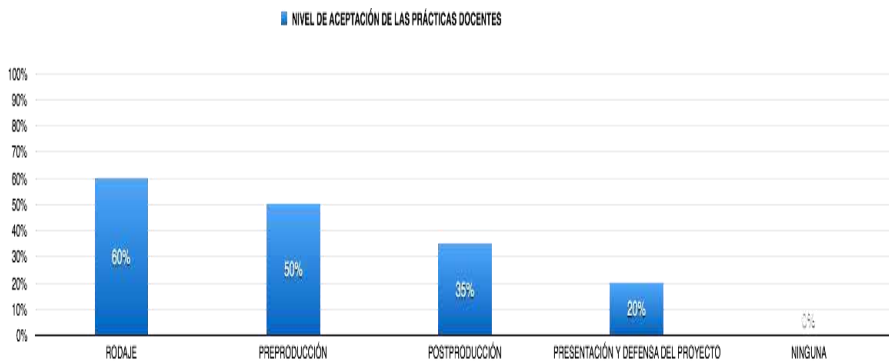


Figura 7. Nivel de Aceptación de cada una de las prácticas. Fuente: Elaboración Propia

La misma encuesta reservaba un espacio al final para que los alumnos pudieran expresar su opinión como participantes de esta experiencia docente. De ellas se extraen, a continuación, en la tabla 1 algunas de las más relevantes.

Tabla 3. Opinión del alumnado sobre la experiencia docente

1. *“Creo que ha sido una de las asignaturas más productivas y con las que más he aprendido”*
2. *“Muy importante para el sector audiovisual y necesario para el aprendizaje*
3. *“Buena experiencia. La atención y dedicación personal ha sido muy buena”.*
4. *“Esta asignatura ha servido de mucho para ahondar en el aspecto comercial del audiovisual, cosa que se agradece ya que no se suele tratar”.*
5. *“Una asignatura IMPRESCINDIBLE que, com la majoria, s’ha quedat curta de temps”.*
6. *“Utilitat en molts aspectes/àmbits dins de les eixides de Comunicació Audiovisual, no sols curtmetratge”.*
7. *“Soltura i productivitat a l’hora de crear tot el ‘papeleo’ necessari”.*
8. *“Prácticas que motivan y empujan a la creación de proyectos y al aprendizaje de su organización y gestión”.*
9. *“Me parece una asignatura muy útil para el proyecto transversal (cortometraje), ya que gran parte del trabajo es de reproducción y, gracias a las prácticas, hay partes que se realizan fácilmente”.*
10. *“Considero que esta asignatura nos ha ayudado a conocer el medio de forma más professional y a adquirir sus responsabilidades”.*

4. Conclusiones

Trabajo en equipo, responsabilidad, competencia profesional, expresión oral y escrita, inteligencia emocional, empatía, habilidades sociales o dotes de persuasión son algunos de los aspectos puestos en práctica y mejorados por los alumnos durante la realización de las experiencias expuestas. Todos estos aspectos y competencias han podido ser objetivados gracias a la observación y mantenimiento de unas determinadas pautas que tienen que ver con el trabajo grupal y casi personalizado llevado a cabo por el tutor y por su elevado nivel de exigencia con el fin de trasladar al alumnado una sensación de tensión competitiva parecida a la que puedan encontrarse en un entorno laboral próximo. Los valores anteriormente mencionados han podido tener una evidencia empírica gracias a la elaboración y cumplimentación de una completa encuesta³ que ha permitido extraer una serie de conclusiones expuestas

³ Encuesta adjunta en el anexo I de la presente comunicación

a lo largo de esta comunicación y que permiten considerar como muy positiva la realización de estas prácticas docentes. Dicha encuesta ha permitido hacer visible algo fundamental para la elaboración de esta clase de comunicaciones: la opinión del alumno, es decir, la voz del estudiante que libremente expresa su parecer respecto de la experiencia docente. Esto permite disponer de evidencias, tanto de aceptación como de rechazo por parte del principal colectivo afectado y centro de atención de este trabajo.

El aprovechamiento de las innovaciones tecnológicas y su adaptación a la docencia universitaria es una de las claves que han de marcar la diferencia entre un alumnado pasivo y desmotivado y otro activo y alentado. El profesorado tiene un gran aliado en las nuevas tecnologías para conseguir esa deseada y necesaria transformación entre el alumno que se limita a asistir a clases teóricas, memoriza el temario, contesta el examen y olvida poco después, a ese otro alumno que se siente partícipe, implicado, integrado e inspirado al adquirir conocimientos que puede llevar a la práctica de forma casi inmediata. Esa gran diferencia la ponen a nuestro alcance las nuevas tecnologías (toda una realidad en el aula) que los docentes hemos de saber asimilar y aprovechar como herramientas realmente útiles para la mejor formación personal y profesional de nuestro alumnado.

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Anexo 1: Cuestionario prácticas de la asignatura de 3º de CAU “El proceso cinematográfico”.

1- Nivel de utilidad futura de las prácticas de la asignatura

a) Muy alto b) Intermedio c) Bajo d) Muy bajo

2- ¿Cuál de estos aspectos se ha visto reforzado con la realización de las prácticas?

a) Trabajo en equipo b) Responsabilidad c) Competencia profesional d) Inteligencia emocional e) Empatía f) Habilidades sociales g) Dotes de persuasión h) Creatividad
i) Ninguno de las anteriores

3- ¿Cuál de las siguientes prácticas te han resultado más útiles para tu formación?

a) Presentación y defensa del proyecto b) Solicitud de permisos c) Desgloses diversos d) Redacción del guión literario e) Elaboración del storyboard f) Elaboración de un presupuesto
g) Ninguna de las anteriores

4- ¿Competencias reforzadas con la realización de las prácticas de la asignatura?

a) Seguridad y autoconfianza b) Experiencia profesional c) Expresión oral d) Expresión escrita e) Expresión artística f) Relaciones públicas g) Gestión h) Ninguna de las anteriores

5- ¿Qué fase del proyecto transversal (cortometraje) te ha gustado más?

a) Preproducción b) Producción o Rodaje c) Postproducción d) Presentación y Defensa pública del proyecto e) Ninguna de las anteriores

6- Nivel de aceptación de esta clase de prácticas docentes

a) Muy Alto b) Alto c) Bajo d) Muy bajo

7- Nivel de rechazo de esta clase de prácticas docentes

a) Muy Alto b) Alto c) Bajo d) Muy bajo

8- Nivel de adecuación de las prácticas realizadas con la teoría dada en el aula

a) Muy Alto b) Alto c) Bajo d) Muy bajo

9- ¿Podrías resumir brevemente cuál es tu opinión respecto de la experiencia docente?

Fuente: Elaboración Propia

La orientación de los alumnos en la Universidad

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Resumen

En el contexto en el que se desarrolla la enseñanza superior se pone de manifiesto la importancia que adquiere la orientación como estrategia de ayuda y apoyo al alumnado universitario en todos los ámbitos. Ante esto, la Universidad está incrementando la oferta de servicios de apoyo al alumnado que se caracterizan por la heterogeneidad pues no hay un modelo único. En este trabajo queremos destacar tres aspectos: la necesidad de orientación del alumnado universitario, la importancia de la orientación como indicador de calidad de la enseñanza universitaria y la tutorización de pares como una particular estrategia de orientación. Así, tras analizar la necesidad de orientación en el contexto universitario actual y su importancia como indicador del buen funcionamiento y calidad de la enseñanza superior, la atención de este trabajo se centra en un programa concreto de acción tutorial, el PATEC, y una estrategia de apoyo, el programa alumno-tutor, que pretende acercar el Programa de tutorización al conjunto del alumnado y que reporta beneficios para ambos tipos de alumnos. Los tutorizados porque se benefician de la ayuda y apoyo que reciben de su compañero tutor; y los alumnos-tutores porque la preparación que adquieren para ofrecer esa ayuda les permite adquirir competencias transversales que van a contribuir a su desarrollo personal, social y profesional

Palabras clave: EEES, orientación, tutoría, alumno-tutor.

Introducción

Los cambios que está experimentando la enseñanza superior, las demandas de la sociedad, la problemática a la que se enfrenta diariamente el alumnado que cursa estudios universitarios y el incremento del número de estudiantes que acceden a los estudios superiores, que en algunas titulaciones se puede considerar que están masificados, implica una mayor diversidad del alumnado y con ella las mayores necesidades de orientación e información.

Álvarez (2010) enumera las características del alumnado que accede a la Universidad: es una población muy heterogénea en cuanto a su procedencia social y cultural y en cuanto a su trayectoria y resultados académicos previos; amplios porcentajes de alumnos proceden de medios familiares sin ninguna tradición de estudio en la Universidad, lo que dificulta los procesos de adaptación de estos estudiantes; la elección de estudios realizada por parte de la población estudiantil al finalizar la Educación Secundaria es ficticia en un porcentaje considerable de casos; los profesores han de lidiar con grupos de alumnos escasamente motivados y culturalmente muy diferentes, lo cual dificulta extraordinariamente las relaciones docentes; y todo lo anterior motiva un alto grado de fracaso en el primer curso de enseñanza universitaria y un considerable abandono de los estudios y de la Universidad. Cada año se repiten entre el alumnado universitario situaciones problemáticas relacionadas con dificultades de integración y adaptación al medio, falta de criterios al elegir asignaturas optativas, escasas expectativas de desarrollo profesional, carencia de habilidades intelectuales y sociales, ... (Álvarez y Cabrera, 1997). Estas cuestiones ponen de manifiesto la necesidad de información y de orientación del alumnado en los procesos de transición y adaptación a la enseñanza universitaria (Arbizu, 1994). Por tanto, la orientación universitaria se propone ofrecer al alumno la ayuda precisa para el desarrollo de su personalidad, el aprovechamiento óptimo de sus estudios y la elección del tipo de profesión más apropiada a sus intereses y aptitudes teniendo en cuenta el mercado laboral (Díaz, 1991), lo que ha llevado a que en los últimos tiempos se hayan potenciado los servicios encargados de desarrollar acciones orientadoras en este tramo de la enseñanza y se haya comenzado a resaltar la figura del profesor tutor (Álvarez y Lázaro, 2002).

Por otra parte, las demandas de la enseñanza universitaria en el contexto del EEES requieren de la puesta en práctica de estrategias dirigidas a lograr una formación del alumnado más integral. Este desarrollo integral del estudiante requiere de la ayuda de orientación y se concreta en actuaciones dirigidas a estimular y favorecer el desarrollo personal, educativo y profesional del estudiante (Álvarez y Lázaro, 2002). En este sentido, la orientación en la Universidad no debe centrarse únicamente en aspectos académicos y profesionales. La orientación personal y la atención a la diversidad (dificultades de aprendizaje, discapacidad, cultural) también son muy relevantes en esta etapa universitaria aunque requieren de una mayor especialización y recursos.

Como señala Álvarez (2010), la orientación en la Universidad debería consistir en una acción institucional y planificada de apoyo a los profesores en sus tareas docentes y a los estudiantes en el proceso de aprendizaje para su formación e inserción profesional. Esta acción orientadora debería planificarse y desarrollarse prioritariamente a nivel de centro, lo que permitiría una adaptación más ajustada a la cultura del mismo y a las necesidades de sus profesores y de sus alumnos, y a un mejor aprovechamiento de los recursos.

Actualmente se pueden encontrar distintos modelos orientadores en la enseñanza universitaria en los que los profesores en general o una parte de ellos intervienen asesorando a sus estudiantes y son asesorados a su vez por los Servicios de Orientación de las Universidades (Álvarez y González, 2010). Además del profesor-tutor cabe destacar la figura del alumno-tutor que como explica García (2010) serán "estudiantes de cursos superiores que se capaciten y comprometan con la labor de ayudar a sus compañeros de cursos inferiores". Esta tutorización entre iguales puede ser de gran interés para algunos aspectos concretos de la orientación del alumno ya que la perspectiva de un compañero puede ser mucho más valorada por el alumno que la opinión de un profesor. Al igual que en el caso del profesor-tutor es necesario que el alumno-tutor reciba una formación y orientación previa para poder desarrollar su cometido con los mejores resultados posibles.

1. La orientación como indicador de calidad de las universidades

La emergencia de las políticas de mejora de la calidad en escenarios cada vez más internacionales ha forzado a las instituciones universitarias a revisar sus políticas y planes, encauzándolos hacia el establecimiento de objetivos estratégicos e indicadores que también inciden en la docencia, la formación y los resultados de aprendizaje de los estudiantes (Martínez, 2009).

La mayoría de las experiencias que se vienen desarrollando en el ámbito de la tutoría universitaria tienen su origen en los planes de Evaluación Institucional llevados a cabo en los últimos tiempos en los Centros y Facultades universitarias, en cuyos informes se recogen distintas carencias que hacen aconsejable la puesta en práctica de Planes de Tutoría (Álvarez y González, 2010).

Así, la orientación como parte integrante del proceso educativo, se ha convertido en claro indicador de calidad y de buen funcionamiento de los sistemas educativos (Echevarría, Figuera y Gallego, 1996). Aunque en los niveles de primaria y secundaria es un hecho, en la Universidad no es así pues se supone que el estudiante universitario tiene autonomía y madurez para tomar decisiones. Sin embargo, el aumento en las posibilidades de elección del alumnado unido a las dificultades de inserción en el mercado laboral en la etapa universitaria hace necesaria la orientación en la enseñanza superior.

Vidal, Díez y Vieira (2002) hacen una recopilación de buenas prácticas en el ámbito de los servicios de orientación. En concreto, distinguen:

- Redes de trabajo en dos niveles: interuniversidades (servicios que trabajan en los mismos ámbitos en distintas universidades) e intrauniversidades (agrupaciones de servicios - ámbito académico, profesional y personal- en la misma Universidad).
- Acción tutorial organizada en torno a dos figuras que actúan como tutores: profesorado y alumnado de últimos cursos.
- Adaptación a las necesidades del entorno laboral: creación de unidades de orientación para el empleo.
- Atención a Alumnos con Necesidades Educativas Especiales: el objetivo es fomentar la igualdad de oportunidades atendiendo a esta tipología de alumnado.

La calidad de la enseñanza universitaria pasa necesariamente por incrementar la oferta de servicios de apoyo a estudiantes tanto dentro como fuera del aula (servicios de orientación, de información, de transición al empleo, etc.) para ayudar al alumno en su toma de decisiones durante su estancia en la Universidad. Álvarez (2010) plantea que esta oferta de servicios puede realizarse desde diferentes niveles de la organización universitaria: desde los servicios generales de la Universidad, dada la heterogeneidad de los centros y de los estudiantes, y desde los entornos más próximos a los estudiantes (centros y departamentos).

En definitiva, en el contexto de la enseñanza superior la tutoría debe verse como una estrategia ante los nuevos retos a los que debe enfrentarse permanentemente el alumnado, por lo que precisa de algún tipo de guía, de ayuda, de asesoramiento que le evite el fracaso y le acompañe por el largo camino de la formación universitaria y en la transición al mundo del trabajo (Álvarez y González, 2001).

La tutoría universitaria, como iniciativa de apoyo al proceso de enseñanza-aprendizaje, permite que los estudiantes reciban una ayuda personalizada para adaptarse al contexto universitario y para planificar su itinerario formativo y profesional por lo que debería mejorar la calidad de la educación superior.

2. El profesor-tutor

Ante las necesidades de orientación, las universidades potencian con diferente intensidad servicios de orientación, documentación, asesoramiento, pero sobre todo de información (Salmerón, 2001). Sin embargo, es necesario que el profesorado se implique en estas acciones orientadoras si se tiene en cuenta la cantidad y diversidad de estudiantes que hay en la Universidad, que no han alcanzado el grado de madurez necesario para afrontar la diversidad de nuevas situaciones y, que sin la ayuda apropiada, corren el riesgo de prolongar o abandonar estudios (Álvarez, 2005). La labor orientadora del profesorado es fundamental y en este sentido, el profesor tutor se preocupa por la formación integral del alumnado, es un referente a lo largo de sus estudios y se preocupa por su proyección social y profesional (Álvarez, 2002).

El profesor tutor es quien mejor puede ayudar al alumnado a adaptarse a la enseñanza universitaria, puede estimular su promoción académica y profesional asesorándole sobre los

estudios de tercer ciclo e informándole sobre las salidas profesionales de cada titulación (Álvarez, 2005). En la medida en que el profesor conozca las necesidades de sus estudiantes y de la institución, dispondrá de mejores recursos para mejorar el aprendizaje de los alumnos (Santos, 2005).

En este sentido, se hace evidente la necesidad de incidir en la formación del profesorado universitario. No es habitual que el profesorado se haya formado como profesor-tutor y, dado que tiene que atender a estudiantes de diferentes edades, cursos, capacidades y experiencia, las iniciativas en formación del profesorado universitario permiten suplir esta carencia.

3. La mentoría o tutorización de pares como estrategia de orientación en la Universidad

Antes de pasar de los estudios de bachillerato a la Universidad, el alumnado tiene que tomar decisiones muy importantes como elegir la carrera y la Universidad. Además, tendrá que enfrentarse a un nuevo sistema de enseñanza-aprendizaje, nuevo círculo de amigos, etc. Este tránsito debe hacerse de manera adecuada para no terminar en fracaso académico y abandono de los estudios. En estos primeros momentos, la mentoría o tutoría entre iguales, entendida como la ayuda entre estudiantes, podría facilitar el tránsito de Bachillerato a la Universidad y la adaptación al contexto universitario.

Los objetivos que perseguiría la tutoría entre iguales para el alumnado de nuevo ingreso serían: facilitarle la transición y adaptación a la Universidad; fomentar su participación en la vida universitaria; proporcionarle información tanto general como académica y administrativa; dar respuesta a sus necesidades y dificultades. Y los objetivos para el alumnado tutor serían potenciar la adquisición de competencias transversales que contribuyan a su desarrollo personal, social y profesional.

La mentoría como estrategia de apoyo y orientación ante las necesidades que tiene el alumnado universitario es una herramienta útil que facilita al estudiante su incorporación a la Universidad en general y a su titulación en particular.

La mentoría se presenta como un recurso fundamental ya que según Valverde et al. (2004): favorece la optimización del aprendizaje y el desarrollo máximo del potencial humano; potencia el desarrollo global del alumno (no sólo el académico); aporta beneficios a los alumnos que reciben ayuda (ayuda a desarrollar su potencial humano y social), a los mentores (desarrollan competencias que pueden utilizar en su vida personal y profesional) y a la institución; mejora la comunicación entre alumnos, profesores y entre ambos; ayuda al alumnado a conocer más fácilmente la Universidad y todos los elementos que la integran y caracterizan.

Una de las principales características de este tipo de asesoramiento es que se reduce la distancia entre tutor y tutorizado al ser ambos alumnos (aunque de diferentes cursos) lo que crea un contexto favorable para el aprendizaje y para que la comunicación a todos los niveles se produzca de manera satisfactoria (González y Álvarez, 2005).

Un elemento fundamental del que depende el éxito de este tipo de orientación es la formación de los alumnos tutores. Estos alumnos tutores, además de tener conocimientos sobre la Universidad, los servicios que ofrece, la titulación, plan de estudios, normativa académica, etc., también tienen que poseer ciertas capacidades como habilidades de comunicación, empatía, saber trabajar en equipo o resolución de problemas.

Esta formación debería cubrir todos los aspectos necesarios para poder facilitar la información y orientación administrativa, académica, social y personal al alumnado tutorizado. Podrían distinguirse varias fases de formación y, en concreto, siguiendo el programa piloto de tutoría entre iguales presentado por la Universidad del País Vasco para el curso 2012-2013 (<http://web.ua.es/es/ice/documentos/tutorial/material/ivjornada/pat-entre-iguales.pdf>) se destacan las siguientes: una primera sesión dedicada a la metodología de la intervención, una segunda sesión de habilidades comunicativas, la tercera sesión se dedicaría al conocimiento y funcionamiento de la Universidad y la última sesión se dedicaría al Centro y la titulación.

En definitiva, con el alumnado de últimos cursos que ha recibido formación para actuar como tutor se pretende conseguir una adecuada integración en la Universidad de los alumnos de primeros cursos al tiempo que los alumnos tutores desarrollan habilidades sociales y aptitudes para el desempeño profesional (Vidal, Díez y Vieira, 2002).

4. El PATEC como estrategia de orientación en la Universidad

Las actividades de orientación promovidas por las universidades van desde la acogida de alumnos de nuevo ingreso, la información y orientación a los alumnos en el acceso y permanencia en la Universidad, hasta la incorporación al mercado de trabajo (Vidal, Díez y Vieira, 2002), pasando por la utilización de métodos para fomentar el aprendizaje autónomo del alumnado y actividades para compensar dificultades académicas o lagunas informativas, etc. (Álvarez, 2005). Y, en este contexto, las relaciones personales que se establecen, especialmente entre los profesores y los estudiantes, y de todos ellos con la institución, son un elemento crucial para la mejora de la calidad que ofrece el sistema (Rué, 2004).

Como se ha puesto de manifiesto, el alumnado necesita orientación, si bien es cierto que a lo largo de su estancia en la Universidad estas necesidades van variando, generando diferentes momentos de orientación. Martínez (2009) y Gairín et al. (2013) enumeran los siguientes:

- Promoción. Antes de ingresar en la Universidad. En esta fase, el trabajo en red entre las universidades y los centros de secundaria debe permitir a los estudiantes acceder a la información y clarificar sus intereses.
- Acogida. La inserción en la vida universitaria también merece una atención particular por diversos motivos: la masificación de la Universidad y el incremento de la oferta y su diversidad, la exigencia de participación del nuevo alumnado (participación académica, sociocultural, política o institucional) o la prevención del riesgo de abandono.

- Permanencia. Durante la realización de los estudios universitarios. En esta fase, que se considera el núcleo de las acciones de orientación, el estudiante construye el conocimiento y la tutoría y la orientación son el complemento de las clases, no su suplemento.
- El egreso. Al finalizar los estudios universitarios. Esta fase constituye la transición hacia la especialización o hacia el trabajo. Cualquiera de las dos opciones debe ser fruto de un proceso de reflexión que debe producirse antes de finalizar la carrera pero que no siempre se produce.

En la tabla 1 se exponen las principales necesidades de orientación del alumnado, los momentos de orientación que se establecen así como las actividades que se pueden poner en marcha en cada una de esas etapas.

Como ha quedado patente, en el nuevo contexto en el que se desarrollan las enseñanzas universitarias las distintas universidades han puesto en marcha estrategias orientadoras. Sin embargo, estas iniciativas no responden a un patrón común.

En la Universidad de Alicante desde el curso 2005-2006 se viene desarrollando el Plan de Acción Tutorial (PAT) promovido por el Vicerrectorado de Estudios, Formación y Calidad y coordinado desde el Instituto de Ciencias de la Educación (ICE). En el marco del PAT, la Facultad de Ciencias Económicas y Empresariales pone a disposición de su alumnado el programa de acción tutorial conocido coloquialmente como PATEC (<http://economicas.ua.es/es/patec/programa-de-accion-tutorial-para-el-alumnado-de-la-facultad-de-cc-economicas-y-empresariales.html>). El objetivo del PATEC es proporcionar al alumnado de la Facultad una persona de referencia que les ayude en su adaptación a la Universidad y les oriente a nivel académico, personal y profesional.

Tabla 1. Necesidades, momentos y actividades en el ámbito de la orientación. Fuente: Martínez (2009), Gaírín et al (2013) y Elaboración Propia

Necesidades de orientación del alumnado	Momentos de orientación	Actividades de orientación
Comprender la oferta formativa y madurar la opción o elección vocacional.	Antes del ingreso en la Universidad	Conferencias informativas y charlas al alumnado y profesorado de secundaria, Jornadas de puertas abiertas. Trabajo con profesores de secundaria.
Insertarse eficazmente en la vida universitaria. Participar en la Universidad.	La inserción en la Universidad	Jornadas de acogida a los alumnos de nuevo ingreso, charlas relacionadas con aspectos académicos (charlas sobre técnicas de estudio, preparación de trabajos, planificación del tiempo, etc.). Tutoría para la matriculación, servicio de orientación.
Desarrollar las competencias académicas y profesionales. Familiarizarse con el entorno formativo y laboral relacionado con el perfil formativo y profesional.	Durante la realización de los estudios universitarios.	Tutorías individuales, asesoramiento psicológico, sobre itinerarios formativos, sobre prácticas externas, sobre programas de movilidad. Técnicas de estudio y apoyo, flexibilidad curricular, desarrollo habilidades sociales.
Orientación para acceso a tercer ciclo. Preparar y ejecutar la transición hacia el mercado de trabajo desde la formación inicial.	Al finalizar los estudios universitarios.	Charlas informativas sobre estudios de postgrado, Jornadas de orientación profesional, asesoramiento sobre incorporación al mercado de trabajo. Información perfiles profesionales, búsqueda de empleo, convenios Universidad-centros de trabajo.

A continuación se muestran los datos más relevantes que muestran cómo ha evolucionado el Programa. La Figura 1 muestra la evolución del número de tutores del PATEC desde 2007 hasta 2016. La Facultad ha pasado de tener 23 tutores en el curso 2007-2008 a 19 en el curso 2015-2016. El número de tutores se ha mantenido aunque destaca la reducción importante en el curso 2013-14. Estos tutores atienden a todos los alumnos de la Facultad.

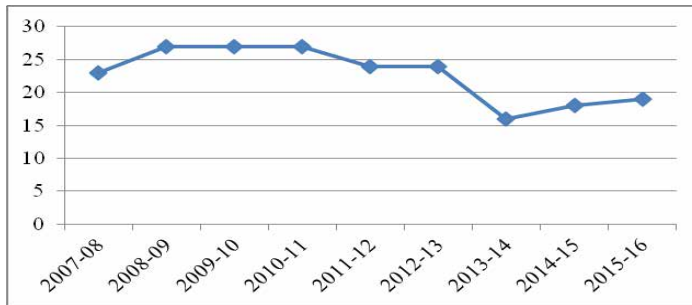


Figura 1. Evolución del número de tutores. Fuente: ICE y elaboración propia.

El número de alumnos inscritos en el Programa muestra una tendencia creciente salvo en el curso 2012-2013 (Figura 2) y alcanza el máximo en los dos primeros años de implantación de los grados superando los 1.500 alumnos inscritos. En el curso actual han solicitado participar en el PATEC 1.082 alumnos.

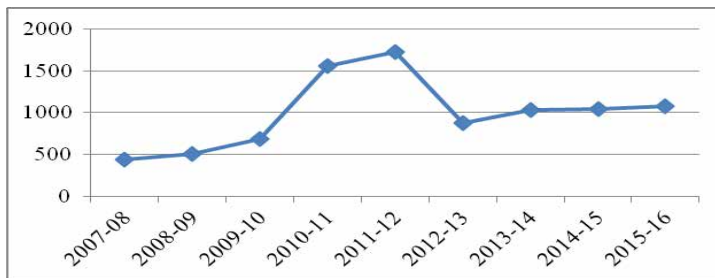


Figura 2. Evolución del número de alumnos tutorizados. Fuente: ICE y elaboración propia.

La Figura 3 muestra el número de alumnos medio por tutor. Se puede observar cómo los tres primeros años se mantiene una ratio aproximada de 20 alumnos por tutor. Sin embargo, a partir del curso 2010-11 se produce un incremento importante situándose en el último curso en 57 alumnos por tutor.

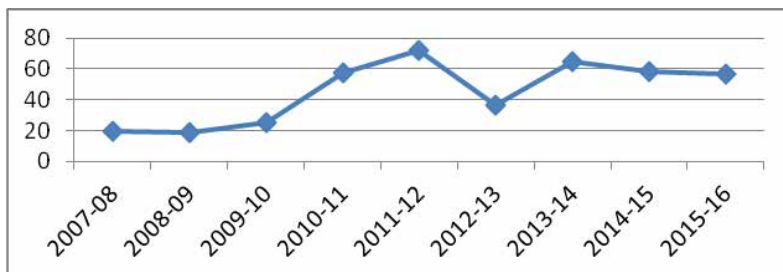


Figura 3. Evolución de la ratio alumno/tutor. Fuente: ICE y elaboración propia.

En cuanto a las actividades que se realizan en el marco del PATEC, además de las reuniones grupales y tutorías individuales, la Facultad organiza actividades complementarias con el

objetivo de contribuir a la formación integral del alumnado. Estas actividades están relacionadas con aspectos académicos (tratando de mejorar el rendimiento que obtienen los alumnos), con la continuación de estudios y con la mejora de la empleabilidad y de las posibilidades de inserción en el mercado de trabajo de nuestros futuros egresados. Las charlas relacionadas con aspectos académicos que se han realizado hasta el momento son: "Planificación y técnicas de estudio para universitarios", "Recursos y fuentes de información de la biblioteca", "Presentaciones en público de trabajos académicos", "Hablar en público y oratoria", "Charla informativa sobre acreditación del B1 en lengua extranjera", "Charla sobre elaboración del Trabajo de Fin de Grado". Y entre las actividades relacionadas con la empleabilidad e inserción laboral, se han realizado jornadas sobre empleabilidad (con la realización de charlas sobre la elaboración del curriculum vitae y la carta de presentación, la entrevista de trabajo, la búsqueda efectiva de empleo) y jornadas informativas sobre estudios de postgrado en las que se ha ofrecido información sobre la continuación de estudios en la Facultad. Destacar además de estas actividades las acciones de difusión dirigidas a futuros alumnos y el acto de presentación del Centro para los alumnos de primero. Se constata, pues, que el PATEC ha consolidado una oferta formativa importante que suponen un complemento a la formación académica. Este es un aspecto positivo del Programa que además presenta otras fortalezas:

- La labor de ayuda que realizan los tutores, dando apoyo y sirviendo de guía al alumnado lo que permite detectar y hacer un seguimiento de los problemas y necesidades del alumnado a lo largo de los años que permanece en la Universidad.
- El contacto personal y directo con el tutor, que puede repercutir en una mayor utilización de las tutorías académicas en los cursos más avanzados y potenciar el aprendizaje y los mejores resultados.
- Las sesiones grupales ofrecen al alumno el encuentro con compañeros con los que poder intercambiar experiencias e información.

Estas cuestiones contrastan con ciertas debilidades que presenta el Programa entre las que destacan:

- La escasa información y motivación del alumno que se inscribe en el Programa lo que repercute en una baja asistencia a las reuniones y actividades que se organizan y la falta de interés hacia el mismo.
- Las dificultades de comunicación entre el alumnado y los tutores (el correo institucional es una herramienta poco eficiente ya que los alumnos no lo usan).

Con el objetivo de solucionar estos problemas en el curso 2013-2014 se crea la Red de Tutores del PATEC con la que se pretende reflexionar sobre el funcionamiento del Programa. Inicialmente su planteamiento fue el de mejorar la comunicación, fomentar el diálogo y la

coordinación del equipo de tutores y recopilar recursos de manera sistemática para mejorar la labor de los tutores actuales y futuros. De aquí surgió la elaboración del Manual del Tutor que se ha ido actualizando en las distintas ediciones del PATEC. Este manual constituye un importante recurso para la acción tutorial que se pone a disposición del equipo de tutores al inicio de cada curso como material básico de acción tutorial.

En el curso 2014-2015 continuó el trabajo de la Red y se orientó hacia el análisis de buenas prácticas de acción tutorial en un grupo de universidades públicas¹. Los resultados de este análisis se pueden consultar en Tolosa et al. (2015). De la comparación entre estos programas de acción tutorial y el PATEC surgió la idea de implementar el programa alumno-tutor en la Facultad dado su potencial para acercar el PATEC al alumnado y mejorar la comunicación entre alumnos y tutores. Este programa se puso en funcionamiento en la Facultad en noviembre de 2015. Para llevarlo a cabo se lanzó la convocatoria que incluía los requisitos que debían cumplir los candidatos y el reconocimiento a su labor (toda la información sobre este programa se puede consultar en <http://economicas.ua.es/es/patec/alumnado-tutor-del-programa-de-accion-tutorial.html>).

La convocatoria para participar en este Programa va dirigida a los estudiantes de la Facultad que han participado con anterioridad en el PATEC y que, estando matriculados en un grado o en un máster, ofrecen apoyo y orientación a otros alumnos de grado con el fin de favorecer su integración y desarrollo académico y social. Los candidatos, además, tienen que tener habilidades comunicativas, empatía y sentido de la responsabilidad.

Para desarrollar su labor estos alumnos están asistidos por su profesor tutor. Además, el ICE (Instituto de Ciencias de la Educación) ha convocado una serie de talleres formativos específicos para alumnos-tutores con el objetivo de proporcionar a los participantes herramientas que contribuyan a generar un contexto de confianza para garantizar una comunicación más eficaz y productiva. En total han sido 12 horas de formación repartidas entre los siguientes talleres: 1) Generar confianza: base para la relación tutor-alumno; 2) Gestión emocional en la relación tutor-alumno; 3) Herramientas para una comunicación eficaz; 4) Mindfulness: obtén más provecho para la elección.

Estos alumnos-tutores ayudan a sus profesores-tutores en la orientación y seguimiento de otros estudiantes y se comprometen a asistir a las reuniones grupales que convoque el profesor-tutor, a facilitar información sobre la Universidad a los estudiantes tutorizados, a ayudarles a integrarse en la Universidad y en la titulación, a asistir a una sesión formativa

¹ Las universidades analizadas fueron: Universidad de Valencia, Universidad Jaume I, Universidad Politécnica de Valencia, Universidad de Murcia, Universidad Politécnica de Cartagena, Universidad de Barcelona, Universidad Autónoma de Barcelona, Universidad Rovira i Virgili, Universidad Politécnica de Madrid, Universidad Rey Juan Carlos, Universidad de Zaragoza, Universidad de Huelva, Universidad de Cantabria y Universidad Islas Baleares.

inicial a cargo del profesor-tutor y a elaborar una memoria final para evaluar el desarrollo del Programa.

Como reconocimiento estos alumnos-tutores recibirán un certificado de participación en el Programa, un certificado de haber recibido del ICE de la UA formación específica para tutores y el reconocimiento de un crédito por la participación en actividades universitarias y cursos de la UA.

Se pretende que en los próximos cursos se consolide este programa así como la oferta formativa necesaria para que estos alumnos tutores sepan dar una respuesta adecuada a las necesidades y demandas de información del alumnado tutorizado.

5. Conclusiones

Como ha quedado patente, en el nuevo contexto en el que se desarrollan las enseñanzas universitarias es fundamental la orientación como estrategia de ayuda y apoyo al alumnado universitario. Es por ello que las distintas universidades han puesto en marcha estrategias orientadoras que se caracterizan por la heterogeneidad pues no hay un modelo único.

En este sentido, la Facultad de Económicas de la Universidad de Alicante viene ofreciendo desde hace más de una década el PATEC. La labor de ayuda que se realiza, el contacto personal y directo con los estudiantes, las sesiones grupales como punto de encuentro entre estudiantes que intercambian experiencias e información, las tutorías individuales que permiten resolver cuestiones más personales y la oferta formativa son fortalezas que caracterizan al Programa. Pese a esto, el Programa sigue mostrando ciertas debilidades entre las que destacan la baja participación del alumnado en las reuniones y actividades que se organizan y las dificultades de comunicación entre el profesorado tutor y sus respectivos alumnos tutorizados.

Para dar respuesta a estas debilidades en el curso 2013-2014 se creó la Red de Tutores del PATEC como punto de encuentro en el que reflexionar sobre el funcionamiento del Programa para mejorarlo. Fruto de este trabajo surgió la idea de implantar la figura del alumno-tutor en la Facultad para acercar el Programa al conjunto del alumnado. En los próximos años se pretende seguir trabajando para consolidar este Programa así como la oferta formativa necesaria para que estos alumnos tutores sepan dar una respuesta adecuada a las necesidades y demandas de información del alumnado tutorizado.

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Trabajo por proyectos: estudio de la Óptica en 2º de Bachillerato

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Abstract

In this communication presents a proposal for teaching innovation in the subject of Physics in 2nd year of Baccalaureate, based on project learning. The innovation focuses on the implementation of this model in a block of contents "The Optics". It is a question of a key topic for the comprehension of the rest of contents of 2nd year of Baccalaureate o, and that is usually presented in a fragmented and incoherent way. It is therefore necessary to the development didactic methodologies where the prior knowledge of the students has an essential and active role and that make possible the assimilation of scientific knowledge.

Keywords: *optics, historic investigation, conceptual obstacle, learning standards, educational innovation.*

Resumen

En esta comunicación se presenta una propuesta de innovación docente en la asignatura de Física de 2º de Bachillerato basada en el aprendizaje por proyectos. La innovación se centra en la puesta en práctica de este modelo en un bloque de contenidos "La Óptica". Se trata de un tema clave para la comprensión del resto de contenidos de 2º de Bachillerato y que se suele plantear de manera fragmentada e incoherente. Es necesario, por tanto, el desarrollo de metodologías didácticas donde los conocimientos previos de los alumnos tengan un papel esencial y activo, y que hagan posible la asimilación de los conocimientos científicos.

Palabras clave: *óptica, estudio histórico, obstáculo conceptual, estándares de aprendizaje, innovación educativa.*

Introducción

En el currículo que establece la LOMCE para Física de 2º de Bachillerato la Óptica es un contenido fundamental. De los seis Bloques que componen el currículo, encontramos que gran parte del Bloque 4 se dedica a la explicación de la óptica ondulatoria y el Bloque 5 en su conjunto aborda la enseñanza de la óptica geométrica. El objetivo de la óptica geométrica sería apropiarse de un modelo de visión que explique cómo se forman las imágenes, lo que requiere el desarrollo de una teoría geométrica de la luz y de la visión. Por su parte, el objetivo de la óptica ondulatoria sería apropiarse de un modelo que explique la naturaleza de la luz y con el que se pueda exponer las bases de la óptica geométrica. Dada la importancia de estos contenidos en este nivel educativo, consideramos necesario una correcta planificación didáctica de los mismos que huya del aprendizaje memorístico presente en muchas prácticas educativas. En la presente comunicación nos proponemos efectuar un análisis exhaustivo del currículo de segundo de bachillerato a fin de detectar las posibles dificultades que los alumnos pueden encontrar para la superación de los estándares de aprendizaje establecidos al abordarse los contenidos referidos a estos Bloques de contenidos. Para ello, el profesor/investigador necesita conocer en profundidad la materia a tratar, ha de ser consciente de cuáles son los problemas que están en el origen de los conocimientos de la óptica, cuáles son las dificultades que hay que superar y las ideas clave que nos permiten avanzar en este conocimiento, entre otras posibles cuestiones. Todo ello requiere un estudio histórico y epistemológico del campo a tratar (Duit et al., 2005; Furió et al., 2006) que posibilitará una planificación didáctica posterior fundamentada en el aprendizaje por proyectos. A través de esta metodología, pretendemos que los alumnos contemplen los contenidos como significativos, desarrollen la necesidad de saber, se sientan con voz y voto en su proceso de aprendizaje, sientan que pueden plantear nuevos interrogantes sobre la óptica, conciben la evaluación relacionada con la realimentación y revisión y puedan, eventualmente, presentar los resultados de su investigación sobre el tema a una audiencia (Trujillo, 2015; Larmer y Mergendoller, 2010).

1. Obstáculos en la enseñanza de la Óptica

Hay muchas razones para incorporar la historia de la ciencia en la enseñanza de la física (Galili y Hazan, 2000; Galili, 2016). En nuestro tema de estudio, el análisis histórico de la enseñanza de la óptica posibilita establecer las grandes ideas clave que tienen que comprender nuestros alumnos y, a su vez, nos ayuda a detectar los obstáculos que previsiblemente tendrán los estudiantes en el aprendizaje de la materia, estableciendo un paralelismo entre sus ideas intuitivas y las mantenidas en algún momento de la historia de la ciencia. Tal como afirma Dedes (2005) todas las ideas básicas que encontramos en las antiguas teorías de visión se pueden encontrar en las concepciones de los estudiantes también. El desarrollo histórico de las ideas sobre óptica y las similitudes entre las ideas de los estudiantes y aquellas de los primeros científicos han sido discutidas previamente

(Dedes 2005; Galili 1996; Galili y Lavrik 1998; Galili y Hazan 2000; La Rosa et al. 1984; Selley 1996). La Historia de la Ciencia puede inspirar estrategias de enseñanza que se pueden utilizar como principio organizador del currículo (Matthews, 1994), como es nuestro caso. Del análisis histórico que hemos realizado podemos derivar la existencia de ciertas dificultades que encontrarán los estudiantes para integrar los modelos geométrico y ondulatorio de la óptica así como ideas erróneas sobre nuestras metas orientadoras, necesarias para comprender cómo vemos y cuál es la naturaleza de la luz (Galili y Hazan, 2000; Viennot y Chauvet, 1997; Osborte et al, 1993; Rice y Feher, 1987; La Rosa et al, 1984; Anderson y Karrqvist, 1983).

Entre los objetivos de nuestra propuesta de innovación docente está que los estudiantes se apropien del modelo de visión de Kepler y comprendan la naturaleza de la luz. Centrando el análisis histórico en este modelo de visión, deben contemplarse este tipo de obstáculos a los que han de enfrentarse los estudiantes. Los primeros obstáculos están relacionados con el modelo de visión de Kepler, ya identificados por Osuna (2007, 2012):

1. Creer que no es necesario que llegue luz al ojo para ver
2. No pensar que de los objetos iluminados sale luz.
3. No considerar a la luz como una entidad independiente que viaja en el espacio
4. Creer que el rayo de luz es lo que se ve, por ejemplo, por los agujeritos de las persianas.
5. No utilizar haces divergentes de luz procedentes de cada punto de la fuente, para explicar la formación de sombra e imágenes.
6. Creer que la imagen es “algo” que se traslada entera
7. Creer que la imagen tiene existencia real independientemente del sistema ojo-cerebro.

Otros obstáculos relativos a la apropiación del modelo ondulatorio de la luz serían:

1. No considerar los límites de los modelos y teorías.
2. Pensar que la luz se modifica al interactuar con los objetos
3. Creer que el color es una propiedad de la luz o de los objetos
4. No comprender que en distintos medios, cada onda de frecuencia diferente, tendrá una velocidad diferente.
5. No consideran el carácter heterogéneo de la luz “blanca”.
6. No explicar correctamente qué son los colores
7. Considerar que la luz es de naturaleza material
8. No considerar que la luz tiene carácter ondulatorio y comprender sus fenómenos básicos
9. No comprender las características propias de la naturaleza de la luz tan alejadas de la percepción humana.
10. No relacionar la producción de luz con fenómenos eléctricos y magnéticos conocidos

11. No comprender que el campo está dotado de energía y momento
12. No comprender la velocidad de propagación de la luz en relación a la inducción electromagnética.
13. No comprender qué es una radiación electromagnética
14. Creer que es necesaria la existencia de un medio material para la propagación de la luz
15. No interpretar el formalismo diagramático matemático que describe una onda electromagnética plana
16. No considerar la necesidad de utilizar luz coherente para la producción de interferencias
17. No utilizar el modelo ondulatorio correctamente para explicar fenómenos previamente explicados con el modelo geométrico (propagación rectilínea, reflexión, refracción)
18. No saber dibujar desde una perspectiva ondulatoria qué le ocurriría a una onda que se desplaza y en su camino encuentra una lente o un espejo esférico
19. No relacionar la sensación de color con la diferente respuesta de los fotorreceptores retinianos a la luz incidente.

2. Relación de los obstáculos encontrados con los elementos curriculares

Una vez identificados los obstáculos que históricamente se han asociado con el aprendizaje de este tipo de conocimientos, parece necesario establecer la relación con los contenidos curriculares que deben trabajarse en esta etapa educativa. Según la Ley Orgánica de Mejora de la Calidad Educativa (LOMCE) para cada bloque de contenidos curriculares deben establecerse unos criterios de calificación de acuerdo a unos indicadores de comprensión que los estudiantes han de alcanzar y que han de ser evaluables mediante unos estándares establecidos. En el siguiente cuadro analizamos la relación de dichos elementos curriculares con los obstáculos que presumiblemente encontrarán los alumnos, de acuerdo a nuestro análisis histórico y epistemológico de la óptica. En este caso, tomamos como referencia el currículum del Principado de Asturias, por ser esta la comunidad en donde se desarrolla la investigación (Consejería de Educación, Cultura y Deporte 2015). Dentro del Bloque 4 nos hemos quedado únicamente con los criterios correspondientes a la óptica física.

Tabla 1. Relación entre los elementos curriculares y los problemas identificados en el aprendizaje de la óptica.

Bloque 4. Ondas		
<p>Dentro de este bloque de contenidos, se trabajan los siguientes contenidos relacionados con nuestra investigación: Ondas electromagnéticas. Naturaleza y propiedades de las ondas electromagnéticas. El espectro electromagnético. Dispersión. El color. Transmisión de la comunicación.</p>		
CRITERIOS DE EVALUACIÓN INDICADORES	ESTÁNDARES DE APRENDIZAJE EVALUABLES	OBSTÁCULOS ENCONTRADOS
<p>Expresar la ecuación de una onda en una cuerda indicando el significado físico de sus parámetros característicos. Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Definir las magnitudes características de las ondas e identificarlas en situaciones reales para plantear y resolver problemas. - Deducir los valores de las magnitudes características de una onda armónica plana a partir de su ecuación y viceversa. 	<ul style="list-style-type: none"> - Obtiene las magnitudes características de una onda a partir de su expresión matemática. - Escribe e interpreta la expresión matemática de una onda armónica transversal dadas sus magnitudes características. 	<p>Obstáculo 15</p>
<p>Interpretar la doble periodicidad de una onda a partir de su frecuencia y su número de onda. Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Justificar, a partir de la ecuación, la periodicidad de una onda armónica con el tiempo y con la posición respecto del origen. 	<ul style="list-style-type: none"> - Dada la expresión matemática de una onda, justifica la doble periodicidad con respecto a la posición y el tiempo. 	<p>Obstáculo 15</p>
<p>Valorar las ondas como un medio de transporte de energía pero no de masa. Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Reconocer que una de las características más sobresalientes y útiles del movimiento ondulatorio es que las ondas transportan energía de un punto a otro sin que exista 	<ul style="list-style-type: none"> - Relaciona la energía mecánica de una onda con su amplitud. - Calcula la intensidad de una onda a cierta distancia del foco emisor, empleando la ecuación que relaciona ambas magnitudes. 	<p>Obstáculo 15</p>

<p>transporte de masa.</p> <ul style="list-style-type: none"> - Deducir la relación de la energía transferida por una onda con su frecuencia y amplitud. - Deducir la dependencia de la intensidad de una onda en un punto con la distancia al foco emisor para el caso de ondas esféricas (como el sonido) realizando balances de energía en un medio isótropo y homogéneo y aplicar los resultados a la resolución de ejercicios. - Discutir si los resultados obtenidos para ondas esféricas son aplicables al caso de ondas planas y relacionarlo con el comportamiento observado en el láser. 		
<p>Utilizar el Principio de Huygens para comprender e interpretar la propagación de las ondas y los fenómenos ondulatorios.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Visualizar gráficamente la propagación de las ondas mediante frentes de onda y explicar el fenómeno empleando el principio de Huygens. 	<ul style="list-style-type: none"> - Explica la propagación de las ondas utilizando el Principio de Huygens. 	<p>Obstáculos 15 y 24</p>
<p>Reconocer la difracción y las interferencias como fenómenos propios del movimiento ondulatorio.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Reconocer la difracción y las interferencias como fenómenos característicos de las ondas y que las partículas no experimentan. - Explicar los fenómenos de interferencia y la difracción a partir del Principio de Huygens. 	<ul style="list-style-type: none"> - Interpreta los fenómenos de interferencia y la difracción a partir del Principio de Huygens. 	<p>Obstáculos 8, 15 y 23</p>
<p>Emplear las leyes de Snell para explicar los fenómenos de reflexión y refracción.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Enunciar la ley de Snell en términos de 	<ul style="list-style-type: none"> - Experimenta y justifica, aplicando la ley de Snell, el comportamiento de la luz al cambiar de medio, conocidos los índices de refracción. 	<p>Obstáculos 8 y 11</p>

<p>las velocidades de las ondas en cada uno de los medios.</p> <ul style="list-style-type: none"> - Definir el concepto de índice de refracción e interpretar la refracción como una consecuencia de la modificación en la velocidad de propagación de la luz al cambiar de medio. - Aplicar las leyes de la reflexión y de la refracción en diferentes situaciones (trayectoria de la luz a su paso por un prisma, reflexión total) y para resolver ejercicios numéricos sobre reflexión y refracción, incluido el cálculo del ángulo límite. - Reconocer la dependencia del índice de refracción de un medio con la frecuencia y justificar el fenómeno de la dispersión. 		
<p>Relacionar los índices de refracción de dos materiales con el caso concreto de reflexión total.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Justificar cualitativa y cuantitativamente la reflexión total interna e identificar la transmisión de información por fibra óptica como una aplicación de este fenómeno. - Determinar experimentalmente el índice de refracción de un vidrio. 	<ul style="list-style-type: none"> - Obtiene el coeficiente de refracción de un medio a partir del ángulo formado por la onda reflejada y refractada. - Considera el fenómeno de reflexión total como el principio físico subyacente a la propagación de la luz en las fibras ópticas y su relevancia en las telecomunicaciones. 	<p>Obstáculos 8 y 11</p>
<p>Establecer las propiedades de la radiación electromagnética como consecuencia de la unificación de la electricidad, el magnetismo y la óptica en una única teoría.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Identificar las ondas electromagnéticas como la propagación de campos eléctricos y magnéticos perpendiculares. - Reconocer las características de una onda electromagnética polarizada y explicar gráficamente el mecanismo de actuación de los materiales polarizadores. - Relacionar la velocidad de la luz con las 	<ul style="list-style-type: none"> - Representa esquemáticamente la propagación de una onda electromagnética incluyendo los vectores del campo eléctrico y magnético. - Interpreta una representación gráfica de la propagación de una onda electromagnética en términos de los campos eléctrico y magnético y de su polarización. 	<p>Obstáculos 8, 14, 15, 16, 17, 18, 19, 20, 21 y 22</p>

constantes eléctrica y magnética.		
<p>Comprender las características y propiedades de las ondas electromagnéticas, como su longitud de onda, polarización o energía, en fenómenos de la vida cotidiana.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Determinar experimentalmente la polarización de las ondas electromagnéticas a partir de experiencias sencillas. - Identificar las ondas electromagnéticas que nos rodean y valorar sus efectos en función de su longitud de onda y energía. 	<ul style="list-style-type: none"> - Determina experimentalmente la polarización de las ondas electromagnéticas a partir de experiencias sencillas utilizando objetos empleados en la vida cotidiana. - Clasifica casos concretos de ondas electromagnéticas presentes en la vida cotidiana en función de su longitud de onda y su energía. 	Obstáculo 15, 16 y 22
<p>Identificar el color de los cuerpos como la interacción de la luz con los mismos.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Relacionar la visión de colores con la frecuencia. - Explicar por qué y cómo se perciben los colores de los objetos. 	<ul style="list-style-type: none"> - Justifica el color de un objeto en función de la luz absorbida y reflejada. 	Obstáculos 9, 10, 12, 13 y 26
<p>Reconocer los fenómenos ondulatorios estudiados en fenómenos relacionados con la luz.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Conocer el debate histórico sobre la naturaleza de la luz y el triunfo del modelo ondulatorio e indicar razones a favor y en contra del modelo corpuscular. - Explicar fenómenos cotidianos (los espejismos, el arco iris, el color azul del cielo, los patrones en forma de estrella que se obtienen en algunas fotografías de fuentes de luz, entre otros) como efectos de la reflexión, difracción e interferencia. 	<ul style="list-style-type: none"> - Analiza los efectos de refracción, difracción e interferencia en casos prácticos sencillos. 	Obstáculos 9, 11, 12, 13, 14, 15, 16 y 26
<p>Determinar las principales características de la radiación a partir de su situación en el espectro</p>	<ul style="list-style-type: none"> - Establece la naturaleza y características de una onda electromagnética dada su 	Obstáculos 8, 12, 15, 16, 17, 18, 19, 20 y 21

<p>electromagnético.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Describir el espectro electromagnético, ordenando los rangos en función de la frecuencia, particularmente el infrarrojo, el espectro visible y el ultravioleta, identificando la longitud de onda asociada al rango visible (alrededor de 500 nm). - Evaluar la relación entre la energía transferida por una onda y su situación en el espectro electromagnético. 	<p>situación en el espectro.</p> <ul style="list-style-type: none"> - Relaciona la energía de una onda electromagnética con su frecuencia, longitud de onda y la velocidad de la luz en el vacío. 	
<p>Conocer las aplicaciones de las ondas electromagnéticas del espectro no visible.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Reconocer y justificar en sus aspectos más básicos las aplicaciones tecnológicas de diferentes tipos de radiaciones. - Analizar los efectos de las radiaciones sobre la vida en la Tierra (efectos de los rayos UVA sobre la salud y la protección que brinda la capa de ozono). - Explicar cómo se generan las ondas de la radiofrecuencia. 	<ul style="list-style-type: none"> - Reconoce aplicaciones tecnológicas de diferentes tipos de radiaciones, principalmente infrarroja, ultravioleta y microondas. - Analiza el efecto de los diferentes tipos de radiación sobre la biosfera en general, y sobre la vida humana en particular. - Diseña un circuito eléctrico sencillo capaz de generar ondas electromagnéticas, formado por un generador, una bobina y un condensador, describiendo su funcionamiento. 	<p>Obstáculos 8, 10, 11, 14, 15, 16, 17, 18, 20 y 21</p>
<p>Reconocer que la información se transmite mediante ondas, a través de diferentes soportes.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Reconocer la importancia de las ondas electromagnéticas en las telecomunicaciones (radio, telefonía móvil, etc.). - Identificar distintos soportes o medios de transmisión (los sistemas de comunicación inalámbricos o la fibra óptica y los cables coaxiales, entre otros) y explicar de forma esquemática su funcionamiento. 	<ul style="list-style-type: none"> - Explica esquemáticamente el funcionamiento de dispositivos de almacenamiento y transmisión de la información. 	<p>Obstáculos 14, 15, 16, 17 y 20</p>

Bloque 5. Óptica Geométrica		
Se trabajan todos los contenidos de este bloque, estos son: Leyes de la óptica geométrica. Sistemas ópticos: lentes y espejos. El ojo humano. Defectos visuales. Aplicaciones tecnológicas: instrumentos ópticos y la fibra óptica.		
CRITERIOS DE EVALUACIÓN INDICADORES	ESTÁNDARES DE APRENDIZAJE EVALUABLES	OBSTÁCULOS ENCONTRADOS
<p>1. Formular e interpretar las leyes de la óptica geométrica.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Describir los fenómenos luminosos aplicando el concepto de rayo. - Explicar en qué consiste la aproximación paraxial. - Plantear gráficamente la formación de imágenes en el dioptrio plano y en el dioptrio esférico. - Aplicar la ecuación del dioptrio plano para justificar fenómenos como la diferencia entre profundidad real y aparente y efectuar cálculos numéricos. 	<p>1.1. Explica procesos cotidianos a través de las leyes de la óptica geométrica.</p>	<p>Obstáculos 1, 2, 3, 4, 5, 6, 7 y 8</p>
<p>2. Valorar los diagramas de rayos luminosos y las ecuaciones asociadas como medio que permite predecir las características de las imágenes formadas en sistemas ópticos.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Definir los conceptos asociados a la óptica geométrica: objeto, imagen focos, aumento lateral, potencia de una lente. - Explicar la formación de imágenes en espejos y lentes delgadas trazando correctamente el esquema de rayos correspondiente e indicando las características de las imágenes obtenidas. - Obtener resultados cuantitativos utilizando las ecuaciones correspondientes o las relaciones geométricas de triángulos semejantes. 	<p>2.1. Demuestra experimental y gráficamente la propagación rectilínea de la luz mediante un juego de prismas que conduzcan un haz de luz desde el emisor hasta una pantalla.</p> <p>2.2. Obtiene el tamaño, posición y naturaleza de la imagen de un objeto producida por un espejo plano y una lente delgada realizando el trazado de rayos y aplicando las ecuaciones correspondientes.</p>	<p>Obstáculos 2, 3, 4, 5, 6, 7 y 8</p>

<p>- Realizar un experimento para demostrar la propagación rectilínea de la luz mediante un juego de prismas.</p>		
<p>3. Conocer el funcionamiento óptico del ojo humano y sus defectos y comprender el efecto de las lentes en la corrección de dichos efectos.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Describir el funcionamiento óptico del ojo humano. - Explicar los defectos más relevantes de la visión utilizando diagramas de rayos y justificar el modo de corregirlos. 	<p>3.1. Justifica los principales defectos ópticos del ojo humano: miopía, hipermetropía, presbicia y astigmatismo, empleando para ello un diagrama de rayos.</p>	<p>Obstáculos 1, 2, 3, 4, 5, 6, 7 y 8</p>
<p>4. Aplicar las leyes de las lentes delgadas y espejos planos al estudio de los instrumentos ópticos.</p> <p>Mediante este criterio se valorará si el alumno o la alumna es capaz de:</p> <ul style="list-style-type: none"> - Explicar el funcionamiento de algunos instrumentos ópticos (lupa, microscopio, telescopio y cámara fotográfica) utilizando sistemáticamente los diagramas de rayos para obtener gráficamente las imágenes. 	<p>4.1. Establece el tipo y disposición de los elementos empleados en los principales instrumentos ópticos, tales como lupa, microscopio, telescopio y cámara fotográfica, realizando el correspondiente trazado de rayos.</p> <p>4.2. Analiza las aplicaciones de la lupa, microscopio, telescopio y cámara fotográfica considerando las variaciones que experimenta la imagen respecto al objeto.</p>	<p>Obstáculos 3, 4, 5, 7 y 8</p>

Creemos, como decía Mathews que *"el conocimiento de los "obstáculos epistemológicos" en el desarrollo de la ciencia puede iluminar problemas similares en el aprendizaje individual. Saber dónde las grandes mentes tenían dificultad sugiere al profesor donde las mentes menores podrían tener también dificultades "* (1989, p. 9). Y, por ello, consideramos fundamental saber qué obstáculos pueden impedir que los alumnos alcancen los estándares de aprendizaje evaluables y puedan cursar con aprovechamiento los bloques relativos a la "Óptica" en 2º de Bachillerato. A tal efecto estos cuadros nos pueden ayudar en el día a día de nuestra práctica docente.

3. Conclusiones

A partir de nuestro estudio, hemos podido determinar qué obstáculos podrán encontrar nuestros alumnos en relación a los estándares de aprendizaje que se les exigen en los Bloques relacionados con “La Óptica” de 2º de Bachillerato del currículo establecido por la LOMCE. Es necesario que el profesor tenga muy presentes dichas limitaciones en el desarrollo de los proyectos implicados en la enseñanza para que los alumnos logren una comprensión real de la materia. Para que los estudiantes se sientan sujetos activos durante todo el proceso, consideramos necesario plantear el aprendizaje de dichos contenidos mediante un modelo didáctico basado en el aprendizaje por proyectos (Trujillo, 2015; Larmer y Mergendoller, 2010). Para ello, como futuras líneas de trabajo, nos planteamos el diseño de actividades que posibiliten a los estudiantes una mejora en su aprendizaje y en la comprensión de los conceptos básicos de la óptica, además de superar sus concepciones intuitivas e ideas previas presentes en los obstáculos anteriormente identificados. El aprendizaje basado por proyectos, asentado en la investigación-acción, posibilita organizar los contenidos curriculares anteriormente señalados bajo un enfoque significativo y constructivista, relacionando los conocimientos escolares con los de la vida cotidiana y eludiendo los obstáculos identificados (Muñoz y Díaz, 2009). Creemos que es absolutamente necesario desarrollar metodologías alternativas que nos permitan superar el desinterés del alumnado y avanzar hacia una enseñanza más contextualizada y participativa.

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¿Cómo se comportan los innovadores?

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Abstract

All companies want to recruit workers able to innovate in their teams. The same applies to universities, institutions and any organization. But, how can we identify the competence of these human assets, these employees, when proposing or implementing an innovation? And, on the other hand, is it possible to be more innovative?, and can innovation be taught? A literature review of recent scientific publications (2000-2016) was carried out to answer these questions. In this paper we present the behaviours that identify innovators, taking FINCODA's model of Innovation Competence as a point of departure. We group the behaviours observed in the literature in FINCODA's dimensions of Creativity, Critical Thinking, Initiative, Teamwork and Networking. This research will facilitate the development of tools, useful to organizations, human resource departments and higher education institutions to detect innovators. Indications for the suitable direction in training the young and the not so young in the future are also provided.

Keywords: *innovation, innovation competence, individual innovation, behavioural indicators.*

Resumen

Todas las empresas quieren en sus equipos personas capaces de innovar. Lo mismo sucede en las universidades, en las instituciones y, en general, en cualquier organización. Pero, ¿cómo identificar a esos posibles activos humanos, esas personas competentes a la hora de proponer o llevar a cabo una innovación? Y, por otro lado, ¿se puede conseguir ser más innovador? e incluso, ¿se puede enseñar a ser más innovador? Para responder a estas preguntas hemos realizado un trabajo de revisión de la literatura científica publicada en los últimos años (2000-2016). En este trabajo ofrecemos nuestra visión sobre los comportamientos que identifican a los innovadores y, partiendo del modelo FINCODA sobre la Competencia de Innovación, que engloba las dimensiones de Creatividad, Pensamiento Crítico, Iniciativa,

Trabajo en Grupo y Trabajo en Red, agruparemos los comportamientos observados en la literatura asociados a cada una de estas dimensiones. Este estudio facilitará el desarrollo de herramientas de utilidad para organizaciones, departamentos de recursos humanos e instituciones académicas para detectar a las personas innovadoras, además de indicar una dirección adecuada en la que formar a los jóvenes, y no tan jóvenes, para el futuro.

***Palabras clave:** innovación, competencia de innovación, innovación individual, indicadores de comportamiento.*

Introducción

Entendemos por innovación la introducción de algo (producto, servicio, proceso o método) completamente nuevo o, también, la mejora de algo que ya existe (Proyecto *FINCODA*, 2015-2017). En la actualidad, las empresas europeas se ven impulsadas a subirse al tren de la innovación si quieren prosperar en un entorno cada vez más competitivo. La innovación constituye una de las competencias transversales más demandadas a cualquier titulado universitario cuando se enfrenta a su inserción laboral (González & Wagenaar, 2006). Sin embargo, algunos estudios (por ejemplo, Cortés-Ruiz et al., 2015) han concluido que los egresados tienen un dominio insuficiente de competencias de innovación, frente a un nivel de desarrollo moderado de los conocimientos específicos adquiridos. Ello nos lleva a plantearnos que puesto que, tanto la innovación como el conocimiento juegan un papel fundamental en el nuevo escenario económico (Cortés-Ruiz et al., 2015), es necesario adecuar el perfil del egresado a la demanda actual. El perfil requerido por la empresa del siglo XXI es el de un trabajador con formación académica adecuada y que aporta creatividad e innovación para solucionar las problemáticas complejas que se presentan.

La Educación Superior es la base del crecimiento socio-económico de un país. Como premisa principal, ésta debe proporcionar al alumnado una formación sólida y en conexión con las organizaciones. Es cada vez mayor la necesidad de búsqueda de la competitividad en las empresas y la creación de nuevos espacios en el entorno profesional. Los encargados de dirigir y llevar a cabo ese objetivo serán los futuros egresados: los profesionales innovadores. Habría que pensar en rediseñar el entorno en el que los contenidos que un alumno universitario necesita adquirir sea más innovador y dinámico.

Algunos estudios sobre la innovación han subrayado que las características y los comportamientos de los individuos en el lugar de trabajo son la base para la innovación en las empresas (Patterson et al., 2009). Expertos en el tema (Patterson et al., 2009; Adams et al., 2006; Cormican & O'Sullivan, 2004; Hammond et al., 2011) enfatizan el vacío existente en la evaluación de los predictores de la innovación a nivel individual, y echan en falta un marco adecuado que permita seleccionar trabajadores capaces de innovar. Los equipos de recursos humanos deben tener una visión clara de cómo se comportan los innovadores, qué características, habilidades y competencias tienen en común las personas innovadoras. Esta

información les permitirá identificar a esos innovadores que puedan aportar talento innovador en la organización. Es importante, por tanto, contar con las herramientas necesarias poder reclutar y seleccionar a aquellos trabajadores capaces de innovar.

Con el fin de contribuir a esta demanda de evaluar la competencia de innovación del trabajador, el presente trabajo parte de una revisión de la literatura científica publicada en los últimos años (2000-2016), y tiene como objetivo el enmarcar los comportamientos que identifican a los innovadores según el modelo de la competencia de innovación propuesto por *FINCODA* (*Framework for Innovation Competencies Development and Assessment*). Finalmente, el trabajo reflexiona sobre la presencia y tratamiento de la innovación como competencia transversal en la educación superior encaminada a potenciar la capacidad de innovación de los egresados.

1. Un modelo de competencia de Innovación

Estamos de acuerdo con *FINCODA* (Marin-Garcia, Andreu-Andrés, et al., 2016) en que la competencia de innovación es la capacidad de crear, introducir, adaptar y/o aplicar una novedad beneficiosa en cualquier nivel organizacional. Como competencia, la innovación puede considerarse un conjunto de competencias, capacidades y habilidades separadas o incluso superpuestas, que conjuntamente pueden considerarse competencias de innovación (Watts et al., 2013).

En este sentido, después de revisar la literatura sobre el tema y teniendo en cuenta a diferentes actores (Aznar-Mas et al., 2016; Marin-Garcia, Andreu-Andrés, et al., 2016; Montero-Fleta et al., 2017) *FINCODA* propone un modelo para la competencia de innovación que integra los modelos previos y tiene cinco dimensiones. Podemos verlo, a continuación, en las figuras 1 y 2.

Creativity	Your ability to think beyond tradition to generate or adapt meaningful alternatives (regardless of their possible practicality or future added value)
Critical Thinking	Your ability to deconstruct and analyse ideas (to evaluate advantages and disadvantages, foresee how events will develop and estimate risk)
Initiative	Your ability to make decisions or carry out actions to operationalise your ideas, as well as mobilise and manage those who have to implement the ideas.
Team Work	Your ability to work efficiently with others in a group
Networking	Your ability to involve internal / external stakeholders

Figura 1. *FINCODA* (2016). Dimensiones de la Competencia de Innovación

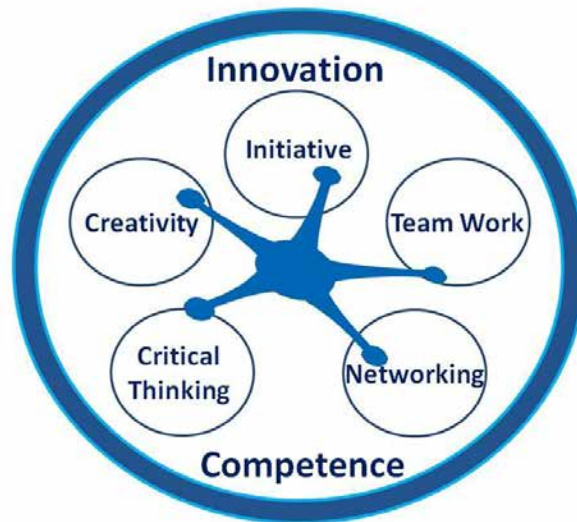


Figura 2. © Equipo FINCODA UPV-SEE-CSP (2017). Modelo de Competencia de Innovación

2. Comportamientos innovadores: categorías

La revisión sistemática de la literatura tuvo como objetivo el identificar las características que pueden denotar el carácter innovador del individuo. La revisión partió de una búsqueda exhaustiva de las palabras clave en internet. Se buscaron publicaciones del 2000 a 2015, indexadas en Elsevier's Scopus, Web of Science y Google Scholar. Tras una primera selección de 1.383 referencias y después de aplicar los criterios inclusivos y exclusivos, 222 artículos y otros 89 artículos más, añadidos por proceso de bola de nieve, fueron leídos de forma exhaustiva (ver Montero-Fleta et al., 2017). La fase final fue la identificación y clasificación, utilizando el modelo *FINCODA*, de los principales indicadores detectados en las publicaciones seleccionadas (Pérez-Peñalver et al., 2017).

En cada una de las dimensiones de la competencia de innovación, *Creatividad*, *Pensamiento Crítico*, *Iniciativa*, *Trabajo en Grupo* y *Trabajo en Red*, hemos agrupado en varias categorías los distintos comportamientos encontrados en los artículos revisados. En las Tablas 1, 2, 3, 4 y 5, que siguen a continuación, recogemos estas categorías:

Tabla 1. Categorías de comportamientos de Creatividad

CREATIVIDAD			
<i>Comportamientos relacionados con</i>			
Generar ideas	Proponer Mejoras	Resolver problemas de forma original	Tener una actitud creativa

Tabla 2. Categorías de comportamientos de Pensamiento Crítico

PENSAMIENTO CRÍTICO				
<i>Comportamientos relacionados con</i>				
Pensar de forma diferente	Identificar y analizar problemas	Adoptar perspectiva global ante los problemas	Evaluar soluciones o ideas	Anticipar futuros acontecimientos

Tabla 3. Categorías de comportamientos de Iniciativa

INICIATIVA					
<i>Comportamientos relacionados con</i>					
Animar a las personas a actuar	Conseguir que las personas alcancen objetivos	Organizar la puesta en marcha del trabajo	Llevar a cabo las ideas	Asumir riesgos aceptables	Ser activo y persistente

Tabla 4. Categorías de comportamientos de Trabajo en Grupo

TRABAJO EN GRUPO	
<i>Comportamientos relacionados con</i>	
Trabajar bien con los demás	Hacer que el equipo trabaje bien

Tabla 5. Categorías de comportamientos de Trabajo en Red

TRABAJO EN RED		
<i>Comportamientos relacionados con</i>		
Hacer los contactos necesarios para un proyecto	Hacer contactos fuera del equipo, organización o institución	Trabajar bien en diferentes contextos

Los comportamientos relacionados con las categorías anteriores, según nuestra revisión, incluidos en las Tablas 1, 2, 3, 4 podrán identificar a los individuos con mayor capacidad de innovación, por los que apostarán las empresas. Para una buena valoración de la presencia de la capacidad de innovación en el individuo, ya sea alumno, egresado o potencial empleado, se necesitan herramientas de medición adecuadas. El proyecto *FINCODA* está trabajando ya en esa dirección.

3. La competencia de Innovación en la Educación Superior

En este momento hay elementos que actúan como motor para favorecer la innovación en la universidad, como el desarrollo tecnológico y sus posibilidades, la internacionalización y el trabajo multidisciplinar, entre otros. La universidad debería plantearse un cambio en la estrategia docente para poder detectar qué personas presentan un comportamiento innovador, para fomentar y potenciar la capacidad innovadora del alumnado.

Ferrari et al. (2009) han propuesto un enfoque diferenciado para la creatividad y la innovación para el campo de la educación. Argumentan que la creatividad está más vinculada al aprendizaje y la innovación a la enseñanza, de ahí las nociones de *aprendizaje creativo* y *enseñanza innovadora*. La neurología ha demostrado que la creatividad es un hábito y por lo tanto se puede aprender con el entrenamiento adecuado (Marina, 2013). Por lo tanto, el aprendizaje creativo y la enseñanza innovadora pueden y deben formar parte de todos los niveles educativos dado que tenemos entornos que varían a mucha velocidad y ello exige un uso creativo de la inteligencia. Así pues, hay una necesidad de un cambio en la pedagogía que permita entrenar los comportamientos que indican competencia de innovación analizados en la sección anterior.

La innovación permite una oportunidad de cambio hacia la excelencia y despierta la mente de los alumnos. Este reto supone una planificación exhaustiva de las asignaturas y de los contenidos en los que se podría tratar de poner en práctica y fomentar estas dimensiones de la competencia de innovación. Habría que familiarizar al alumno con este enfoque desde los primeros cursos, para alejarle de la visión de rigidez que, en ocasiones, ofrece el sistema educativo universitario. Las alternativas de aprendizaje son muy variadas. Las metodologías elegidas para adquirir esta competencia deben tender hacia un ambiente más permisivo que acaricie las ideas de los estudiantes, aliente la asunción de riesgos y errores, y que permita que los estudiantes asuman la responsabilidad de su propio aprendizaje. Además se requiere la redefinición del papel de los profesores como facilitadores, motivadores, mentores y entrenadores de los procesos de aprendizaje (Ferrari et al., 2009). El concepto de asignatura podría verse afectado también por un cambio de planteamiento en el que metodologías activas cobran fuerza a través de la resolución de problemas, simulación, o el trabajo en equipo a través de proyectos, en los que el alumno podría trabajar más cerca del profesorado e incluso de profesionales del sector para que el resultado fuese más provechoso.

La puesta en práctica de estas capacidades en las titulaciones necesitaría de instrumentos de medida adecuados tanto para los resultados del aprendizaje como para la adquisición de las capacidades elegidas, en nuestro caso, las cinco dimensiones presentes en el modelo *FINCODA* de competencia de innovación. Sería necesario el análisis previo de los instrumentos de medida a través de estudios y pilotajes entre el alumnado y el profesorado, para descartar los indicadores de comportamiento que no resulten adecuados. Con el instrumento correcto, la evaluación de la competencia de innovación y sus diferentes dimensiones sería mas efectiva inicialmente.

3.1. Algunas experiencias recientes

A título de ejemplo, citamos a continuación algunas experiencias llevadas a cabo en estos últimos años para fomentar la innovación:

- La denominada *Pedagogía de la Innovación* (Kettunen, 2011; Lehto et al., 2011) es un enfoque de aprendizaje novedoso que, mediante la asimilación, producción y utilización del conocimiento, fomenta la disposición a innovar en los estudiantes universitarios. Se basa en la integración de docencia, investigación y desarrollo, así como la cooperación con los actores de la vida laboral. La *Pedagogía de la Innovación* se lleva a cabo en la Universidad de Ciencias Aplicadas de Turku (Finlandia) donde trabajan proyectos multidisciplinares y de investigación aplicada cuyo desarrollo responde a las necesidades del cliente y son integrados en la educación superior de una manera flexible.
- *Engineering Challenge* (Marin-Garcia, González, et al., 2016) en la UPV, plantea acciones concretas en las que empresas se reúnen con estudiantes universitarios de Grado y Máster para la resolución de problemas reales o áreas de mejora de dichas empresas. Al

final de este proceso, los estudiantes que proponen las mejores soluciones tienen acceso a estancias de prácticas en esas empresas.

- La Universidad Carlos III va a lanzar un nuevo máster experimental de innovación educativa, una experiencia arriesgada para formar adecuadamente al educador del siglo XXI (Torres, 2017) y dar respuestas a las carencias de los actuales estilos docentes, estableciendo como base la creatividad.
- Algunos organismos, como *WISE Initiative (World Innovation Summit for Education, 2009)*, defienden métodos en los que se promueven las habilidades personales, que son toda una revolución en el entorno educativo.
- En la propia Universitat Politècnica de València hay equipos de innovación que llevan trabajando en la identificación, características y evaluación de la innovación desde hace más de una década. El resultado es un conjunto de proyectos docentes de innovación y mejora educativa (Watts & García-Carbonell, 2006; Labrador & Andreu, 2008) que ya han traspasado el ámbito local.

Estos ejemplos reflejan el interés que la adquisición de la competencia de innovación ha despertado en ámbitos educativos y que su puesta en práctica puede contribuir a la consolidación del conocimiento y el desarrollo de habilidades personales e interpersonales del futuro egresado en el ámbito de la innovación.

4. Conclusiones

Nuestro trabajo, a partir de una revisión de la literatura, ofrece una agrupación de las distintas categorías de comportamientos, de acuerdo con las dimensiones que componen la competencia de innovación, según el modelo *FINCODA*. La investigación realizada podrá permitir la identificación de personas innovadoras, a través de instrumentos de evaluación que incluyan estos tipos de comportamientos.

Además, puesto que el comportamiento innovador es un hábito que se puede adquirir, este se puede fomentar en todos los niveles educativos y en las organizaciones. Las empresas y organizaciones no van a esperar a que el alumnado ponga en práctica experiencias de innovación una vez que haya finalizado sus estudios y entren en el entorno profesional; lo que necesitan es que la innovación esté integrada en su proceso de formación y que produzca cambios estratégicos. Familiarizarse con esta dinámica puede plantear una carga de trabajo adicional en la elaboración de programas y proyectos de innovación, pero los beneficios y la motivación para el alumnado serán, sin duda, notables.

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Una experiencia en contexto no formal con alumnos de la enseñanza superior: el potencial pedagógico-didáctico de la granja pedagógica

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Abstract

Nowadays in Portugal, in the several courses that prepare technicians in Education, it is compulsory to have some sort of professional practice (IPP). Our present study comes from this context and it is developed in the subject of IPP that has as main objective: motivate the first research projects connected to academic subjects in different contexts of education. We are here presenting our understanding and the results from the experiment of a pedagogical farm and its consequent didactical and pedagogical possibilities. Students should know and understand the natural heritage of the region, with high educational potential and be motivated to explore and value these resources aiming Science Education for Citizenship. Thus, Nature and open spaces, as well as pedagogical farms, are a context of non-formal education with a relevant interest related to didactical and pedagogical work in class. This favours meaningful learnings in the academic setting. The results of this pedagogical and didactical experience emphasize the need to inquire about the teaching procedures in the area Natural Science teaching, mainly in the possibilities of learning in the non-formal contexts aiming the development of capacities, behaviour and values to a responsible and active citizenship to conserve the natural heritage.

Keywords: *Teacher Formation, Natural Sciences, Non-formal Education, Education to Citizenship.*

Resumen

Actualmente en Portugal, en el grado de educación básica, que forma técnicos en educación, se exige que la formación proporcione una iniciación a la práctica profesional (IPP). Es en esta asignatura que se encuadra este estudio y tiene como principal objetivo curricular: estimular la iniciación de trabajos de investigación encuadrados en la articulación de aprendizajes curriculares entre

diferentes contextos de educación. Presentamos nuestra experiencia y los resultados obtenidos en relación al potencial pedagógico-didáctico de una granja pedagógica. Los estudiantes deben conocer y entender el patrimonio natural de la región y ser motivados a la exploración y valoración de estos recursos para la educación en ciencias con una perspectiva de educación para la ciudadanía. Por eso, la naturaleza y los espacios naturales locales constituyen un contexto de educación no formal de interés muy relevante en articulación con el trabajo pedagógico-didáctico en clase. Esta asociación favorece aprendizajes significativos del ámbito curricular. Los resultados de esta experiencia enfatizan la necesidad del cuestionamiento relativamente a los procedimientos de enseñanza en el área de ciencias naturales, las potencialidades de los aprendizajes en contexto no formal con vista al desarrollo de capacidades, actitudes y valores para una ciudadanía responsable y activa en preservar el patrimonio natural.

Palabras clave: *Formación de profesores, ciencias naturales, educación no formal, educación para la ciudadanía.*

Introducción

La formación superior conducente a la titulación en educación infantil o primaria (1º y 2ª ciclo), en Portugal, en consecuencia del proceso de Bolonia, requiere un trayecto académico que obligatoriamente se inicia con el grado en educación básica ((Ministério da Educação e Ciência, 2014). Este grado deberá asegurar la formación de base a estos niveles de enseñanza que, en la formación posterior, tendrá que ser complementada con un master habilitante para la docencia. En suma, se espera que este grado proporcione una calificación de nivel superior, ajustado en competencias generales, específicas y transversales que preparen a los estudiantes para acceder a la formación superior habilitante (master) en uno de estos dominios del profesorado.

El grado de educación básica en esta institución de enseñanza superior inició en el año lectivo 2007/2008. El grado, con duración de tres años, se organiza en seis semestres, posee 180 créditos ECTS (1 crédito representa 27 horas de trabajo autónomo del estudiante) distribuidos por un plan de estudios constituido por 36 asignaturas, cambiando el número de créditos ECTS entre los 3 y los 8 por asignatura. Las asignaturas de iniciación a la práctica profesional I (IPPI) e iniciación a la práctica profesional II (IPPII) solamente existen en los 5º y 6º semestres del grado, siendo las que poseen más número de créditos ECTS (8) en el plan de estudios.

Esta realidad atesta la importancia dada a esta asignatura en esta formación, cuyo objetivo es de “complementar la formación académica, proporcionando al estudiante el aprendizaje de competencias profesionales en un contexto real de trabajo” (ESECD, 2011, p.2) buscando

que la educación formal se inter-relacione a contextos del patrimonio natural local en espacios de educación no formal, posibilitando aprendizajes del dominio cognitivo íntimamente inter-relacionadas al desarrollo afectivo con la presencia y valoración de la naturaleza.

En esta asignatura (IPPI e IPPII) son objetivos pedagógicos: a) integrar el alumno en contexto de aprendizaje profesional de una forma progresiva y orientada; b) conocer el potencial educativo de contextos de educación en espacios formales y no formales; c) analizar estrategias de enseñanza y aprendizaje en contextos de educación no formal; d) reflexionar sobre estrategias/actividades de enseñanza en contexto de educación formal; e) desarrollar competencias a nivel de la observación y reflexión; f) promover la adquisición de hábitos de pesquisa en una perspectiva de relación teórico-práctica; g) estimular la iniciación de trabajos de investigaciones encajados en la articulación de los aprendizajes curriculares, en los contextos de educación formal y no formal.

1. Material y métodos

El proceso de enseñanza y aprendizaje en asignaturas cuya naturaleza es la de iniciación a la práctica profesional tiene asociado muchísimos desafíos, algunos de los cuales sobre “cómo enseñar”. Para conseguir alcanzar esos retos, se siguió una metodología de enseñanza basada en el aprendizaje cooperativo según la perspectiva de Ros (2001). Los aprendizajes fueron obligatoriamente realizados en grupo, en los cuales la participación activa por parte de todos los elementos del grupo fue determinante en la calidad de ese aprendizaje. Los grupos de trabajo son organizados, por sorteo aleatorio, en una reunión con todos los alumnos, en la cual son explicadas todas las reglas de funcionamiento de la asignatura, al inicio de cada año lectivo, siendo constituidos entre 2 y 4 elementos de máximo. A pesar de ser una asignatura de un semestre, los grupos no cambian al pasar del IPPI al IPPII para permitir que todos los estudiantes observan contextos de enseñanza y aprendizaje formales (educación infantil, educación primaria – 1º y 2º ciclo en Portugal) y no formal (granja pedagógica).

Esta asignatura tiene como soporte de base la observación directa realizada por los alumnos, con vista al desarrollo de sus capacidades de análisis y reflexión sobre los diferentes contextos observados (formales y no formales). Como evaluación final, cada grupo debe entregar un reporte de observación para cada contexto observado. Éste incluye, por un lado, un encuadramiento del contexto observado, realizado en grupo y, por otro, guiones de observaciones reflexivos sobre la realidad observada, realizado por cada alumno individualmente.

En este contexto, se reconoce la necesidad de que el proceso de enseñanza en el componente no formal de esta asignatura se edifique con la ayuda de un componente direccionada para una educación que permita recuperar/formar/educar en el ámbito de las actitudes y de los valores de la ciudadanía pro-ambiental. Así, se puede afirmar que la asignatura de IPP contempla una formación pro-ambiente en contexto de *outdoor learning* (educación no formal) en una granja pedagógica. En este artículo presentamos nuestra experiencia sobre el potencial

pedagógico-didáctico de este recurso con los alumnos de la enseñanza superior que frecuentan esta asignatura.

1.1 Aprendizaje basado en outdoor learning: algunas reflexiones

Un aprendizaje no necesita de un local específico ni tampoco de una fecha concreta para desarrollarse. “Embora a conceção estática e fechada do contexto de ensino seja a mais generalizada, a verdade é que existem exemplos muito antigos de práticas diferentes” (Reis, Conceição & Roque, 2015, p.4). Aún en la Antigua Grecia se adaptaban los espacios con bellezas naturales para darse clases. Y estas experiencias se repetían a lo largo de los años, al mismo tiempo que se aumentaban la cantidad de locales dónde se podía enseñar. Se empezó por locales formales para llegar a locales más informales, pero siempre con el mismo objetivo: facilitar y fomentar la enseñanza y el aprendizaje.

Cuando un alumno sale del espacio formal donde está acostumbrado a tener clases y cambia ese local por uno que le permite el contacto directo con lo que se pretende enseñar resulta muy estimulante para él, más motivador y por eso consigue aprender con más facilidad. Los alumnos, en general, pueden aprender tanto en la calle, plazas, edificios comerciales y culturales de ciudades, en los parques locales y nacionales, en los edificios históricos, en visitas de estudio o en viajes al extranjero. Los alumnos consiguen aprender mejor porque están el centro del proceso, directamente envueltos en la construcción de su propio aprendizaje. El-kind (2001) afirma que permitir que los niños disfruten de los espacios abiertos y jueguen de modo activo en armonía con la naturaleza, favorece un desarrollo saludable y aumenta el potencial físico y emocional de los niños, apreciando su sentido de independencia y sus capacidades.

Los alumnos deben ser motivados a la exploración y valoración de recursos para la educación en ciencias con una perspectiva de educación para la ciudadanía. Por eso, la naturaleza y los espacios naturales locales, así como las granjas pedagógicas constituyen un contexto de educación no formal de interés muy relevante en articulación con el trabajo pedagógico-didáctico en sala de clase. Esta asociación, educación formal y no formal, favorece aprendizajes significativos del ámbito curricular. Así se confirma la afirmación de Weissmann (Fumagalli, 1998, p. 18) [...] que dice que

a formação científica das crianças e dos jovens deve contribuir para a formação de futuros cidadãos que sejam responsáveis pelos seus atos, tanto individuais como coletivos, conscientes e conhecedores dos riscos, mas ativos e solidários para conquistar o bem-estar da sociedade e críticos e exigentes diante daqueles que tomam as decisões.

Se debe fomentar tanto el trabajo en el aula como fuera. Eso facilita la resolución de problemas paso a paso. Cuando se realizan actividades al aire libre con alguna frecuencia, los alumnos están más atentos a los cuidados que deben tener porque construyen un compromiso no solamente con el medio sino con todo los demás. Al valorar la autonomía de cada alumno e

incitarle responsabilidad, se formará de seguida una responsabilidad colectiva para que todos juntos sean ciudadanos conscientes de sus actos, que sepan las consecuencias de cada uno y valoren todo lo que les rodea y sea parte integrante de sus vidas.

Las actividades al aire libre, el *outdoor learning*, son fundamentales y no pueden ser sustituidas por actividades en el interior o frente a un ordenador, que es lo que más se practica actualmente. Pues,

La tecnología sirve para muchas cosas, pero no para acceder a lo esencial. Los niños necesitan contacto directo, el olor de una flor, el tacto de una oveja, etc. Después pueden utilizar Internet para ampliar la información o para conocer otros mundos. Pero su primer contacto no puede ser mediante un ordenador. (Freire, 2011, p.22)

La educación tiene el reto fenomenal que consiste en estimular y favorecer prácticas que ayuden a la sociedad a cambiarse en una colectividad motivada y movilizada en proteger la naturaleza y saber aprovecharla de la mejor forma. Así, la educación del patrimonio regional asociada a la educación para la ciudadanía permite motivar y sensibilizar a alumnos a intervenir para el bien estar de todos, construyendo una sociedad más equitativa y ambientalmente sostenible.

El *outdoor learning* tiene muchas ventajas y éxito porque permite aprender directamente con la experiencia realizada; los alumnos sienten así toda la percepción proporcionada por esta; el contexto facilita las condiciones de aprendizaje; establecen relaciones directas entre causas y efectos; estos resultados se pueden más fácilmente generalizar porque se transponen muy rápidamente a la vida cotidiana y, por lo tanto, se logran resultados mejores. Por fin, se puede afirmar que cuando se gusta se aprende mejor y más rápidamente, entonces aprender con el objeto de estudio motiva mucho más y permite alcanzar resultados mejores.

El aprendizaje basado en actividades al aire libre, en situaciones reales (naturales) y locales específicos permite una experiencia única, con repercusiones positivas en el momento de enseñanza. Momento ese que facilita la adquisición de conocimiento porque el alumno consigue percibir en contexto tanto sus facilidades como sus dificultades y por eso intenta pronto corregir y mejorar su desempeño. Las granjas pedagógicas constituyen contextos de *outdoor learning* con potencialidades de transformación del medio natural en un estructurador de los procesos de enseñanza y aprendizaje permitiendo capacitar para una ciudadanía interventora pro-ambiente en un contexto de enseñanza y aprendizaje en el área de las ciencias naturales.

2. Descripción de la experiencia: La granja pedagógica como estrategia de enseñanza y aprendizaje

En el grado de educación básica, en Portugal, se exige que la formación proporcione una iniciación a la práctica profesional (IPP) que contemple una observación en contexto formal y otra en contexto no formal. Con esta asociación, educación formal y no formal, se procura favorecer aprendizajes significativos del ámbito curricular, específicamente el desarrollo de competencias sociales. En este último se encaja la experiencia realizada con el potencial pedagógico-didáctico de una granja pedagógica.

Siguiendo la metodología de aprendizaje cooperativa, los alumnos desarrollan un trabajo en grupo con la supervisión del profesor titular de la asignatura y de una técnica superior del ayuntamiento al cual la granja pedagógica pertenece. En las sesiones tutoriales con el profesor que alecciona la asignatura se analizan, con todos los grupos, los objetivos del trabajo a desarrollar, en el ámbito de las potencialidades educativas de la granja que son los siguientes: Conocer el potencial educativo; valorizar la preservación del medio natural; analizar las estrategias de enseñanza propuestas para una granja pedagógica; organizar actividades y materiales; reflexionar sobre el potencial de las actividades desarrolladas.

La orientación metodológica seguida en las sesiones tutoriales en relación a la reflexión de las acciones desarrolladas tienen por base la relación acción-reflexión-acción como un eje crucial de orientación de los aprendizajes en este recurso educativo – La granja pedagógica. En la organización de actividades y materiales, los alumnos tienen conocimientos a los cuales se deben añadir actividades didácticas, pues estas permiten su participación directa. Se debe también partir del conocimiento que tiene el alumno en busca de lo que se pretende attingir porque permitirá proporcionar todo un conjunto de reflexión del cotidiano que llevan a la previsión de resultados, simulación de situaciones y elaboración de hipótesis.

3. Resultados y discusión

El hecho de que sea el alumno que a través de su propia observación y experiencia, entienda lo que está sucediendo, consigue interpelar para el proceso que debe implementar y tener conciencia de lo que puede y de lo que no puede hacer. Cuando se produce la transferencia del particular para lo general, se puede afirmar que el alumno tiene una visión sistémica. O sea que el alumno entiende un fenómeno menor dentro de un mayor (Capra, 2006). Pone en práctica lo que se pide con esta asignatura: observar, intervenir y reflexionar.

Los alumnos trabajan juntos, con una metodología cooperativa, el *Learning Together*, permitiendo que se promueva un sentimiento de interdependencia y reciprocidad de todos los participantes y así que cada uno dé el mejor de si mismo porque de eso va a depender el éxito del grupo (Bessa & Fontaine, 2002).

La metodología de aprendizaje seguida permitió desarrollar competencias sociales en el campo de la valorización y preservación del ambiente. Promueve la educación para la ciudadanía, cambia la mentalidad de los alumnos que se transforman en agentes activos y participativos del bien de la comunidad. Esto sólo se consigue si hay una buena comunicación entre los sujetos para que lleguen a resultados muy positivos y que sepan respetar y aceptar los ideales de cada uno. El aprendizaje cooperativo y la educación para la ciudadanía pueden y deben trabajar juntos para que tengan más impacto y consecuencias más eficaces para que se viva en un mundo mejor. Todavía, esta experiencia teniendo como contexto de *outdoor learning* la granja pedagógica, siguiendo un aprendizaje cooperativo, ha revelado algunas dificultades específicamente al nivel del funcionamiento de los grupos. Situación en línea con lo que las investigaciones hechas en el área concluyen (Johnson, Johnson e Smith, 2007; Herreid 1998). Se constató que la obligatoriedad de la asiduidad del grupo en las sesiones tutoriales fueron decisivas para promover la inter-ayuda, las relaciones personales, y la responsabilidad, pues el contacto del grupo con el profesor que alecciona la asignatura ha permitido detectar los problemas y criar las condiciones necesarias para resolverlos.

4. Consideraciones finales

Consideramos que los estudiantes de la enseñanza superior que frecuentan el grado de educación básica deben conocer y entender el patrimonio natural de la región, de elevado potencial educativo y ser motivados a la exploración y a la valoración de estos recursos para la educación en ciencias naturales con una perspectiva de educación para la ciudadanía. Las actividades de *outdoor learning* en granjas pedagógicas, como también en otros contextos de la naturaleza, aún como los espacios naturales locales, constituyen un contexto de educación no formal de interés muy relevante en articulación con el trabajo pedagógico-didáctico en sala de clase. Esta asociación, educación formal y no formal, favorece aprendizajes significativos del ámbito curricular, en el cual la educación del patrimonio regional asociada a la educación para la ciudadanía permite motivar y sensibilizar a los estudiantes, futuros profesores, a intervenir para el bien estar de todos, construyendo una sociedad más equitativa y ambientalmente sostenible.

Los resultados, expresos en los reportes finales construidos por alumnos envueltos en la metodología de la evaluación de IPP, de esta experiencia pedagógico-didáctica enfatizan la necesidad del cuestionamiento relativamente a los procedimientos de enseñanza en el área de ciencias naturales, principalmente las potencialidades de los aprendizajes en contexto no formal con vista al desarrollo de capacidades, actitudes y valores para una ciudadanía responsable y activa en preservar el patrimonio natural. Nuestra investigación sobre la relevancia de estos recursos de *outdoor learning* está en este momento a desarrollarse en torno de la análisis de los reportes producidos por los alumnos a lo largo de los últimos 4 años.

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M-learning: ¿dispositivos o metodologías para innovar la enseñanza universitaria?

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Abstract

The presence of mobile devices in classrooms is an undeniable reality that is sometimes uncomfortable for teachers and other times can open a number of possibilities to innovate in the use of new methodologies in which these devices are involved. Access to the internet and social networks, along with learning based on the use of certain useful applications in different fields of knowledge and the use of virtual worlds, are processes that are changing the current ways of teaching and learning and placing teachers before important changes and facing unavoidable challenges. This communication is part of the I + D + I subproject "Media Competences of Citizens in Emerging Digital Media in University Environments" aimed at detecting innovative teaching practices regarding the use of mobile devices in university settings. In light of a review of the recent literature on this field, we will explore a series of approaches related to the idea that innovation in the university environment is given by methodologies and didactic strategies that teachers use with mobile devices and not both by the use of the devices themselves.

Keywords: *Mobile learning, university education, M-learning, educommunication, media education.*

Resumen

La presencia de los dispositivos móviles en las aulas es una realidad innegable que a veces resulta incómoda para el profesorado y otras veces puede abrir una serie de posibilidades para innovar en el uso de nuevas metodologías en las que se implican dichos dispositivos. El acceso a internet y a las redes sociales, junto al aprendizaje basado en el uso de determinadas aplicaciones de utilidad en diferentes campos del conocimiento y el uso de los mundos virtuales, son procesos que están cambiando las formas actuales de enseñar y aprender y situando al profesorado ante importantes cambios y frente a retos ineludibles. Esta comunicación surge en el marco del subproyecto I+D+I "Competencias mediáticas de la ciudadanía en medios digitales emergentes en entornos

universitarios" dirigido a detectar prácticas docentes innovadoras del uso de dispositivos móviles en el ámbito universitario. A la luz de una revisión de la literatura reciente sobre ese ámbito, exploraremos una serie de planteamientos relacionados con la idea de que la innovación en el ámbito universitario viene dada por las metodologías y las estrategias didácticas que el profesorado usa con los dispositivos móviles y no tanto por el uso de los dispositivos en sí.

Keywords: *aprendizaje móvil, enseñanza universitaria, M-learning, educación mediática, educación mediática.*

Introducción

Entre las tecnologías de la información y la comunicación que están modificando el panorama de la educación y la formación en los últimos años destacan los dispositivos móviles. Los datos sobre su nivel de penetración y su uso por parte de la población española nos sitúan ante una nueva realidad comunicativa¹. En este contexto, surge el Mobile Learning o M-learning, como una conjunción entre el e-learning y la utilización de los "Smart Devices" o dispositivos móviles inteligentes como medios de acceso a la formación. Hablamos de aprendizaje móvil situándolo como el aprendizaje que se produce a través de dispositivos móviles que mediante una conexión 3G o wifi brinda acceso a diferentes tipos de aplicaciones (Apps)², a plataformas de aprendizaje y a contenidos en línea. Es por ello un aprendizaje que, potencialmente, permite adquirir conocimiento en cualquier lugar ya que se desplaza fuera del aula y, teóricamente, puede darse en el hogar, en un parque, en la playa o mientras estamos trabajando pero, a su vez, necesita de infraestructuras técnicas caracterizadas por su ubicuidad (Burbules, 2012). De aquí, la relación inseparable del aprendizaje móvil con el concepto de "aprendizaje ubicuo" (u-learning o ubiquitous learning) centrado en "*anyone, anywhere, anytime*", "*cualquier persona, en cualquier momento y en cualquier lugar*". Pese al valor innegable del aprendizaje a través de dispositivos móviles (ISEA, 2009), cabe señalar también una cierta euforia injustificada en torno a esta nueva modalidad que conviene matizar. Consideramos que para aprender es necesaria una disposición y cuando se trata de un aprendizaje de nivel se requiere un cierto diseño pedagógico para que el aprendizaje ocurra, un diseño que no siempre encontramos en las ofertas de M-learning.

¹ El móvil está en el 96,7% de los hogares españoles a la par que la televisión. El principal tipo de conexión a Internet por banda ancha es el establecido a través de un dispositivo de mano (teléfono móvil de últimas generaciones -al menos 3G-, etc.) con un 80,1% de las viviendas con acceso. El 77,1% de los hogares españoles están conectados. Ocho de cada diez personas de 16 a 74 años han usado Internet en los tres últimos meses. Dos de cada tres lo hacen a diario. La participación de la población española en redes sociales está por encima de la media europea, sobre todo para desarrollar una comunicación de tipo social (con familiares, amigos, etc.) (INE, 2016).

² Al aumentar el número de estudiantes que utilicen dispositivos móviles en contextos de educación formal es de esperar que las aplicaciones (Apps) pasen a ser una parte importante del ecosistema del aprendizaje móvil (UNESCO, 2013: 16).

1. Dispositivos Móviles: aliados o amenazas

La introducción de los dispositivos móviles como medio de enseñanza en los entornos universitarios no alcanza los índices de influencia que dichos dispositivos tienen a nivel social³. El alumnado en su vida cotidiana hace un uso masivo de dichos dispositivos y de las herramientas que desde ellos permiten controlar múltiples aspectos de realidad, tener un acceso rápido a la información y desarrollar nuevas formas de aprendizaje informal y comunicación ubicua. Sin embargo, esos dispositivos no se utilizan en el aprendizaje académico de manera habitual. Nos encontramos, además, con un profesorado con un perfil de uso de dichos dispositivos que difiere mucho del que presenta el alumnado. En una universidad como la española, fuertemente envejecida, predomina un profesorado que, si bien es usuario de los dispositivos móviles, no parece haber avanzado hacia los mismos usos que de ellos hacen sus alumnos. Un profesorado que, en un porcentaje importante, participa de las características de los llamados “*immigrantes digitales*” (Prensky, 2010) una denominación que, pese a ser bastante simplista en algunos aspectos, nos ofrece algunas ideas de partida para nuestro estudio que deberemos poner a prueba a lo largo del proceso de investigación. Un sector de este profesorado no parece haber visto la utilidad que los dispositivos móviles pueden tener en el desarrollo de la docencia para potenciar el aprendizaje del alumnado. Más bien parecen entender que los dispositivos móviles son una amenaza para la buena marcha de las clases y para mantener sistemas de evaluación que se basan en la memorización y que, por tanto, son fácilmente “alterables” por unos dispositivos que pueden permitir al alumnado acceder a esa información de una manera más ágil que las “tradicionales chuletas” (Fueyo y Hevia, 2017: 1929).

Los resultados de algunos de los estudios realizados en este campo muestran cómo una parte del profesorado (posiblemente minoritaria) percibe que los dispositivos digitales móviles pueden ser útiles y funcionales desde una perspectiva didáctica cuando se usan para poder realizar videoconferencias, para gestionar de forma ubicua chats y foros académicos relacionados con las asignaturas o para el fomento de la participación del alumnado en la vida académica e investigadora. De hecho, los datos indican que en estas experiencias de uso de dispositivos móviles se da una mejora de varios indicadores de las competencias genéricas, especialmente las de «aprendizaje autorregulado», «cognitivas superiores», «de comunicación», «instrumentales en la Sociedad del Conocimiento» e «interpersonales» y lo que está muy relacionado con la alta valoración que en dichos estudios muestra el alumnado universitario sobre la funcionalidad y operatividad de los dispositivos móviles en

³ Los datos de implantación del smartphone en nuestro país reclaman la necesidad de estudios científicos rigurosos que potencien el uso competente y constructivo del mismo en la ciudadanía. Según el informe anual de «La Sociedad de la Información en España» (Fundación Telefónica, 2016), la sociedad española es la más ‘conectada’ de Europa; el teléfono móvil es el dispositivo preferido por el 91,7% de los internautas; el cien por cien de los más jóvenes (de catorce a diecinueve años) se conectan ya utilizando el smartphone y la conexión mediante la tablet entre los mayores de sesenta y cinco años crece un 219%.

dimensiones como la comunicación, el tratamiento de la información, la economía de tiempo, la movilidad y la ubicuidad (Vázquez-Cano, 2015; Gegenfurtner, Veermans y Vauras, 2013; Ramos, Herrera y Ramírez, 2010; Vázquez-Cano, Fombona y Fernández, 2013; Vázquez-Cano y Sevillano, 2014).

El aprendizaje ubicuo que, técnicamente, posibilitan los dispositivos móviles en combinación con las nuevas formas de comunicación transmedia van a introducir, a la larga, un cambio importante de paradigma educativo. Este cambio pensamos que estará orientado a producir un aprendizaje que aproveche mejor las posibilidades de interacción y acceso a contenidos muy diversos, el aprendizaje independiente y autónomo, el aprendizaje de alto nivel o profundo, la colaboración y el intercambio, el aprendizaje social en red etc. (Fueyo y Hevia, 2017; Fueyo y Fano, 2015). Si bien son escasos los datos de estudios en el nivel universitario sobre la importancia para el aprendizaje de la creación de contenidos a través de los dispositivos móviles, algunas investigaciones centradas en niveles de enseñanza secundaria ponen de relieve su valor para mejorar la implicación, la autenticidad y contextualización del aprendizaje y la indagación y para la resolución de problemas, así como a la hora de potenciar el aprendizaje grupal. Pero también indican que estas experiencias ponen de manifiesto que el alumnado, si bien está muy habituado a usar los móviles en su vida cotidiana, sobre todo en el ámbito del ocio, no está familiarizado con su uso en un ámbito más formal como puede ser el de la enseñanza (Grupo EMA, 2013).

Otra de las cuestiones cruciales para nuestra investigación son las implicaciones que el uso generalizado de dispositivos móviles debería tener en la formación inicial y permanente del profesorado en orden a que este sea capaz de aprovechar los aspectos positivos que estas tecnologías emergentes para mejorar e innovar su docencia potenciando formas de enseñar y aprender más adaptadas a la nueva realidad comunicacional que ofrecen los espacios transmedia.

2. Metodología de la investigación

El estudio preliminar que abordamos en esta comunicación está destinado a perfilar los instrumentos de recogida de la información del Subproyecto "*Competencias mediáticas de la ciudadanía en medios digitales emergentes en entornos universitarios*" que se enmarca dentro del Proyecto de I+D sobre "*Competencias mediáticas de la ciudadanía en medios digitales emergentes (smartphones y tablets): prácticas innovadoras y estrategias educacionales en contextos múltiples*" (EDU2015-64015-C3-2-R). Los objetivos de nuestra investigación son:

- 1) Realizar una primera aproximación a los usos de los dispositivos móviles por parte del profesorado y el alumnado universitario.
- 2) Perfilar algunas características pedagógicas de las prácticas innovadoras en el uso de dispositivos móviles (smartphones y tablets) en el entorno universitario.

- 3) Hacer una detección inicial de las necesidades y oportunidades que se ponen de manifiesto en las prácticas formativas con dispositivos móviles.

Dado el carácter preliminar de esta investigación, la población estudiada ha sido una muestra no significativa de alumnado y profesorado universitario. En esta fase preliminar se ha empleado dos técnicas de recogida de información. Por un lado, un cuestionario sobre “*Aprendizaje con medios digitales en los estudios universitarios*” con 37 ítems de los cuales un 90% es de respuesta cerrada siendo el resto de ítems de respuesta abierta o mixta (cerrada-abierta). El cuestionario, que fue administrado a 56 estudiantes de cuarto curso del Grado de Pedagogía, indaga sobre el uso que realiza el alumnado de las tecnologías de la información y la comunicación para el aprendizaje académico fuera del aula. Por otro lado, se utilizó un grupo de discusión focalizado con profesorado universitario con experiencia en el desarrollo de proyectos de innovación docente con dispositivos móviles. A continuación, se organizan los resultados de este estudio piloto en torno a cuatro de las dimensiones que se han determinado para el grupo de discusión y que son las que se emplean como base para el diseño del cuestionario central del proyecto I+D que se denominará “*Prácticas innovadoras con dispositivos móviles en la enseñanza universitaria*”.

3. Resultados preliminares

3.1 Datos identificativos sobre docentes y alumnado participante

En el grupo de discusión participaron 15 profesores y profesoras de tres áreas de conocimiento: Ciencias Sociales y Jurídicas (Ciencias de la Educación), Ciencias de la Salud (Psicología), Ciencias (Geología, Morfología y Biología Celular, Biología Funcional y Física). En general, es profesorado con una amplia experiencia docente y que ha llegado al uso de los dispositivos móviles en la enseñanza de forma autodidacta, a través de proyectos de innovación o de investigación y buscando formas para mejorar la docencia y los resultados de aprendizaje del alumnado.

Por su parte, al cuestionario responden 56 estudiantes, de un total de 78, que están en cuarto curso del Grado de Pedagogía. El 87% de este alumnado tiene entre 20 y 24 años y un 76,8% son mujeres (rasgo característico de las carreras de Ciencias de la Educación).

3.2 Aproximación a los usos que hacen los estudiantes de los dispositivos móviles

Todo el profesorado participante en el grupo de discusión es usuario de dispositivos móviles pero reconoce que sus usos, en comparación con los que hacen sus estudiantes, son menos intensos y posiblemente menos sofisticados.

El alumnado se considera autodidacta en el uso de las tecnologías (un 62,5%). Un 81% dice que tiene una habilidad y un conocimiento medio o avanzado del uso de las TIC y un 85% manifiesta que utiliza el ordenador portátil para el aprendizaje académico (frecuentemente o siempre). Un 79% utiliza los teléfonos tipo smarthphone en las tareas académicas y un 62% dice usar con frecuencia su conexión a internet para tareas que tienen que ver con el aprendizaje académico.

Por su parte, el profesorado es consciente del uso habitual que hacen los estudiantes de dispositivos conectados a internet, lo que concuerda con las respuestas del alumnado al cuestionario ya que un 94 % dice usar esos dispositivos en su aprendizaje académico y hacer ese uso durante todo el curso (82,1%). El profesorado junto a esa alta frecuencia de uso reconoce la pericia técnica del alumnado, pero señalan que la etiqueta de “*nativos digitales*” es inadecuada ya que los usos que el alumnado realiza de dichos dispositivos no son tan avanzados en lo que al aprendizaje o al trabajo académico se refiere. Varios participantes señalan que al alumnado no le gusta que se le imponga el uso de dispositivos móviles para actividades académicas ya que los vinculan al ocio y a actividades de comunicación con iguales privadas, pero no tanto al trabajo académico reglado. Sí que hacen un uso de esos dispositivos en el trabajo académico fuera del aula, pero en el aula rechazan su uso obligatorio entre otras cosas debido a la falta de recursos y condiciones para ello en las aulas (se quejan del funcionamiento de la wifi en la mayoría de los centros).

En cuanto a las actividades para las que los estudiantes usan los dispositivos en las valoraciones que realizan a través del cuestionario destacan por orden de importancia: a) Acceso al campus virtual para la descarga o lectura de contenidos, la realización de actividades o la participación en los foros de las asignaturas; b) Para leer el correo; c) Para leer apuntes; d) Para buscar información de cara a los trabajos; y e) Para elaborar los trabajos que les pide el profesorado.

Preguntados por las herramientas de internet que utilizan para el trabajo académico en sus respuestas destacan:

- Motores de búsqueda tipo Google pero también herramientas para buscar recursos en bibliotecas, Wikipedia, etc.
- Revistas especializadas.
- Redes sociales, en menor medida, citan algunas que permiten conseguir apuntes (se menciona Patata Brava)

- Herramientas para conectarse con compañeros y compañeras de cara a la realización de trabajos con documentos compartidos (varios mencionan el uso del drive, videoconferencias, etc.).
- Para comunicarse con compañeros y compañeras en relación con temas de clase (varios mencionan el WhatsApp).

Entre todos los usos señalados destaca el del campus virtual como entorno de trabajo que utilizan frecuentemente o siempre un 76% del alumnado encuestado.

El tipo de contenidos que consultan en internet son mayoritariamente textos escritos (un 97% consultan estos contenidos frecuentemente o siempre), vídeos (un 75%) y diapositivas (un 72%). En menor proporción consultan imágenes y audios. En cuanto a la creación de contenidos hay que destacar que un 60,7% no crea contenidos para la red y entre los que los crean la mayoría (60,8%) crean textos, vídeos (63%) y diapositivas (70%). Por otro lado, se comprueba que el 56,4% no comparte contenidos para el aprendizaje académico. Entre quienes sí comparten, la forma de compartir predominante es el correo pero incorporan también la web y el almacenamiento en la nube, con textos online.

El uso de los dispositivos móviles es importante para desarrollar el trabajo colaborativo con los iguales. En ese sentido un 92,7% afirma quedar frecuentemente para trabajar con sus compañeros y compañeras de clase. La mayor parte de las veces se encuentran para realizar el trabajo que marca el profesorado (dicen hacerlo un 96%) y para realizar las tareas de clase, pero también para estudiar juntos (76%), resolver dudas (84,9%) y, en menor medida, quedan para preparar exámenes y ampliar conocimientos. La mayoría (72%) combinan para estas actividades los encuentros presenciales y virtuales.

3.3 Elementos pedagógicos de las innovaciones docentes

En el grupo de discusión se exploraron las concepciones que tiene el profesorado acerca de las prácticas innovadoras con dispositivos móviles. En la mayoría de los casos las prácticas relatadas apuntan hacia la búsqueda de experiencias de aprendizaje que den al alumnado un papel más activo. Sobre todo, se debate acerca del tipo de metodologías didácticas que se emplean en clases prácticas y del uso que se hace en ellas de los dispositivos móviles como herramientas de aprendizaje. En cuanto al tipo de actividades en que se usan estos dispositivos y los contextos de uso se plantearon las siguientes cuestiones:

- Uso de aplicación (App) para dispositivos móviles sobre “argayos” en el ámbito de la Geología. Cada alumno sube una fotografía de un argayo a la aplicación y después se realizan una serie de prácticas en el aula.
- Utilización de los smartphones y las tablets en las salidas de campo como sustitutos del diario impreso, sacaban fotografías, llevaban material digital y se manejaban con este tipo de dispositivos móviles.
- Trabajo con Apps y gamificación en el diagnóstico y evaluación de las inteligencias múltiples a través de estos dispositivos.

- Prácticas que usan las imágenes en microscopio para prácticas de Histología. Estas prácticas se comparten en la red social de Facebook. Se aspira a sustituir el cuaderno tradicional de dibujos por un cuaderno digital.
- Uso de una App para medir la presión arterial. Diseño de una App sobre disección animal a través de fotos y vídeo.
- A través de una App usan el acelerómetro del móvil para obtener información de actividades cotidianas.
- Utilización de un juego online llamado Kahoot, con el que los alumnos tenían que jugar respondiendo preguntas relacionadas con los temas trabajados. Gamificación para la asimilación de conceptos teóricos en una asignatura de Tecnología Educativa.
- Realidad aumentada con el uso de Apps y por tanto de dispositivos móviles.
- Idear y diseñar (sobre el papel) una App que ayude a mejorar la vida universitaria proporcionando ideas que puedan ser puestas en práctica por diseñadores o programadores informáticos.
- Uso de dispositivos móviles para la innovación docente en la creación de Moocs y análisis por parte del alumnado del uso de Apps en la formación del profesorado en TIC.

En cuanto al alumnado, cuando se le ha pedido que describa una práctica en la que haya participado y en la que los medios digitales y los dispositivos móviles se hayan utilizado para favorecer su aprendizaje académico, las respuestas indican:

- La mayoría hace referencia a una práctica de diseño de cursos MOOC mediante la realización de una página web con herramientas digitales a la que se incorporaron diversos dispositivos de redes sociales, vídeos, videoconferencias etc.
- Son abundantes las referencias a prácticas en las que se usa el campus virtual, bien para realizar trabajos individuales o grupales, bien para consultar los materiales que los profesores facilitan para dichos trabajos.
- También hay bastantes referencias a la realización de un blog educativo con la herramienta blogger.
- Otro grupo de referencias tiene que ver con la realización de actividades usando las redes sociales y varias personas citan la realización de una campaña de sensibilización con este tipo de herramientas.
- Hay referencias también abundantes a prácticas de una asignatura en la que se trabaja sobre la búsqueda de información educativa en bases de datos especializadas como Dialnet, Redined, Google Académico, realización de bases de datos con herramientas como Zotero, etc.
- En diferentes experiencias poco definidas se hace alusión al uso de herramientas como Prezzi, Madmagz, Hangout, Powtoone, WhatsApp, Youtube, Instagram, Google, Movimaker, Videscribe, etc.

Cabe resaltar la unanimidad de la respuesta a la pregunta de si consideran útil que se utilicen los medios digitales para fomentar el aprendizaje académico. El 100% afirma la utilidad de esos medios por razones variadas que van desde constatar que estamos en la Sociedad Digital y que, por tanto son imprescindibles, hasta señalar que hay que “*renovarse o morir*”.

4. Necesidades y oportunidades detectadas

La mayor parte de las necesidades que ha señalado el profesorado tienen que ver con su formación y actualización docente. De esta forma se señalan las siguientes:

- La importancia de contar con un centro de recursos que proporcione al profesorado las herramientas para diversas metodologías docentes.
- La necesidad de dar una mayor formación al profesorado pero orientada hacia el intercambio y reflexión sobre experiencias mediante estrategias formativas muy prácticas (en la línea de seminarios, talleres, etc.) y creación de espacios virtuales para compartir experiencias.
- La importancia de difundir ejemplos de buenas prácticas en metodologías docentes que incorporen el uso de los dispositivos móviles
- La necesidad de acercarse al conocimiento de las opiniones de los alumnos y de los usos que hacen de los dispositivos móviles
- Avanzar en conocimientos sobre el diseño de intervenciones y en la formación en aspectos relacionados con evaluación. Señalan que son imprescindibles nuevas estrategias y herramientas para la evaluación de los aprendizajes con nuevos dispositivos.

En otro orden de cosas, las personas participantes en el grupo coincidían en la necesidad de vencer las resistencias al uso de los dispositivos móviles para actividades académicas que ponían en conexión con la “*falsa pericia*” de los nativos digitales. Afirman que el alumnado muestra muchas carencias a la hora de usar los dispositivos en el ámbito académico de cara a un trabajo más sistemático y riguroso, señalando que, en muchos casos, el supuesto dominio sobre las herramientas es limitado y que la información que manejan con dichos dispositivos es analizada de forma superficial y rápida, sin el rigor y el detenimiento que requieren los aprendizajes académicos.

En cuanto a las oportunidades detectadas entre el profesorado cabe señalar las siguientes:

- Usos alternativos que posibilitan los dispositivos móviles, por ejemplo como complemento a las aulas de informática, que no tienen siempre los recursos necesarios o no funcionan adecuadamente. A esto se añade la versatilidad de funciones que permite el móvil para grabar, sacar imágenes, buscar información, etc. se conecta con la

diversidad de usos que posibilita como medio para el aprendizaje pero siempre en el marco de una Buena metodología.

- Uso como herramienta para renovar algunas prácticas: se pusieron diferentes ejemplos de su uso para la recogida de información a través de fotografías, vídeos, sustitución del cuaderno de clase y el cuaderno de campo por un cuaderno o portfolio digital.
- Desarrollo de Apps o uso de Apps existentes con fines didácticos. Se pusieron ejemplos de uso de Apps para la medida de la presión arterial, uso del acelerómetro o para el asentamiento de conceptos teóricos de una asignatura, etc. y de la creación de Apps para la disección animal.
- La Realidad Aumentada y la Gamificación aunque escasamente mencionadas presentan posibilidades de innovación que conectan con las experiencias y los intereses del alumnado que hay actualmente en las aulas y que contarán con avances importantes en el futuro:
 - El concepto “gamificación” (del inglés “game”: juego) se refiere a la introducción de mecánicas de juego en actividades formativas que permitan mediante la participación de los alumnos en experiencias de aprendizaje. La investigación reciente parece indicar que esas mecánicas de juego permiten experimentar tareas dentro de un ambiente significativo y ameno en el que se fomenta la exploración, la motivación, se refuerza el progreso, permitiendo experimentar el error de manera no coercitiva y posibilitando el pensamiento creativo y divergente.
 - La realidad aumentada indica la posibilidad de añadir información “virtual” (computacional: sonido, imagen, texto, geolocalización) a objetos físicos de nuestra realidad cotidiana, mediante el uso de dispositivos móviles. Esto es, la realidad “se aumenta”, se amplía con capas de información virtual que son visibles o accesibles a través de aplicaciones móviles. El contenido que puede añadirse virtualmente puede aparecer en cualquier formato multimedia: geolocalización, perfiles sociales, información educativa, juegos... pero también incorpora la publicidad.

Una primera valoración de este estudio piloto nos lleva a plantear que no es el contacto con las tecnologías lo que produce la innovación sino que el profesorado parece avanzar en la incorporación de los dispositivos móviles en metodologías que ya utilizaba previamente con el fin de enriquecerlas y hacerlas más participativas y motivadoras. Existen trabajos que se han centrado en este aspecto destacando que las tecnologías por sí solas no cambian los ambientes de aprendizaje (Marcelo, Yot y Mayor, 2015). Se requiere de intervenciones más intensas en las que las tecnologías acompañen a estrategias de enseñanza y de aprendizaje que no solo prioricen la adquisición de conocimientos basados en recursos digitales sino que apoyen un proceso de apropiación de estos conocimientos por parte del alumnado a través de

actividades de aprendizaje productivas, experienciales o comunicativas (Marcelo, Yot y Mayor, 2011).

Por otro lado, hemos constatado que los dispositivos móviles se emplean para facilitar el desarrollo de entornos de aprendizaje colaborativos en los que el alumnado pueda realizar tareas cuasi reales de manera activa, autónoma y grupal. En estos entornos tienen especial interés las redes sociales como herramientas de colaboración entre el alumnado y de apertura de las experiencias de aprendizaje al entorno social y laboral. Por todo ello, creemos que estos dispositivos van a ser fundamentales en el acceso a nuevas formas de enseñanza online que incorporan nuevas maneras de organizar el contenido de aprendizaje y nuevas experiencias didácticas para el alumnado que aprovechen la potencialidad de la web 2.0, los formatos transmedia, etc. Estos cambios que están teniendo como referencia las metodologías utilizadas en los cursos Masivos, Abiertos en Línea o cursos MOOC.

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Los talleres de elaboración de escenarios como herramienta docente

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Abstract

Los talleres de elaboración de escenarios son una herramienta ampliamente utilizada en proyectos de investigación y como soporte a la toma de decisiones. El objetivo de los escenarios es pensar sobre desarrollos plausibles y relacionados con las incertidumbres de forma estructurada y creativa. Los escenarios son útiles para intentar de comprender y reflexionar sobre las incertidumbres que se plantean en el futuro. En los enfoques participativos se involucra a los distintos actores en la elaboración y la evaluación de los escenarios mediante la realización de talleres.

La experiencia se llevó a cabo con los alumnos de la asignatura Política del agua y gestión eficiente del regadío (PAGER) del Máster Universitario en Economía Agroalimentaria y del Medio Ambiente de la UPV (MUEAMA) durante el curso 2016-17. Los alumnos prepararon el seminario y adoptaron los roles de usuarios de la zona (regantes, usuarios urbanos, administraciones públicas y ecologistas). En una sesión final se expusieron los resultados. Por último se realizó una evaluación de la metodología empleada y su utilización como herramienta docente.

Palabras clave: *juego de rol, cambio climático, adaptación, metodología participativa, evaluación.*

Introducción

El proceso de adaptación de las enseñanzas universitarias oficiales al Espacio Europeo de Educación superior (EEES)- conocido como el “Proceso de Bolonia” ha supuesto importantes cambios en el sistema universitario español. Tanto la estructura de las titulaciones ofrecidas como las metodologías docentes empleadas han experimentado modificaciones. En el año 2009 cuando se crea el Master en Economía Agroalimentaria y del Medio Ambiente cuya entidad responsable es el Departamento de Economía y Ciencias Sociales. Este Master se ha caracterizado por la utilización de nuevas tecnologías en las metodologías docentes (García Mollá et al, 2015) lo que ha permitido acceder a los estudios de posgrado a alumnos que de otro modo no hubieran podido hacerlo.

El EEES fomenta la búsqueda de alternativas a la trasmisión unidireccional del conocimiento, donde el alumnado tiene que asumir el protagonismo y la implicación en el proceso de enseñanza aprendizaje. Debe ser por tanto el profesor el que diseñe y guíe los procesos de adquisición de conocimientos y competencias por el alumno (Imbernon y Medina, 2008).

En este contexto se plantea la utilización de los talleres de elaboración de escenarios como metodología docente en la asignatura PAGER del MUEAMA. Los talleres son una herramienta ampliamente utilizada en proyectos de investigación y como soporte a la toma de decisiones. El objetivo de los escenarios es pensar sobre desarrollos plausibles y relacionados con las incertidumbres de forma estructurada y creativa. Los escenarios son útiles para intentar de comprender y reflexionar sobre las incertidumbres que se plantean en el futuro. En los enfoques participativos se involucra a los distintos actores en la elaboración y la evaluación de los escenarios mediante la realización de talleres.

El objetivo de este trabajo es evaluar la experiencia de utilización de esta metodología en la docencia mediante la realización de un juego del rol. Se pretende por un lado, enseñar a los alumnos las distintas técnicas existentes para llevar a cabo este tipo de investigación y, por otro, profundizar en el conocimiento sobre los efectos que pueden tener los cambios del clima en los regadíos y cuáles son las medidas que se pueden adoptar.

1. Los talleres de elaboración de escenarios

1.1. La metodología

Hay una amplia literatura sobre el uso de métodos de escenarios futuros para lograr alternativas de adaptación robustas en la gestión de los recursos naturales y la gestión del agua (Berkhout et al., 2002; Carpenter et al., 2006; Lempert et al., 2006; Alcamo et al., 2007; Alcamo 2008, March et al., 2012; Moore et al. 2013). En el sector agroalimentario y de la gestión del agua, trabajos recientes proponen el uso de metodologías participativas para el desarrollo de escenarios que contribuyan al desarrollo estrategias de adaptación (Chaudhury, 2012; Faysse et al., 2014, Hatzilacou et al., 2007, Pahl-Wostl 2008). Van der Voorn et al.

(2012) utilizan el *backcasting* participativo como complemento a una gestión adaptativa del agua.

Ante la imposibilidad de reducir la incertidumbre, los escenarios exploratorios son una herramienta que integra la incertidumbre, identificando caminos alternativos sin avalar la mayor o menor certeza de esos desarrollos futuros. Es más, los escenarios abordan los problemas desde una perspectiva integral, multi-dimensional, y con un horizonte temporal y espacial más amplio que el que, usualmente, las prisas políticas permiten incluir (Alcamo, 2008). La participación de los actores y otros expertos en el desarrollo de los escenarios contribuye a aumentar la relevancia, la legitimidad y el impacto de los escenarios (Rothman, 2008), y además puede contribuir al aprendizaje social en la evaluación de impactos climáticos (Berkhout et al., 2002, Pahl-Wostl, 2008).

1.2. Objetivos

Los escenarios futuros son una herramienta que permite incluir a los diferentes actores en el proceso de adaptación. Por un lado, permiten conocer la opinión de los participantes y por otro lado discutir sobre los cambios e impactos del cambio global en la agricultura local. Los objetivos del uso de escenarios futuros pueden ser diferentes, no obstante permiten: Integrar y analizar la visión de los actores en la gestión de los recursos naturales; Considerar diferentes escenarios climáticos y socio-económicos diferentes ante situaciones de incertidumbre futura; Evaluar la percepción de los impactos del cambio climático; Discutir y evaluar medidas de adaptación con actores clave, mejorando su aceptación y aplicabilidad y desarrollar la toma de conciencia sobre impactos que requieren acciones a largo plazo.

En un contexto donde elevada presión sobre los recursos hídricos dificulta encontrar soluciones y visiones compartidas por los diferentes sectores en competencia, estas herramientas pueden ser útiles. No obstante, su correcta aplicación requiere conocimientos específicos y capacidades que se desarrollan y perfeccionan con su puesta en práctica.

1.3. Adaptación para su uso en docencia (juego de rol)

Para la utilización de la metodología de los talleres como herramienta didáctica se ha recurrido a los juegos de rol. En el aula se simulará que se está realizando un taller participativo con investigadores y actores de la zona estudiada y cada alumno tomará un rol. Los juegos de rol consisten en usar la simulación de una situación de modo que los alumnos están en contacto directo con los conocimientos y destrezas necesarios para lograr el aprendizaje (Fernandez Roca y Tenorio, 2014). Esta metodología permite al alumno experimentar su conocimiento en el aula y con unas reglas que facilitan y fomentan su participación (Spiegel, 2006), haciendo que el aprendizaje sea significativo (Barbato, 1999) Además, el juego de rol tiene motivaciones adicionales para los alumnos ya que motiva asumir ideas y posiciones distintas a las propias, trabajo en equipo, empoderamiento en la

toma de decisiones en el juego, mayor compromiso con la asistencia a clases (Gaete-Quezada, 2011).

2. La aplicación en el MUEAMA

2.1. El MUEAMA y la asignatura PAGER

El Departamento de Economía y Ciencias Sociales de la UPV oferta el Máster Universitario en Economía Agroalimentaria y del Medio Ambiente (MUEAMA) desde el curso 2009-10. Se trata de uno de los primeros másteres impartidos en la UPV y actualmente se imparte su sexta edición en el curso 2016-17. El Master cuenta con 60 créditos. La asignatura PAGER es una asignatura optativa de 4 ECTS. Los objetivos de la asignatura son el análisis de la evolución de los modos de uso del agua; el estudio del agua como factor de y como activo ecológico y social; el análisis de las políticas y de la economía de agua de riego.¹

2.2. El cambio climático

En los próximos años la resolución de los problemas derivados del cambio climático sobre la agricultura de regadío será un gran reto, tanto para los usuarios como para las administraciones. Durante los últimos cursos se ha considerado fundamental que la asignatura PAGER incluyera contenidos sobre cambio climático y su influencia en los recursos hídricos.

La Convención Marco sobre el Cambio Climático (CMCC), define el cambio climático como: “cambio del clima atribuido directa o indirectamente a actividades humanas que alteran la composición de la atmósfera mundial, y que viene a añadirse a la variabilidad natural del clima observada durante períodos de tiempo comparables”. La actividad humana ha dado lugar a una importante incorporación a la atmósfera de gases de efecto invernadero especialmente CO₂, alterando su composición y provocando el efecto invernadero efecto invernadero inducido o antropogénico, responsable de las modificaciones del sistema climático.

2.3. Objetivo del taller

De acuerdo con Inbernon y Medina (2008) los talleres tienen una serie de objetivos como metodología docente: Desarrollar, aprender y practicar estrategias que fomenten la participación del alumno; desarrollar estrategias de aprendizaje activo y aplicar estrategias metodológicas que posibiliten desarrollar en el alumnado habilidades sociales y cooperativas. En cuanto a la aplicación de esta metodología en la asignatura los objetivos son: Explicar qué es el cambio climático, sus causas e impactos; Analizar los efectos del cambio climático en el sector agrario y las posibles medidas de adaptación; comparar diversas formas de afrontar

¹ https://www.upv.es/titulaciones/MUEAMA/menu_974416i.html

la gestión del agua y los intereses de los actores claves; conocer las metodologías participativas de investigación y las claves de la facilitación de talleres y utilizar los escenarios en la evaluación del cambio climático como método de investigación.

2.4. Preparación del taller

2.4.1. Primera clase: introducción al cambio climático, a la metodología de trabajo con escenarios.

La primera clase consistió en una introducción por parte de los docentes al cambio climático (magnitud, implicaciones, impactos esperados, etc.), su relación con el desarrollo socioeconómico, y su importancia de cara al futuro, y en especial para el sector agrícola. También se introdujeron las metodologías de trabajo con escenarios futuros (tipos de escenarios disponibles, escenarios climáticos y socioeconómicos globales, etc.) así como sus ventajas y limitaciones. Tras la introducción al tema, se propuso la realización de un taller con escenarios futuros y se debatió acerca del área donde aplicar la metodología. Finalmente, se eligió la zona del Vinalopó (propuesta por los docentes).

2.4.2. Segunda clase: explicación de la zona de estudio (Vinalopó), análisis de actores y reparto de roles y tareas.

La cuenca del Vinalopó presenta una situación de importante déficit hídrico, por lo que existen usos en competencia y un posicionamiento de los actores sobre las diferentes medidas de gestión del agua. Por este motivo, la segunda clase consistió en una descripción general de la zona de estudio. Tras esta contextualización se procedió al análisis de actores. En base a la información inicial sobre la zona, los alumnos identificaron a los principales actores y, por parejas, analizaron la posición de los actores según su poder (y capacidad de influencia) e interés. Tras esto, se realizó una puesta en común, aclarando y discutiendo las posiciones de los diferentes actores (con ayuda de la tabla 1). Además, se analizó el rol de los actores clave y se debatió qué perfiles de participantes sería necesario incluir para que un taller fuera representativo y tuviera éxito.

Finalmente, se presentaron los roles a elegir por los alumnos. Se dividió el trabajo en dos grupos: un grupo que tendría el rol de equipo investigador y otro que desempeñaría el rol de los actores de la cuenca. El grupo que asume el rol investigador organiza el taller y desempeña las siguientes tareas: Diseño de la metodología del taller, elaboración de escenarios (narrativas) adaptados a la zona, moderación del debate y control del tiempo y análisis y presentación los resultados del taller. El grupo que toma el rol de usuarios interpreta el papel de un actor clave, busca información para preparar su rol en el taller y busca información sobre medidas de adaptación. Cada alumno debe elegir un papel de entre los posibles usuarios.

Tabla 1. Matriz de análisis de actores (adaptada de Alcamo, 2008)

		- ←-----Poder -----→ +	
+ ↑ -----Interés----- ↓ -	VÍCTIMAS: es necesario incluirlas para que defiendan su interés (gente no organizada, etc.)	JUGADORES: tienen interés y poder.	
	BYSTANDERS: no incluir, pues no tienen ni poder ni interés.	ÁRBITROS: tienen poder pero poco interés (pueden servir de mediadores)	

2.5. Resultados

2.5.1. Trabajo relacionado con el taller

Tras las dos clases preparatorias uno de los grupos de alumnos abordó la preparación del taller, que incluyó las siguientes actividades:

Elaboración de narrativas y escenarios: búsqueda de información sobre la zona de estudio y elaboración de un escenario futuro. En primer lugar, los alumnos realizaron una propuesta inicial de escenarios que consistió en describir la situación actual y luego una hipotética situación futura (en 2027) incluyendo el impacto del cambio climático. La situación actual incluyó una descripción de los recursos disponibles, los problemas ambientales, así como las posibles alternativas de gestión. La situación futura describió los cambios que tendrían lugar (impacto del cambio climático de forma general). Tras esto, los docentes guiaron las propuestas de mejora para la elaboración del escenario futuro, enfatizando que se convirtiera en una narrativa.

Metodología: los alumnos plantearon un programa de trabajo, detallando las actividades del taller y el tiempo necesario para cada una de ellas. Pensaron las cuestiones logísticas y se repartieron los roles de cara a la facilitación del taller.

El segundo grupo, cuyo rol consistía en caracterizar a los usuarios de la cuenca, realizó dos tareas principales:

Partiendo de la visión de la situación general de la zona del Vinalopó y el análisis de actores, prepararon el taller buscando **información sobre el rol asignado**. La búsqueda tenía por objetivo conocer bien su rol para formarse una opinión sobre lo que harían esos actores en su situación, sus posibles opiniones y las posiciones que tomarían sobre las acciones y medidas relacionadas con la gestión del agua y la adaptación al cambio climático. Además, se les propuso realizar una búsqueda de información sobre posibles **medidas de adaptación de la agricultura al cambio climático**.

2.5.2. Tercera clase: taller sobre escenarios futuros

El equipo investigador estaba formado por cuatro alumnos que organizaron el taller y asumieron los siguientes roles: dos fueron moderadores o dinamizadores del debate, uno fue observador-tomador de notas, y una persona se encargó del control del tiempo y su adecuación al debate planteado. El equipo de los usuarios, tuvo también cuatro alumnos que asumieron los siguientes roles: regantes del Vinalopó, agricultores ecológicos, Confederación Hidrográfica del Júcar y organizaciones ecologistas.

El desarrollo del taller, simuló las necesidades de un taller real. En primer lugar, el equipo investigador se presentó e invitó al equipo de los usuarios a presentarse. Posteriormente, el equipo investigador presentó las actividades a realizar. Las actividades con escenarios futuros consistieron en una presentación y lectura inicial del escenario, una adaptación del escenario incluyendo la visión de los actores, y un análisis de los impactos del cambio climático. El hilo conductor de esta última parte fue la pregunta de qué pasaría si ocurriera este escenario (en la agricultura, en los cultivos, en la economía, etc.). Las ideas se fueron capturando y organizando, mediante la ayuda de post-its y papel continuo, lo que permitió construir un mapa de las ideas abordadas. El papel de los docentes en el desarrollo del taller consistió en aclarar dudas sobre el papel y visión de los actores, reorientar el debate, e ir incluyendo en el desenlace del taller información práctica sobre cómo aplicar estas metodologías participativas.

2.5.3. Cuarta clase: el equipo investigador presenta resultados y el equipo de los usuarios las medidas

En la cuarta clase el equipo con el rol de investigador presentó los resultados del taller, enfrentándose a las dificultades de sintetizar la información cualitativa y presentando las principales ideas y las diferentes opiniones de los usuarios. Asimismo, los participantes con el rol de usuarios realizaron una presentación de las medidas más adecuadas para abordar la adaptación de la agricultura al cambio climático en la zona. Para concluir, se realizó evaluación de la experiencia del juego de rol con escenarios como herramienta docente, mediante un cuestionario anónimo a los alumnos.

2.6. Evaluación de la experiencia por parte de los alumnos

2.6.1. Metodología de evaluación de la experiencia por parte de los alumnos

El cuestionario de evaluación incluyó un apartado cuantitativo sobre datos personales. Además, se realizó una evaluación de la estructura y organización de la actividad, los materiales aportados, y la adecuación del tiempo destinado a cada actividad. Los resultados de los seis alumnos que respondieron a la encuesta se presentan en el apartado siguiente.

2.7. Resultados de la evaluación de la experiencia por parte de los alumnos

Los alumnos participantes tuvieron un perfil de edades variado y una formación previa diversa. La mayoría de alumnos tenían una experiencia profesional previa. Además, un 83,3% de los alumnos respondió que tenía interés en aprender nuevas metodologías de investigación. La valoración de la **estructura y organización de la asignatura** fue muy positiva. El principal aspecto a mejorar según los alumnos fue el tiempo empleado. En las respuestas abiertas, cinco alumnos comentaron que dedicarían más tiempo al debate en el taller. Respecto al material proporcionado, los alumnos comentaron que les gustaría recibir más información sobre otros tipos de escenarios y resolución de conflictos en el caso del agua..

La valoración del juego de rol como herramienta de aprendizaje fue, en general, positiva, pues los alumnos valoraron que la actividad permitió aprender sobre nuevas metodologías de investigación, sobre el impacto del cambio climático en la agricultura, sobre el trabajo con escenarios futuros y empatizar con la visión de otros actores. Según la opinión de los alumnos, los contenidos abordados mediante el uso de talleres participativos y escenarios ha sido positiva. Además, consideraron que el caso elegido (la cuenca del Vinalopó) y la actividad eran coherentes con los objetivos de la asignatura. Los alumnos también respondieron que esta actividad les fue útil para profundizar en los temas abordados en mayor medida que una clase magistral. Como valoración general los alumnos respondieron que recomendarían la actividad y los docentes a otro compañero.

3. Conclusiones

El juego de rol integrado en la organización de un taller de escenarios futuros ha sido una estrategia efectiva para fomentar la implicación del alumno en el proceso enseñanza aprendizaje. Además de fomentar la participación del alumnado la experiencia ha permitido desarrollar, mediante una experiencia práctica, habilidades sociales y cooperativas. En este sentido, el juego de rol ha potenciado el respeto a la diversidad de opiniones, el apoyo mutuo y la relación entre iguales. La actividad ha permitido acercar a los alumnos a la diversidad de opiniones e intereses contrapuestos en la gestión del agua. Al ponerse en el papel de otro, los alumnos se han planteado los problemas desde diferentes puntos vista, entendiendo desde una perspectiva amplia la complejidad y las dificultades de las situaciones de gestión del agua en la realidad. Esto les ha permitido empatizar con ideas que en un principio pueden parecer alejadas, promoviendo también el aprendizaje de la tolerancia.

Por otro lado, la herramienta ha permitido desarrollar estrategias de aprendizaje activo. Esto ha permitido convertir en significativos aspectos de los contenidos de la asignatura mediante el debate y la preparación del taller. Además, el uso de talleres basados en experiencias reales ha incrementado la cantidad de información que los alumnos han recibido y procesado. Por otro lado, se ha favorecido la toma de contacto con herramientas de investigación que requieren de un conocimiento metodológico eminentemente práctico, y que se adquiere a

través de la experiencia (moderación de debates, facilitación de talleres, organización de actividades adecuadas a la temática del taller, desarrollo de escenarios, etc.).

En cuanto a contenidos, la herramienta del trabajo con escenarios ha sido útil para entender qué es el cambio climático y sus impactos en el sector agrario. Las actividades realizadas han permitido abordar el cambio climático desde esta perspectiva y además, conocer en más detalle los escenarios futuros como herramienta de investigación.

Podemos concluir, por tanto, que la utilización de juegos de rol ha resultado ser una herramienta útil para fomentar la participación y la adquisición de nuevos conocimientos de un modo activo de los alumnos en el aula y ha servido para poner en contacto a los alumnos con técnicas de investigación novedosas, lo que resulta puede resultar especialmente útil para los alumnos de master.

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Análisis del uso de la metodología aprendizaje basado en problemas como herramienta de desarrollo de competencias en estudiantes de grado de ingeniería

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Abstract

La sociedad actual requiere de los egresados la formación en un amplio abanico de competencias transversales, además de competencias específicas de su título. En el presente trabajo se analiza la viabilidad de la metodología aprendizaje basado en problemas (ABP) como herramienta de desarrollo de competencias en estudiantes de grado de ingeniería, con especial énfasis en la competencia instrumental específica manejo de Matlab de la que la asignatura es punto de control. Para ello, se ha diseñado un conjunto de 6 problemas reales con nivel de dificultad que aumenta gradualmente. Los resultados obtenidos indican que, pese a que la actividad ha supuesto una carga de trabajo importante para los alumnos (el tiempo de dedicación promedio 71 ± 35 h), el 95.9% de los alumnos encuestados valoran positivamente la metodología ABP como herramienta de desarrollo de sus competencias. Además de mejorar de forma considerable el dominio de la competencia instrumental específica manejo de Matlab, los alumnos consideran que la actividad también ha contribuido a la formación de otras competencias: aplicación y pensamiento práctico, análisis y resolución de problemas, aprendizaje permanente, integración de conocimientos multidisciplinares, trabajo en equipo y liderazgo, y planificación y gestión del tiempo. Por otro lado, el tiempo de dedicación del profesorado a la actividad en cambio está dentro del rango esperado (entorno al 40 h/grupo), lo cual sugiere la sostenibilidad de la actividad en los cursos posteriores

Keywords: *Aprendizaje basado en problemas, competencias transversales, Instrumental específica.*

Introducción

Graduados y empleadores apuntan la gran importancia de la formación no sólo en conocimientos sino más bien en competencias transversales puesto que determinan a capacidad de adaptarse de forma rápida y eficaz a los cambios, utilizando y actualizando constantemente las aptitudes y actitudes requeridas en su vida laboral. La implantación del Espacio Europeo de Educación Superior (EEES) y la entrada de los nuevos títulos ha supuesto una sustancial transformación de la docencia universitaria tanto en lo referente a las metodologías empleadas, a las estructuras de enseñanza, o a la implantación de sistemas de regulación y control de su calidad (Hermosilla 2013). El eje central del cambio es hacer al estudiante protagonista del mismo, responsable de un aprendizaje que debe ser significativo y autónomo (Villa 2011). El enfoque del aprendizaje basado en competencias no sólo se refiere al conocimiento nuevo que puede y debe adquirir el estudiante, sino al desarrollo y evolución del modo de aprender, de aprender y mejorar cómo aplica los conocimientos a situaciones nuevas, cómo integra las actitudes y valores y los pone en juego, cómo incorpora las técnicas y métodos en su modo de actuar y afrontar las situaciones (Villa 2011). Este nuevo enfoque requiere un aprendizaje significativo por parte del alumno que dote de sentido al material de aprendizaje mediante su interiorización.

En este respecto, la Universitat Politècnica de València (UPV) ha definido un total de 13 competencias transversales con el fin de formar y acreditar a los estudiantes egresados en cualquiera de los títulos oficiales impartidos en la UPV. Partiendo de la hipótesis de que se trabajan las competencias transversales en las distintas materias/asignaturas, a nivel institucional se realiza el seguimiento del progreso de los estudiantes a través de materias/asignaturas seleccionadas como puntos de control. En este contexto, Señales Biomédicas es una asignatura troncal de tercer curso del Grado de Ingeniería Biomédica que se imparte en la Escuela Técnica Superior de Ingenieros Industriales de la UPV. Tiene aproximadamente unos 65 alumnos, y es punto de control de la competencia “Instrumental específica”. Concretamente, la competencia “Instrumental específica” hace referencia a la capacidad de utilizar herramientas y tecnologías necesarias para el ejercicio profesional asociado a cada titulación, estando en este caso ligado al manejo de la herramienta de programación Matlab. Así, el objetivo de este trabajo es diseñar una actividad formativa que permita a los alumnos trabajar y desarrollar la competencia “Instrumental específica” y otras competencias transversales en la medida de lo posible.

Existen diversas metodologías docentes que permiten los alumnos trabajar, desarrollar y evaluar las habilidades de identificar las herramientas más adecuadas en cada aplicación, así como integrarlas y combinarlas para resolver un problema, como el aprendizaje basado en problemas, el aprendizaje basado en proyectos o el uso del portafolio. El portafolio es una técnica de recopilación, compilación, colección y repertorio de evidencias y competencias profesionales que ha sido ampliamente utilizada como una herramienta de evaluación del

desarrollo de competencias (Villardón 2006, Barragán 2005). El aprendizaje basado en problemas y en proyectos son metodologías que sitúan al alumno en el centro del aprendizaje para que sea capaz de resolver de forma autónoma ciertos retos o problemas. Se basan en el principio de usar problemas como punto de partida para la adquisición e integración de los nuevos conocimientos (Barrows 1986). Ambas metodologías son estrategias eficaces y flexibles para ayudar al alumno a desarrollar y trabajar diversas competencias, i.e, análisis y resolución de problemas (habilidades de identificación de problemas relevantes del contexto profesional, búsqueda y manejo de información, etc..), integración de conocimientos multidisciplinares, aprendizaje autónomo y permanente, planificación de las estrategias que se van a utilizar para aprender, trabajo en equipo, pensamiento crítico, habilidades de manejar las herramientas, habilidades de comunicación (argumentación y representación de la información), habilidades de evaluación y autoevaluación (De Miguel 2005, Prieto 2006). A pesar de que ambas metodologías comparten numerosas características, existen ciertas diferencias entre ellas. A diferencia del aprendizaje basado en proyectos, en el que en general los problemas a resolver son más complejos y se hace más hincapié en la utilización de conocimientos adquiridos para obtener el producto final, en el aprendizaje basado en problemas se busca la adquisición de conocimientos durante el proceso de aprendizaje, no siendo excesivamente complejos los problemas que se abordan.

En este trabajo se pretende diseñar una actividad formativa para trabajar la competencia “Instrumental específica” manejo de Matlab en la asignatura “Señales Biomédicas” de tercer curso del Grado en Ingeniería Biomédica. Puesto que en este curso el nivel de dominio en el manejo de la herramienta Matlab es inicialmente es bajo y el del resto de competencias transversales a trabajar también, se ha preferido emplear una metodología aprendizaje basado en problemas.

1. Objetivos

El objetivo general de este trabajo es valorar el desempeño de una actividad formativa para trabajar la competencia “Instrumental específica” manejo de Matlab en la asignatura “Señales Biomédicas” de tercer curso del Grado en Ingeniería Biomédica en el curso 15-16. Se plantean los siguientes objetivos específicos:

- -Valorar el grado de adquisición por parte del alumnado de la competencia instrumental específica manejo de Matlab.
- -Determinar el grado de mejora que considera el alumno que ha experimentado en el dominio de la competencia instrumental específica manejo de Matlab.
- -Estimar la dedicación horaria de los alumnos y el profesorado en las actividades destinadas al trabajo y a su evaluación, para valorar la sostenibilidad de la misma.
- -Analizar si los alumnos consideran que las actividades propuestas favorecen el desarrollo de otras competencias transversales como aplicación y pensamiento práctico, análisis y resolución de problemas, capacidad de autoaprendizaje, integración de

conocimientos multidisciplinares, trabajo en equipo y liderazgo y planificación y gestión del tiempo.

2. Desarrollo de la innovación

La asignatura de Señales biomédicas (6 créditos, 4,2 de teoría y 1,8 de prácticas con 1 grupo de teoría y 3 de prácticas) da una visión básica sobre las diferentes señales biomédicas utilizadas en la práctica clínica y su tratamiento/procesado, centrándose en las técnicas de análisis espectral y filtrado de señales biomédicas, continuas y discretas, en el dominio temporal y en los diferentes dominios transformados, para señales deterministas y para procesos estocásticos. Se muestran ejemplos teórico/prácticos de diferentes técnicas de procesado y ayuda al diagnóstico de las principales señales utilizadas en el ámbito médico, como son el electrocardiograma (ECG), el electromiograma (EMG) y el electroencefalograma (EEG) entre otras.

En esta asignatura se trabajan competencias genéricas y específicas de la titulación como la capacidad de análisis y síntesis, el poseer conocimientos de herramientas informáticas para analizar, calcular, visualizar, representar y obtener la información necesaria para apoyar las tareas de análisis, cálculo, diseño, desarrollo y gestión relacionadas con la ingeniería biomédica, el fomento de la autonomía y de la consolidación y la actualización de nuevos conocimientos en el área de la ingeniería biomédica entre otras. Asimismo, se trabajan las competencias transversales: comprensión e integración, instrumental específica (CT13, dentro del marco UPV) centrada en el manejo de la herramienta de programación Matlab, aplicación y pensamiento práctico, análisis y resolución de problemas siendo la asignatura punto de control de las dos primeras. El concepto “punto de control” hace referencia a las asignaturas que son elegidas para “medir” el grado de adquisición de la competencia que se le ha asignado. Puesto que las CTs se adquieren en un proceso evolutivo largo, se han establecido, al menos tres momentos para evaluar el nivel de adquisición de cada una de las CT durante el proceso formativo: al menos una vez durante los dos primeros cursos del grado (nivel de dominio I); una segunda vez en asignaturas de la franja de tercero y cuarto curso de grado (nivel de dominio II); y durante la formación del máster (nivel de dominio III). De manera complementaria, la UPV evalúa el grado de adquisición de las diferentes competencias transversales mediante el TFG y el TFM.

El sistema de evaluación de la asignatura consiste en: 6 trabajos académicos (30 %) y 2 pruebas escritas de respuesta abierta (70%). El trabajo académico está vinculado a las prácticas de la asignatura. Éstas han sido diseñadas por el profesorado para, desde el aprendizaje basado en problemas “reales”, trabajar y evaluar la competencia instrumental específica manejo de Matlab. Concretamente las 6 prácticas consisten en el desarrollo de diferentes algoritmos para el procesamiento y análisis de señales biomédicas: eliminar interferencias (mediante técnicas de filtrado digital), ejecutar análisis de señales discretas con el fin de obtener parámetros que puedan servir de diagnóstico (parametrización de las señales

en el dominio temporal y espectral, caracterizando su amplitud, frecuencias dominantes y contenido espectral), y realizar algunos procesamientos estandarizados (ventanas móviles, cálculo de periodograma...).

Las prácticas 1 y 2 son prácticas de formación/consolidación de los alumnos en el manejo básico de la herramienta Matlab. Sirven para guiarlos en la interpretación de problemas reales dentro del ámbito de la ingeniería biomédica (Práctica 1: detección de marcha para diagnóstico del párkinson; Práctica 2: detección del ritmo cardiaco) y en la formulación de algoritmos de programación para la generación de soluciones a los problemas planteados. Al finalizar cada una de estas dos prácticas los alumnos deben entregar una memoria detallando los resultados obtenidos y las conclusiones derivadas. Cada práctica supone el 3% de la nota final de la asignatura. En la figura 1 se adjunta la rúbrica de evaluación empleada. En estas primeras prácticas no se evalúa ni califica la competencia transversal (CT) instrumental manejo de Matlab, puesto que están orientadas a la revisión de conceptos previos sobre el manejo de la herramienta vistos en asignaturas previas. Así se evalúan tres ítems: consecución de objetivos, presentación de resultados y gestión del tiempo. Los dos primeros se evalúan sobre 10 en base a la memoria presentada y permiten al equipo de alumnos obtener la máxima puntuación de la práctica (65% consecución de objetivos y 35% presentación de resultados). En cuanto al ítem gestión del tiempo, la no entrega de la memoria en el plazo establecido supone una penalización de 1 punto sobre 10 respecto de la nota final de la práctica. Para pasar de la evaluación a la calificación de la práctica se ha establecido en este caso las siguientes equivalencias entre niveles de calidad y notas: nivel muy bajo (2 puntos), bajo (4 puntos), medio (7 puntos) alto (9 puntos). Mediante una flecha ascendente o descendente sobre la rúbrica se suma o resta un punto a la puntuación media de cada nivel de calidad.

Criterio	NIVELES DE CALIDAD			
	Muy bajo	Bajo	Medio	Alto
CONSECUCCIÓN DE OBJETIVOS	La memoria que entrega al finalizar contiene gran cantidad de resultados erróneos o faltan resultados importantes	La memoria que entrega al finalizar la práctica está poco elaborada, o con falta de algún contenido relevante que demuestren la correcta ejecución de los algoritmos	La memoria que entrega al finalizar la práctica contiene resultados correctos pero con vaga o deficiente interpretación de los mismos	La memoria que entrega al finalizar la práctica contiene resultados correctos y los comentarios relativos a la interpretación de los mismos son apropiados
PRESENTACIÓN DE LOS RESULTADOS	La presentación es deficiente: gráficas sin ejes y/o unidades, texto sin formatear, faltas ortográficas, figuras con mala calidad de imagen, mala apariencia del documento	La presentación es regular, alguna gráfica sin ejes y/o unidades, algún texto sin formatear o con faltas ortográficas, figuras con mala calidad de imagen.	La presentación buena, sin errores gramaticales y corrección en la elaboración del documento	La presentación es excelente, se cuidan todos los detalles a nivel de redacción, formato, figuras y referencias bibliográficas
GESTIÓN DEL TIEMPO	Memoria final entregada fuera de plazo (se resta un punto respecto de la nota final)			Memoria final entregada en plazo. No resta

Figura 1. Rúbrica de evaluación de las prácticas 1 y 2 de la asignatura Señales Biomédicas, Grado en Ingeniería Biomédica, UPV curso 15-16. Fuente: Elaboración Propia

Tras estas primeras prácticas introductorias, en las prácticas 3, 4, 5 y 6 los alumnos deben elaborar y entregar por equipos de 3 alumnos, un algoritmo implementado en Matlab previo a la sesión de la práctica correspondiente. El grado de dificultad del algoritmo previo crece

de forma gradual a lo largo de las mismas. El profesor de prácticas revisa los algoritmos presentados en la fecha fijada antes de la práctica y, con suficiente antelación, envía las correcciones pertinentes a los alumnos. Al finalizar las prácticas cada equipo de alumnos entrega una memoria de resultados y conclusiones de la misma. Estas 4 últimas prácticas suponen cada una de ellas un 6% de la nota final y se evalúan según la rúbrica mostrada en la figura 2. En estas 4 prácticas se evalúa y califica la CT instrumental manejo de Matlab, de modo que la rúbrica ha sido elaborada teniendo en cuenta directrices sobre la elaboración de rúbricas de esta competencia (niveles de dominio 1 y 2) propuestas por la Universitat Politècnica de València. La rúbrica contempla 5 ítems de evaluación: Trabajo previo, selección de herramientas y resolución autónoma de problemas complejos, consecución de objetivos, presentación de resultados y gestión del tiempo, definiendo 4 niveles de calidad para cada uno de ellos. Los cuatro primeros se evalúan sobre 10 y permiten al equipo de alumnos obtener la máxima puntuación de la práctica (15% previo, 35% combinación de herramientas, 35% consecución de objetivos y 15% presentación de resultados). Para la evaluación del ítem combinación de herramientas se tiene en consideración la ayuda requerida por parte de los equipos (tutorías virtuales y/o presenciales) para la elaboración del algoritmo previo así como la ayuda durante la realización de la misma, recurriendo para ello el profesorado a la observación de los equipos durante la sesión de prácticas. La detección de copia de algoritmos entre equipos es penalizada con la asignación de la mínima nota. Los plagios son fácilmente identificables dada la complejidad del problema a resolver, las múltiples soluciones posibles admisibles y la forma de implementarlas. En cuanto al ítem gestión del tiempo, la no entrega de la memoria en el plazo establecido supone una penalización de 1 punto sobre 10 respecto de la nota final de la práctica. Para pasar de la evaluación a la calificación de la práctica se han establecido las mismas equivalencias entre niveles de calidad y notas que en las prácticas 1 y 2: nivel muy bajo (2 puntos), bajo (4 puntos), medio (6 puntos) alto (9 puntos). Mediante una flecha ascendente o descendente sobre la rúbrica se suma o resta un punto a la puntuación media de cada nivel de calidad.

Criterio	NIVELES-DE-CALIDAD			
	Muy-bajo	Bajo	Medio	Alto
TRABAJO-PREVIO	El trabajo previo no tiene los contenidos recomendados en el enunciado, o se detecta similitudes con otras memorias	El trabajo previo está poco elaborado, falta gran parte de los contenidos recomendados en el enunciado, o se detecta similitudes con otras memorias	Al trabajo previo le falta algún contenido importante para la posterior ejecución de la práctica	El trabajo previo contiene todos los algoritmos necesarios para el correcto desarrollo de la práctica
SELECCIÓN-DE-HERRAMIENTAS-Y-RESOLUCIÓN-AUTÓNOMA-DE-PROBLEMAS-COMPLEJOS	No define el flujo de programa ni identifica los comandos adecuados Es incapaz de desarrollar los algoritmos, aún con ayuda del profesor	Puede tener algún error en el flujo de programa o no identificar adecuadamente algún comando Desarrolla los algoritmos, pero con bastante ayuda del profesor	Flujograma adecuado Maneja y combina los comandos de forma autónoma Desarrolla los algoritmos con consultas muy puntuales al profesor	Flujograma adecuado, maneja y combina los comandos de forma autónoma, desarrollando los algoritmos sin consultar al profesor
CONSECUCCIÓN-DE-OBJETIVOS	La memoria que entrega al finalizar contiene gran cantidad de resultados erróneos o faltan resultados importantes	La memoria que entrega al finalizar la práctica está poco elaborada, o con falta de algún contenido relevante que demuestren la correcta ejecución de los algoritmos	La memoria que entrega al finalizar la práctica contiene resultados correctos pero con vaga o deficiente interpretación de los mismos	La memoria que entrega al finalizar la práctica contiene resultados correctos y los comentarios relativos a la interpretación de los mismos son apropiados
PRESENTACIÓN-DE-LOS-RESULTADOS	La presentación es deficiente: gráficas sin ejes y/o unidades, texto sin formatear, faltas ortográficas, figuras con mala calidad de imagen, mala apariencia del documento	La presentación es regular alguna gráfica sin ejes y/o unidades, algún texto sin formatear o con faltas ortográficas, figuras con mala calidad de imagen	La presentación buena, sin errores gramaticales y corrección en la elaboración del documento	La presentación es excelente, se cuidan todos los detalles a nivel de redacción, formato, figuras y referencias bibliográficas
GESTIÓN-DEL-TIEMPO	Previo y/o memoria final entregada fuera de plazo (se resta un punto respecto de la nota final)			Previo y/o memoria final entregada en plazo. No resta

Figura 2. Rúbrica de evaluación de las prácticas 3-6 de la asignatura Señales Biomédicas, Grado en Ingeniería Biomédica, UPV curso 15-16. Fuente: Elaboración Propia

La evaluación y calificación de la CT instrumental específica manejo de Matlab se realiza empleando los dos primeros criterios definidos: Trabajo previo y Combinación de herramientas. La calificación final de la competencia instrumental específica se estima considerando la valoración que más se repite (A=Alto, B=Medio, C=Bajo pero suficiente, D= Muy bajo, no alcanzado) en las 3 sesiones de prácticas.

Para valorar el grado de mejora que considera el alumno que ha experimentado en el manejo de la herramienta Matlab, estimar la dedicación horaria de los alumnos y el profesorado en las actividades (problemas) destinados al trabajo de la competencia instrumental específica, y para analizar si los alumnos consideran que las actividades propuestas favorecen el desarrollo de otras competencias transversales (aplicación y pensamiento práctico, análisis y resolución de problemas, etc..) los profesores han elaborado un cuestionario que será cumplimentado de forma individual por los alumnos en la última sesión de la asignatura (véase anexo)

3. Resultados

De los 66 alumnos matriculados en la asignatura, se formaron inicialmente 25 equipos de trabajo de 2 o 3 alumnos. Todos los equipos han seguido la dinámica preprogramada de la actividad, siendo la tasa de abandono de la actividad del 0%. Del total de alumnos matriculados, 53 alumnos han contestado la encuesta de auto-evaluación en la última sesión de clase de teoría. Se han descartado 4 encuestas incompletas, por tanto se presentarán sólo los resultados de la encuesta realizados sobre 49 alumnos. En la figura 3 se aprecia que el 95.9% (47 de 49) consideran que han mejorado el manejo de la herramienta Matlab con el desarrollo de las actividades. Antes de comenzar el curso, el 89.8% de los alumnos encuestados sitúa su nivel de manejo de la herramienta en “Muy Bajo” (34.7%) o “bajo”

(55.1%), mientras que después de cursar la asignatura el 81.6% de alumnos consideran es “Buena”, “Muy Buena” o “Excelente”. Estos resultados cumplen la expectativa inicial de los profesores.

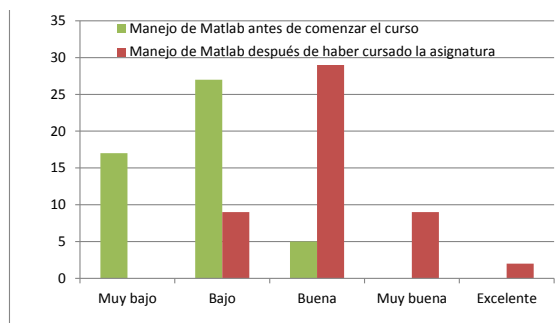


Figura 3. Auto-evaluación de los alumnos sobre el manejo de la herramienta Matlab antes de comenzar el curso y después de haber cursado la asignatura, siendo el n° de alumnos encuestados 49.

Fuente:Elaboración Propia.

En la tabla 1 se observa que en promedio, las horas totales dedicadas a la actividad por los alumnos a estas actividades está alrededor de 71 ± 35 h, valor superior al estimado para desarrollar la actividad (56 h). Esta discrepancia en la dedicación horaria podría ser debida a que el nivel de manejo de la herramienta Matlab de los alumnos antes de comenzar el curso sea inferior a la expectativa del profesorado. El tiempo de dedicación del profesorado a la actividad se sitúa alrededor de unas 40 h/grupo que están dentro del rango esperado por parte del mismo. Estos resultados sugieren la sostenibilidad de la actividad en los cursos posteriores con cambios menores para reducir ligeramente la carga de trabajo de los alumnos.

Tabla 1. Tiempo de dedicación a la actividad de los alumnos y de los profesores fuera del horario de clase, siendo el n° de alumnos encuestados 49. Fuente: Elaboración Propia.

	Alumnos	Profesores
A nivel de equipo (h)	28 ± 23	6 (h/reunión profesorado coordinación)
A nivel individual (h)	43 ± 22	40 h/por grupo de prácticas
Total	71 ± 35	--

Además se ha analizado la relación entre las horas de dedicación, tanto a nivel individual como grupal, con el grado de mejora de la CT13 que los alumnos suponen que han alcanzado tras cursar la asignatura (ver figura 4). Todos los alumnos han considerado que la realización de las actividades propuestas en la prácticas les han permitido mejorar en al menos un nivel su dominio de la CT13. Además los alumnos que han dedicado más de 30 horas a nivel individual a las actividades propuestas consideran que mejoran dos niveles su nivel de dominio de la competencia, siendo el valor mediana de dedicación horaria individual de los alumnos que consideran que sólo mejoran en un nivel notablemente inferior, en torno a 20h. Asimismo se evidencia que un aumento en la dedicación horaria individual suele repercutir

en un mayor aumento de dominio de la CT 13, pero no ocurre lo mismo con el número de horas totales invertidas.

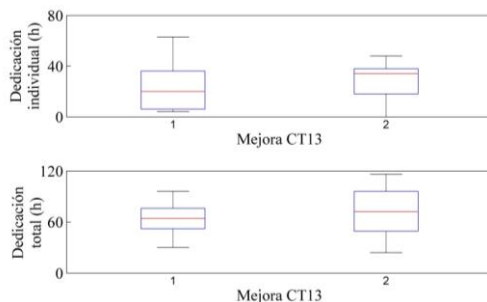


Figura 4. Diagrama de cajas y bigotes correspondiente al número de niveles de mejora de dominio de la CT13 (mejora en 1 nivel o en 2 niveles respecto del nivel al inicio de la asignatura) que los alumnos consideran que han alcanzado tras cursar las prácticas de la asignatura Señales Biomédicas y el número de horas individuales y totales dedicadas a las mismas. Datos del curso 2015-2016. Fuente: Elaboración Propia.

En la figura 5 se muestran los resultados correspondientes a las preguntas de la 5ª a la 9ª de la encuesta. El 77.6% de los alumnos (38 de 49) valoran positivamente el feedback del trabajo previo por parte del profesorado para la corrección del programa Matlab, aunque el resto de alumnos consideran que el feedback del trabajo previo que proporcionan los profesores a veces es difícil de entender. Sólo el 48.9% (24 de 49) consideran que poseen los conocimientos necesarios y los materiales docentes para el desarrollo del programa de Matlab en las prácticas. El resto de alumnos hacen especial hincapié de que no disponen una buena base en el manejo de Matlab para el desarrollo de la actividad. Estos resultados han revelado los principales puntos débiles que se necesitan mejorar de cara a la realización de la actividad en cursos posteriores. El 77.6% de los alumnos (38 de 49) consideran que las prácticas les han ayudado a comprender mejor los conocimientos adquiridos en la teoría y a mejorar su nivel de competencia en comunicación escrita efectiva. Finalmente el 95.9% (47 de 49) de los alumnos coinciden en que la metodología “*Aprendizaje basado en problemas*” es una buena metodología docente para mejorar la capacidad de abstracción e resolución de problemas reales (i.e, mediante el uso de herramienta Matlab).

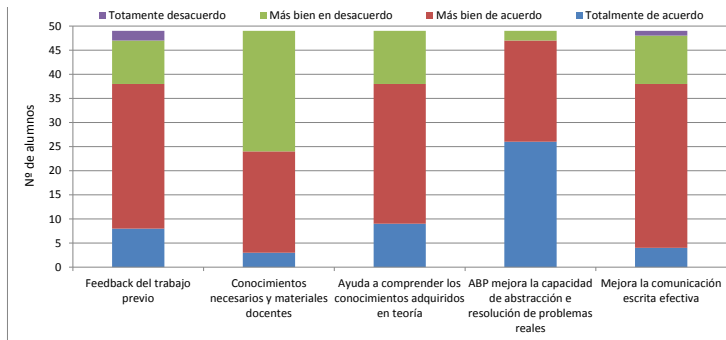


Figura 5. Resultados de las preguntas nº5-nº9 de la encuesta. Alumnos encuestados 49. Fuente:Elaboración Propia.

La figura 6 muestra los resultados de la encuesta al alumnado sobre las otras competencias que se trabajan en las prácticas de la asignatura (pregunta nº10): alrededor de 70-80% de alumnos consideran que las prácticas les han ayudado en mejorar las competencias “Aplicación y pensamiento prácticos”, “Análisis y resolución de problemas”, “Capacidad auto-aprendizaje” y “Trabajo en equipo y liderazgo”. Sólo entorno al 45 % creen que las prácticas les han ayudado en mejorar su capacidad de “integrar conocimientos multidisciplinares asociados a la ingeniería, biología y medicina”, y su capacidad de “planificación y gestión del tiempo”. Estos resultados fueron sorprendentes dado que según el profesorado es importante la capacidad de “Integración de conocimientos multidisciplinares” para el desarrollo de la actividad.

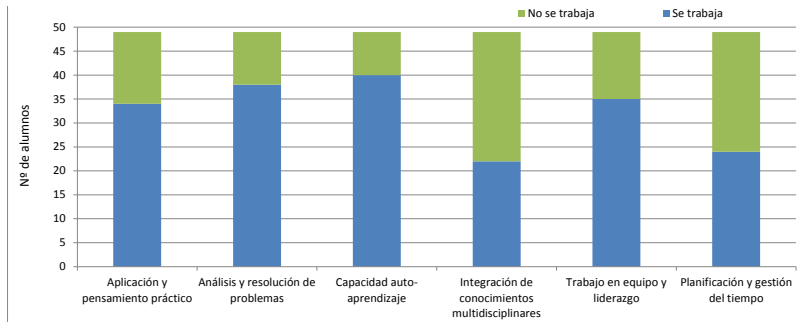


Figura 6. Resultados de la encuesta del alumnado sobre las otras competencias se han desarrollado en las prácticas además de la Instrumental Específica manejo de Matlab. Fuente: Elaboración Propia.

A pesar de los positivos resultados obtenidos, se pretende realizar ciertas mejoras para se realización en el siguiente curso académico, como es el rediseño de ciertas actividades para reducir el número de horas de dedicación no presencial de los alumnos. Asimismo también se pretende añadir rediseñar parte del sistema de evaluación de forma que incorpore una parte de evaluación individualizada del alumno.

4. Conclusiones

La mayoría de los alumnos consideran que la metodología aprendizaje basado en problemas les ha ayudado a mejorar su capacidad de abstracción y resolución de problemas reales, así como a profundizar en los conocimientos adquiridos en teoría y perfeccionar su nivel de comunicación a nivel escrito (redacción de informes técnicos). Asimismo, los alumnos consideran que las prácticas les han permitido mejorar de forma significativa del dominio de la herramienta Matlab pasando en su mayoría de un nivel de dominio muy bajo o bajo a bueno o muy bueno.

Por otra parte, a pesar de que los alumnos han dedicado un número elevado de horas respecto del número de créditos de prácticas asignados, su nivel de satisfacción con las actividades propuestas es muy alto en general, considerando especialmente positivo la evaluación del algoritmo previo a la sesión de prácticas. Además, los alumnos han considerado que las prácticas basadas en problemas reales les han ayudado a desarrollar otras CT's como aplicación y pensamiento práctico, análisis y resolución de problemas, capacidad de autoaprendizaje, integración de conocimiento multidisciplinares, trabajo en equipo y liderazgo, así como planificación y gestión del tiempo. Finalmente indicar que parece identificarse que un aumento de la dedicación horaria individual de los alumnos a las prácticas de la asignatura suele conllevar un aumento considerable en el nivel de dominio (hasta 2 niveles) de la competencia instrumental específica manejo de Matlab, mientras esta tendencia no se observa al analizar las horas de dedicación totales.

5. Agradecimientos

Este trabajo está subvencionado parcialmente por la ETSII UPV y el Vicerrectorado de Estudios, Calidad y Acreditación de la UPV (PIME B17, Convocatoria 2016-2017).

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Anexo: Cuestionario sobre las prácticas de Señales Biomédicas Curso 2015-2016

- 1.- Indique el nº de horas de trabajo has invertido a nivel individual en la elaboración de los trabajos previos de las prácticas, la corrección del código y la elaboración de las memorias de prácticas (fuera del horario de clase). Respuesta: _____ horas
- 2.- Indique el nº de horas ha invertido el equipo en la elaboración de los trabajos previos de las prácticas, la corrección del código y la elaboración de las memorias de prácticas (fuera del horario de clase). Respuesta: _____ horas
- 3.- Si tuviera que realizar un auto-diagnóstico del manejo de la herramienta Matlab, ¿Cuál era tu nivel de Matlab antes de comenzar el curso?
- Muy bajo Bajo Buena Muy buena Excelente
- 4.- Si tuviera que realizar un auto-diagnóstico del manejo de la herramienta Matlab, ¿Cuál sería tu nivel de Matlab después de haber cursado la asignatura?
- Muy bajo Bajo Buena Muy buena Excelente
- 5.- ¿Consideras que el feedback del trabajo previo por parte del profesorado os han ayudado en la corrección del programa Matlab para la realización de las prácticas?
- Totalmente de acuerdo
 Más bien de acuerdo
 Más bien en desacuerdo
 Totalmente en desacuerdo
- 6.- ¿Consideras que los alumnos poseen los conocimientos necesarios y materiales docentes (i.e, powerpoint, memoria) para el desarrollo del programa de Matlab en cada práctica?
- Totalmente de acuerdo
 Más bien de acuerdo
 Más bien en desacuerdo
 Totalmente en desacuerdo
- 7.- ¿Consideras que las prácticas os han ayudado a una mejor comprensión de los conocimientos adquiridos en la teoría?
- Totalmente de acuerdo
 Más bien de acuerdo
 Más bien en desacuerdo
 Totalmente en desacuerdo
- 8.- ¿Consideras que la metodología “*Aprendizaje basado en problemas*” es una buena metodología docente para mejorar la capacidad de abstracción e resolución de problemas reales (i.e, mediante el uso de herramienta Matlab)?
- Totalmente de acuerdo
 Más bien de acuerdo
 Más bien en desacuerdo
 Totalmente en desacuerdo
- 9.- ¿Consideras que las prácticas te han ayudado a mejorar la presentación de los resultados, y por tanto la comunicación escrita efectiva?
- Totalmente de acuerdo
 Más bien de acuerdo
 Más bien en desacuerdo
 Totalmente en desacuerdo
- 10.- Además del manejo de la herramienta Matlab, las prácticas os han ayudado en mejorar las siguientes competencias (multi-respuesta):
- Aplicación y pensamiento práctico
 Análisis y resolución de problemas
 Capacidad auto-aprendizaje para emprender estudios posteriores con alto grado de autonomía
 Capacidad de integrar conocimientos multidisciplinares asociados a la ingeniería, biología y medicina
 Trabajo en equipo y liderazgo
 Planificación y gestión del tiempo

Desarrollo de una novedosa herramienta software para una docencia individualizada adaptada al alumno

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Abstract

Students are evaluated using global group results instead of individual ones. The individual contributions of each student must be considered as an essential issue to evaluate individual learning. Nowadays, it is considered as one of the greatest educational challenge.

In this contribution, a new software tool is proposed to obtain a successful individual learning process. This tool will allow to establish individual learning profile of each student, monitor his academic situation and predict his individual learning progress.

For this purpose, the software tool will include three different modules (acquisition module, processing module and analysis module). The acquisition module will be based in five survey data (four of them based in Kolb model and other focused on each individual learning ability). After data insertion in the first module, the second module will analyze and define the students profiles and also the difference between achieve and expected learning results. Finally, the third module, which will be composed by an artificial neuronal network, will be able to obtain the learning level acquired and a student future learning progress prediction.

In this way, the authors expect a successful research outcome, which will transform the actual teaching process into an individual learning process adapted to each student

Keywords: *teaching, education, performance, learning, strategies*

Resumen

Actualmente, los criterios para evaluar el rendimiento del estudiante se basan en resultados finales en comparación con la totalidad del grupo. La necesidad de evaluar el aprendizaje de cada alumno en función de sus aportaciones individuales se marca como un reto de la docencia.

A continuación se detalla una investigación que se está llevando a cabo para implementar un software educativo que permita diagnosticar el perfil de aprendizaje del alumno, monitorice su situación académica y permita predecir su progreso.

La solución está formada por tres módulos; adquisición, procesado y extracción de resultados. El primero registra datos de cinco encuestas, cuatro de ellas basadas en el modelo de Kolby una última centrada en las habilidades de cada alumno en el trabajo en grupo. En el segundo módulo, se implementa un modelo matemático para definir el perfil de cada alumno así como establecer la brecha entre los valores alcanzados y esperados en cada asignatura. El tercer módulo es una red neuronal encargada de obtener el nivel de aprendizaje adquirido y predecir el futuro progreso de cada alumno.

De este modo, se espera que los resultados muestren la potencia de la herramienta, transformando la docencia en un proceso adaptado e individualizado al alumno.

***Palabras clave:** docencia, educación, rendimiento, aprendizaje, estrategias.*

Introducción

Tradicionalmente, en la enseñanza siempre se ha agrupado a los alumnos de forma artificial según determinados rasgos comunes, lo que facilita la acción didáctica, pero reduce la potenciación de las posibilidades individuales.

Desde hace unos años, existe un especial interés por cómo aprenden los alumnos, por sus características individuales, en orden a favorecer y mejorar sus procesos de aprendizaje.

Son varios los estudios que confirman la relación entre los Estilos de Aprendizaje y el éxito académico, como resultado de la respuesta de los alumnos a diferentes métodos de enseñanza (Komaraju, Karau, Schmeck y Avdic, 2011), (Suliman, 2010). Tras analizar las distintas investigaciones se llega a la conclusión de que los estudiantes aprenden con más efectividad cuando se les enseña con sus Estilos de Aprendizaje predominantes (Sun y Shen, 2014), (Li, 2015).

Sin embargo, tal y como señalan diferentes estudios (Kumaran, 2015), (Islam, 2015), (Dorca, 2013) existe una gran dificultad a la hora de poner en práctica la adaptación de la docencia a los Estilos de Aprendizaje de los alumnos. No sólo hay que tener en cuenta el Estilo de Aprendizaje de los alumnos sino también el Estilo de Enseñar de los profesores.

Es por ello que, con el objetivo de potenciar una educación más individualizada a cada alumno, se ha desarrollado una herramienta que facilite al profesorado un marco de reflexión y que sirva de apoyo para su acción educativa. Se explica detalladamente el funcionamiento de esta herramienta a continuación.

1. Herramienta LSSM-System

La solución propuesta se basa en un sistema de software capaz de monitorizar de manera individual al alumno y con capacidad de predicción para valorar el progreso de aprendizaje de cada uno de ellos que permite establecer pautas de acción docente y tutorial, incorporando en su materia, actividades más variadas, con la finalidad de favorecer un amplio abanico de estrategias en el proceso de aprendizaje del alumno y, propiciando un proceso de reflexión en el que se indique a cada alumno qué aspectos de su forma de aprender debe potenciar o, en qué medida debe equilibrar su forma de aprender de acuerdo con los requerimientos de las distintas materias, profesores o situaciones de aprendizaje.

El sistema en el que se basa la presente investigación consta de los siguientes elementos:

- **MÓDULO DE ADQUISICIÓN DE DATOS:** Este módulo es el encargado de recoger los datos en referencia a las respuestas de los cuestionarios integrados en el sistema. Los cuestionarios están orientados tanto para profesores como alumnos y pedagogos.
- **MÓDULO DE PROCESADO DE DATOS:** Con los datos obtenidos del módulo de adquisición de datos, este módulo es capaz de obtener el perfil de aprendizaje del alumno así como evaluar tanto las capacidades como habilidades de éste de manera individual.
- **MÓDULO DE EXTRACCIÓN DE CARACTERÍSTICAS:** Este módulo es el encargado de predecir y valorar el progreso de aprendizaje del alumno y permite establecer la estrategia de enseñanza a llevar a cabo para avanzar en la construcción del aprendizaje de cada alumno en particular.

El sistema funcionará como se detalla en el siguiente esquema:

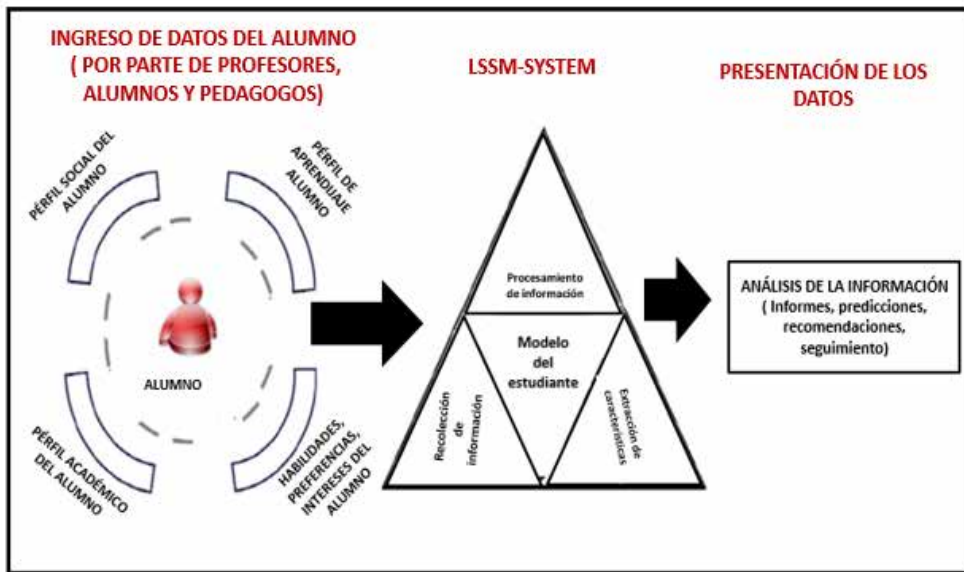


Figura1. Funcionamiento software. Fuente elaboración propia

1.1. Diseño del Módulo de Adquisición de Datos.

El módulo de adquisición de datos ofrece interfaces a los alumnos, profesores y pedagogos para responder a cuestionarios que permitan identificar las capacidades y habilidades de cada alumno. En relación a los cuestionarios, se plantean cinco tipos de cuestionarios pre-instalados a definir en este módulo. Cuatro de los cuales son para las cuatro categorías correspondientes a los cuatro estilos/perfiles de aprendizaje de los alumnos, determinados por el modelo de aprendizaje de Kobs - *KLB, Kolb's Learning Style* (Li y Armstrong, 2015), los cuales son:

- Acomodador-AC
- Divergente-D
- Asimilador-AS
- Convergente-C

Y un último que se centra en las habilidades que presenta el alumno en trabajo en grupo (TG). Las preguntas de los cuestionarios serán definidas por los profesores y pedagogos basadas en su experiencia y podrán ampliarse o reducirse según sea necesario. Por otra parte, además de los alumnos, los profesores y pedagogos también ingresarán las respuestas de cada uno de los cinco cuestionarios del sistema.

Los resultados obtenidos de cada cuestionario para evaluar a los alumnos, denotamos L^k a las capacidades cada uno de los estudiantes siendo k el alumno y L las capacidades de éste compiladas desde los cuestionarios, son grabados en matrices donde cada columna representa una pregunta del cuestionario y cada fila a un alumno. Por tanto se obtienen cinco matrices

correspondientes a cada uno del perfil de aprendizaje; éstas son: $\{AC^k\}, \{D^k\}, \{AS^k\}, \{C^k\}$. Por ejemplo, la capacidad de acomodación AC de cada alumno será:

$$\{AC^k\} = \begin{pmatrix} M_1^1 & \cdots & M_1^n \\ \vdots & \ddots & \vdots \\ M_m^1 & \cdots & M_m^n \end{pmatrix} (1)$$

Donde M_m^n significa la marca (un entero de 1-10) de la pregunta n en relación al perfil de acomodador de cada alumno m . Por tanto cada columna representa los puntos fuertes y débiles de los diferentes tipos de perfil de acomodador.

Tendremos por tanto registrados tras este módulo una base de datos cualitativa en referencia a los resultados registrados por los alumnos para cada perfil de aprendizaje, y por otra parte, una base de datos cuantitativa, con las capacidades de cada alumno, creada a partir de los datos registrados por profesorado y pedagogos.

1.1.1.- Modelo de Aprendizaje de Kolb, (KLS)

Kolb (Li y Armstrong, 2015) identificó dos dimensiones principales del aprendizaje: la percepción y el procesamiento. Decía que el aprendizaje es el resultado de la forma como las personas perciben y luego procesan lo que han percibido.

Describió dos tipos opuestos de percepción:

- Las personas que perciben a través de la **experiencia concreta**,
- Y las personas que perciben a través de la **conceptualización abstracta** (y generalizaciones).

A medida que iba explorando las diferencias en el procesamiento, Kolb también encontró ejemplos de ambos extremos:

- Algunas personas procesan a través de la **experimentación activa** (la puesta en práctica de las implicaciones de los conceptos en situaciones nuevas).
- Mientras que otras a través de la **observación reflexiva**.

La yuxtaposición de las dos formas de percibir y las dos formas de procesar es lo que llevó a Kolb a describir un **modelo de cuatro cuadrantes** para explicar los estilos de aprendizaje.

- Involucrarse enteramente y sin prejuicios a las situaciones que se le presenten,
- Lograr reflexionar acerca de esas experiencias y percibir las desde varias aproximaciones,
- Generar conceptos e integrar sus observaciones en teorías lógicamente sólidas,
- Ser capaz de utilizar esas teorías para tomar decisiones y solucionar problemas.

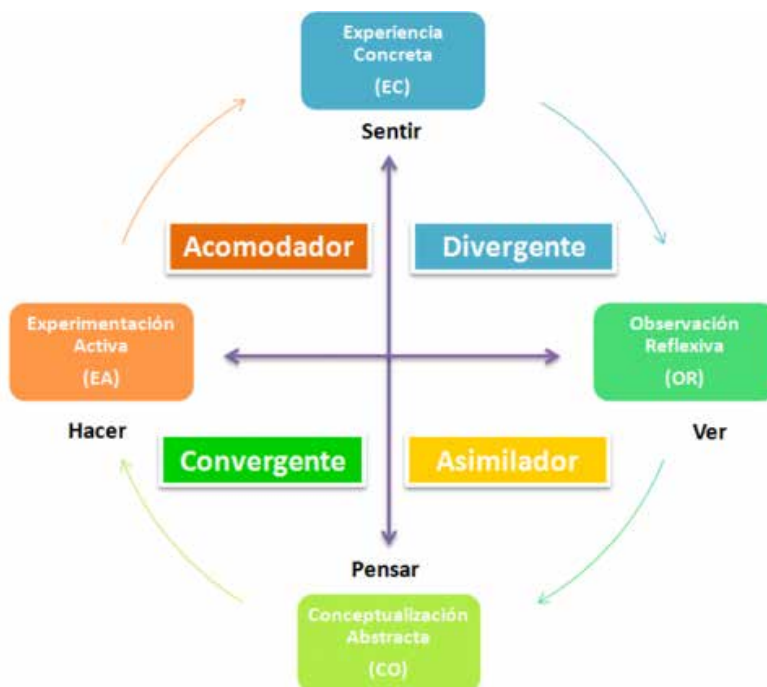


Figura 2. Modelo de aprendizaje de Kol. Fuente de elaboración propia

De estas capacidades, experiencia concreta (EC), observación reflexiva (OR), conceptualización abstracta (CA) y experimentación activa (EA) se desprenden los cuatro estilos de aprendizaje.

1.1.2.- Algoritmo de Diagnóstico del Perfil de Aprendizaje del Alumno.

En referencia a las habilidades y preferencias registradas de cada uno de los alumnos así como las capacidades de cada uno de ellos registradas a través de los cuestionarios realizados a profesores y pedagogos, el principio de operación de este módulo es, por una parte definir el perfil de aprendizaje de cada alumno mediante el cálculo de la correlación cruzada de ambos resultados, y por otro conocer la brecha entre la realidad ideal del alumno y la realidad, así como para conocer la capacidad del alumno para cada asignatura frente a los valores alcanzados y esperados.

Por tanto, para definir el perfil de aprendizaje de cada alumno, se utilizará la siguiente ecuación para calcular el valor de, por una parte, la parte cualitativa (habilidades) en referencia a los resultados aportados por el alumno, y la parte cuantitativa (capacidades) en referencia a los resultados aportados por el profesorado y pedagogos.

$$AC^k = \frac{\sum_{j=1}^m \sum_{i=1}^n M_j^i}{nm} \quad (2)$$

A calcular tres veces para los resultados obtenidos (respuestas de alumnos, y las correspondientes a profesorado y pedagogos). Así, del mismo modo, se calculan los valores para los otros cuatro tipos de matrices. Por tanto, aquí se obtienen los valores AC^k, AS^k, D^k, C^k y TG^k . Por tanto, tendremos un set de cinco resultados como:

$$KLS_{alumnos-alumnok} = \{AC^k, AS^k, D^k, C^k, TG^k\} \quad (3),$$

$$KLS_{profesores-alumnok} = \{AC^k, AS^k, D^k, C^k, TG^k\} \quad (4),$$

$$KLS_{pedagogos-alumnok} = \{AC^k, AS^k, D^k, C^k, TG^k\} \quad (5)$$

Con esto, cada uno otorga un perfil de aprendizaje de cada alumno K, que realizando una correlación cruzada con todos los valores, resulta en un perfil de aprendizaje muy adaptado y ajustada a la realidad del alumno.

La fórmula a emplear para la correlación cruzada es la siguiente:

$$C_{12} = \sum_{n=0}^{N-1} AC_{alumnok}[n] * AC_{profesoresalumnok}[n] \quad (6)$$

Ecuación a emplear para cada perfil de aprendizaje.

Por otro lado, para conocer la brecha entre los resultados ideales y reales del alumnado se definen dos variables:

La variable DeP, que define la brecha entre el resultado ideal del alumno y el real de cada uno de ellos, definida como:

$$DeP_k^{ij} = 5 - P_k^{ij} \quad (7)$$

Siendo el grado de preferencia del alumno 5; la ecuación anterior es la derivada de la distancia euclídea unidimensional, que se traduce como la diferencia aritmética entre el grado más alto de preferencia y el grado específico escogido.

La segunda variable DeK, denota la desviación entre las capacidades KLS del alumno y los valores de las diferentes asignaturas a evaluar.

$$DeK_k^{ij} = -\{sign[\sum KLS^k - ST^{ij}]\} * \|KLS^k - ST^{ij}\| \quad (8)$$

Siendo:

$$KLS^k - ST^{ij} = \{AC^k - AC^{ij}, AS^k - AS^{ij}, C^k - C^{ij}, D^k - D^{ij}\} \quad (9)$$

$$\|KLS^k - ST^{ij}\| = \sqrt{(AC^k - AC^{ij})^2 + (AS^k - AS^{ij})^2 + (C^k - C^{ij})^2 + (D^k - D^{ij})^2} \quad (10)$$

Cada $ST^{i,j}$ representa la subtarea j de la tarea i.

Un valor ideal de DeK es siempre por debajo de cero, la ecuación (9) es para determinar el signo positivo o negativo de la ecuación (8). La ecuación (10) es la distancia euclídea de cuatro dimensiones entre el valor esperado para cada asignatura y la capacidad KLS del alumno.

1.1.3.- Algoritmo de Predicción del Progreso y Establecimiento de Aprendizaje del Alumno.

Tras obtener los resultados del módulo anterior, este módulo proporciona una visión real y totalmente ajustada a la realidad tanto del nivel de aprendizaje adquirido por el alumno para cada asignatura como el progreso a futuro que se dará en cada alumno individual.

Para ello, los resultados del módulo anterior, son integrados en un algoritmo de red neuronal con capacidad de aprendizaje que es capaz de valorar si el progreso de cada alumno es satisfactorio o insatisfactorio y otorgará informes sobre distintos campos como:

- Necesidad de refuerzo en asignaturas,
- Niveles de progreso periódico individual y en referencia al grupo,
- Niveles de progreso a futuros,
- Necesidad de adaptación de contenidos,
- Etc.

Todas las nuevas situaciones se acumulan y alimentan el algoritmo neuronal, de manera que la predicción y ajuste a la realidad se produzca de manera óptima.

Tener capacidad de predicción es una característica del sistema muy potente, ya que permite ayudar en la asistencia de los alumnos, comunicación, conflictividad, rendimiento académico, auto-motivación etc. El clima de convivencia es algo que también se podría mejorar mucho a partir de los datos de los alumnos.

• Red Neuronal Propuesta

Para esta última etapa se propone el enfoque que se ajusta a las soluciones muy de actualidad dentro de las técnicas de clasificación de patrones, esto es la utilización de redes neuronales dinámicas retroalimentadas (FNN; Feedforward Neural Network), que utilizan el vector de características relevantes obtenido en la fase anterior como patrón de entrada de un clasificador no-lineal basado en una red neuronal artificial dinámica (ANN), así como los vectores de entrada adquiridos en estados previos, aportando gran precisión a la hora de elaborar el diagnóstico.

Las redes neuronales recurrentes dinámicas se caracterizan por poseer un grado de retroalimentación dentro de su estructura. Esta retroalimentación permite guardar información sobre los patrones de entrada proporcionados anteriormente a la red. Se trata, por tanto, de redes que poseen un grado de memoria.

Para llevar a cabo el diseño y desarrollo de una red recurrente retroalimentada, ha sido fundamental definir la arquitectura (o funcionamiento interno de la red). La arquitectura de red se refiere al tipo de conexión entre las neuronas de la red. Actualmente, la arquitectura

utilizada para la construcción de estos sistemas se basa en recurrencia local donde la salida de una neurona es retroalimentada a la propia neurona. Se trata de un sistema fácil de tratar sin embargo no tiene en cuenta el comportamiento global de toda la red. Es por ello, que en la presente investigación se propone una arquitectura global donde la salida de una neurona es entrada a neuronas de capas anteriores, lo que proporciona que todo el sistema aprenda proporcionando mayor precisión

A continuación se describe el modelo de red neuronal recurrente completo propuesto.

✓ Modelo de Red Neuronal Recurrente Completo

El modelo de arquitectura de red propuesto se basa en que cada neurona de la capa oculta/de salida puede tener una función de activación distinta y todas se realimentan a sí mismas y al resto de las neuronas de la misma capa.

Los valores de las neuronas en cada instante de tiempo dependen de las entradas que se proporcionan a la red (vector de características: KLS del alumno, KLS del profesor, variables DeP y DeK, etc.) y de los valores de las neuronas recurrentes en instantes anteriores. De esta forma, se crea un sistema dinámico que se adapta con el tiempo a las características del entorno proporcionando así una alta precisión en el diagnóstico. Así, la salida puede variar dependiendo del estado actual y de los datos que se presentan en la capa de entrada.

Por tanto, la evolución del estado de la red neuronal recurrente dinámica propuesta se rige mediante la siguiente fórmula:

$$S(t + 1) = f(V * X(t) + US(t)) \quad (11)$$

Siendo $S(t)$ el estado de nuestro sistema en el instante t , V y U matrices de valores desconocidos y $X(t)$ la entrada al sistema en t . Por tanto, el estado de la red recurrente en el estado $t+1$ depende funcionalmente del estado en el tiempo actual $S(t)$ y de las entradas $X(t)$. Considerando por tanto, el modelo del sistema dinámico expuesto, entonces, si $f(\cdot)$ es una función no lineal prefijada y $S(t)$ y $X(t)$ son valores conocidos en el instante t , para conocer el funcionamiento del sistema se debe calcular los valores de V y U . En este modelo, por tanto, V y U se corresponden con los pesos de la red. Por tanto sea $S_i(t)$ el valor de la neurona oculta i en el instante t . Las ecuaciones siguientes muestran la dinámica del comportamiento de la red:

$$S_i(t) = f_i(nenth_i(t)) \quad (12)$$

$$nenth_i = \sum_{j=1}^n V_{i,j} \cdot X_j(t) + \sum_{j=1}^h U_{i,j} \cdot S_j(t) \quad (13)$$

$$O_k(t) = S_k(t), \quad 1 \leq k \leq o \quad (14)$$

Siendo;

- $V_{i,j}$ son los pesos de la conexión entre el valor de entrada j y la neurona oculta/de salida i , con $1 \leq i \leq h$, $1 \leq j \leq n$
- $U_{i,j}$ es el peso de la conexión entre el valor del estado dado por la neurona oculta j y la neurona oculta i , con, $1 \leq i \leq h$, $1 \leq j \leq h$
- Los valores n , h , o son el número de entradas, neuronas ocultas, y de la salida de la red recurrente, respectivamente.
- $f(\cdot)$ es la función de activación de la neurona oculta i

Para operar la red neuronal recurrente dinámica propuesta mediante el algoritmo de aprendizaje propuesto, se debe realizar una fase de entrenamiento previa de la red, para la cual se ha de disponer de una fracción de los datos de entrada y los correspondientes de datos conocidos de salida para validación; y mediante sucesivas corridas, la red es alimentada con dichos datos de entrada y el algoritmo de aprendizaje propuesto que modifica los pesos de las interconexiones hasta que se llegue al mínimo de variaciones de dichos pesos, que es cuando, idealmente, la respuesta de la red es muy aproximada a los datos de validación. Una vez entrenada la red, se le da el resto de los datos de entradas y se obtiene la respuesta de la red propiamente dicha.

2. Conclusiones

Conscientes de la gran importancia de tener una enseñanza personalizada que evalúe individualmente a cada alumno según su experiencia, habilidades, preferencias y perfil social, y viendo la falta de estudios y herramientas tecnológicas en relación al campo de aplicación, en esta investigación se ha querido profundizar y desarrollar un sistema para conseguir una mejora en la calidad de la enseñanza.

Para afrontar la complejidad que se presenta siempre a la hora de evaluar a cada alumno personalizadamente, se ha propuesto un modelo para diagnóstico del perfil de aprendizaje que mejora la estrategia de enseñanza así como los procesos de aprendizaje mediante la monitorización individual y gestión académica del alumnado.

Este modelo se ha llevado a cabo a través del diseño de un sistema de software, sistema LSSM_System. El sistema se divide en tres elementos:

- Diseño y desarrollo de encuestas para los tres tipologías de actores que intervienen en el proceso de aprendizaje (docentes-alumnos-pedagogos). Desarrollo del módulo de adquisición de datos provenientes de las encuestas en lenguaje máquina.
- Diseño y desarrollo de la algoritmia para el diagnóstico del perfil de aprendizaje del alumno para sí conformar el del módulo de procesado de la información.
- Diseño y Desarrollo del módulo de monitorización y predicción del progreso del alumno basado en redes neuronales artificiales retroalimentadas. Integración de todos los módulos constituyentes del nuevo software educativo propuesto.

De esta manera y gracias a esta herramienta tecnológica, se espera poder solucionar el problema que tantos años ha persistido en la enseñanza.

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Radiografía de los Másteres en Turismo en las universidades españolas

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Abstract

El artículo analiza la situación actual de los estudios oficiales de Máster en Turismo de las universidades españolas. En el trabajo se realiza un análisis de las principales características de los programas contemplando varios aspectos de su diseño curricular, tales como la distribución de materias/créditos, los idiomas de impartición de las clases, las facultades donde se inscriben los programas o la distribución geográfica de los mismos. La recopilación de los datos se ha llevado a cabo consultando varias fuentes oficiales como la base de datos de ANECA, la página web de SEPIE y las páginas web de las universidades españolas. De los resultados obtenidos se desprende, entre otros aspectos, que la formación de máster en materia turística en España ha tenido una evolución positiva con su adaptación al EEES, pero, sigue habiendo algunas áreas susceptibles de mejora, tales como la especialización de los títulos o el grado de internacionalización de los mismos.

Keywords: máster, turismo, universidades españolas, plan de estudios.

Introducción

La importancia del sector turístico en España se manifiesta tanto en su aportación al PIB (15.2%), como en la generación de puestos de trabajo, representando el 15.3% del empleo total en el país en el año 2014 (World Travel & Tourism Council, 2015). La competitividad del turismo español guarda estrecha relación con la calidad de sus recursos humanos (Bañuls, Rodríguez, & Jiménez, 2007) y en este sentido, la formación universitaria adquiere un papel clave.

La evolución de la educación superior en turismo ha sido objeto de varios estudios tanto a nivel nacional (Ceballos et al., 2010; Vera-Rebollo y Baidal, 2001; Vila y Brea, 2013), como internacionalmente (Craig-Smith & Ding, 2007; Dale & Robinson, 2001; Fidgeon, 2010) que se han centrado, sobre todo, en las titulaciones de primer ciclo. El estudio realizado por Ceballos et al. (2010) analiza el presente de la Diplomatura en Turismo, señalando como conclusión que la entrada en vigor de la ley 1393/2007 es “una importante oportunidad para

desarrollar algunas de las iniciativas que el sector reclama con más interés”. La misma idea fue proclamada también por Bañuls et al. (2007) que esperaba que a través de la reestructuración de los títulos de grado y postgrado en turismo se consiga un mayor acercamiento entre formación turística y las necesidades del sector.

Los trabajos, cuyo objeto de estudio son los programas de master en turismo, resultan escasos, debido a su más tardía implantación establecida en el Espacio Europeo de Educación Superior (EEES). Los programas de postgrado se relacionan con una especialización de los conocimientos genéricos adquiridos en el grado, lo que constituye uno de los reclamos del sector. De ahí, el examen de la oferta de programas de master en turismo se convierte en una tarea necesaria.

Si bien es cierto que el estudio realizado por Vila y Brea (2013) proporciona datos sobre la evolución de la formación turística en España tanto en las titulaciones de grado, como en las de postgrado, su análisis resulta limitado, ya que recoge la duración, denominaciones y ubicación geográfica de los títulos hasta el año 2011. En este sentido, aspectos relevantes como el diseño curricular, los idiomas en los que se imparten o los centros académicos, en los cuales se desarrollan dichos estudios, no han sido contemplados como variables de estudio hasta la actualidad, a pesar de relacionarse con las expectativas del sector turístico respecto a la formación universitaria. Tal y como señala Ceballos et al. (2010) el sector reclama dotar de un enfoque empresarial los estudios de turismo. De igual manera, entre las competencias mejor valoradas por el mercado laboral es el uso del inglés como lengua extranjera de trabajo (Manjón & López, 2009). Las prácticas profesionales también aparecen como un aspecto de la formación turística de reconocida importancia para el sector (Caballero & Soria, 2009). No obstante, no consta ningún estudio que haya abordado los aspectos anteriormente mencionados en los programas de postgrado en turismo.

Conscientes de los cambios acaecidos en el ámbito universitario a causa de la adaptación al nuevo Espacio Europeo de Educación Superior (EEES) y atendiendo a la futura línea de investigación planteada por Ceballos et al. (2010) de analizar la situación de la formación turística en España como resultado de ello, el presente artículo pretende realizar una radiografía de los programas oficiales de postgrado en turismo.

1. Metodología

Para elaborar el listado completo de los programas de master oficiales ofertados por las universidades españolas en el curso 2016-2017 se han utilizado varias fuentes. En primer lugar, se recopiló información de la página web de como la base de datos de ANECA, la página web de SEPIE. Los datos no disponibles en dichas fuentes se fueron completando con la información proporcionada en las páginas web de las universidades españolas, lo que puede inducir a errores involuntarios en la presentación de los datos, habida cuenta la gran variedad de presentaciones que existen, la relativa claridad con las que se presentan, y la

confusión que puede crear la simultaneidad de programas acordes a dos distintas normativas (reales decretos de 2005 y 2007).

2. Resultados

De acuerdo con el actual marco de referencia de los estudios de master (RD1393/2007), su finalidad es “la adquisición por el estudiante de una formación avanzada, de carácter especializado o multidisciplinar, orientada a la especialización académica o profesional, o bien a promover la iniciación en tareas investigadoras”.

La oferta de títulos universitarios de masters en turismo en España para el curso académico 2016-2017 asciende a 38 (véase Anexo I).

Teniendo en cuenta que la denominación de las titulaciones es elegida por cada universidad, así como la transversalidad de los estudios en turismo, parece oportuno realizar un análisis de los títulos de los programas para indagar en su cobertura temática.

Se observa la predominancia de títulos de cobertura temática empresarial, ya que los términos “dirección”, “gestión” y “empresas turísticas” aparecen más frecuentemente en la denominación de los títulos. Más concretamente, la dirección y gestión de organizaciones turísticas está presente en 27 de los 38 títulos. Por otro lado, la “planificación” de destinos turísticos también tiene una importante representación en los títulos (32% de todos los programas). En esta relación, cabe mencionar el título “Máster en Dirección y Planificación del Turismo”, que se imparte en ocho universidades españolas y está vinculado con la RedIntur. El título nació de la necesidad e inquietud de enmarcar los estudios de postgrado en turismo en el nuevo escenario planteado por el Espacio Europeo de Enseñanza Superior. El objetivo general del título es conseguir la “formación de profesionales de alto nivel para la dirección y planificación de empresas, actividades e instituciones turísticas así como la formación de expertos que orienten su carrera profesional hacia el ámbito de la investigación”. El diseño de un título común para las universidades que participan en la red permite por un lado, mantener el criterio unitario de una troncalidad común, y, por otro, ofrecer diferentes especialidades de acuerdo a las características y problemáticas del territorio turístico de cada miembro.

Por otra parte, en lo que concierne a los másteres de temática especializada, su número asciende a 11 y las áreas que cubren son las siguientes: e-tourism, economía del turismo, turismo de eventos, turismo de congresos y convenciones, turismo urbano, turismo cultural, turismo ecológico, turismo sostenible, turismo interior y de salud, turismo activo y técnicas de análisis e innovación turística.

Aunado a lo anterior, parece interesante identificar los centros a los que se adscriben los diferentes programas de postgrado en Turismo en España, dada la transversalidad de la disciplina. De la información recogida se desprende que la mayor parte de los programas están vinculados a facultades de ciencias empresariales y económicas (9 de los 38), como por ejemplo la Facultad de Ciencias Económicas y Empresariales de la Universidad de Alicante

o la Facultad de Economía de la Universidad de Valencia. Asimismo, encontramos 8 casos de facultades que engloban esas ramas junto con el turismo, entre las cuales la Facultad de Economía, Empresa y Turismo de la Universidad de Las Palmas de Gran Canaria o la Facultad de Ciencias Empresariales y Turismo de la Universidad de Vigo. Por otra parte, destaca el hecho de que existen otros 7 programas de masters que se adscriben a facultades propias de turismo, señalando la importancia de esa rama de estudios para esas universidades, entre las cuales están la Universidad de Málaga y la Universidad de Girona. Cabe señalar también el caso de los masters de turismo de la Universidad de Rovira i Virgili y la Universidad de Barcelona, que se adscriben a la Facultad de Turismo y Geografía y la Facultad de Geografía e Historia. Por último, cabe señalar aquellos programas de masters vinculados a las facultades de ciencias sociales (6), entre los cuales están la Facultad de Ciencias Sociales y Humanas de la Universidad de Deusto y la Facultad de Ciencias Sociales y de la Comunicación de la Universidad de Cádiz.

Si atendemos a la distribución geográfica de los programas de master en turismo por comunidades autónomas, observamos que Cataluña es la región con el mayor número de titulaciones (un total de 8), concentrando así el 21% de toda la oferta en España. En segunda posición está la comunidad de Madrid con 7 masters (18%), seguida de Andalucía con 5 (13%). Cabe destacar la falta de oferta de masters en turismo en las siguientes comunidades autónomas: La Rioja, Navarra, Castilla- La Mancha y Castilla y León.

Por lo que respecta al diseño curricular de los programas de máster en turismo ofertados por las universidades españolas, observamos que la gran mayoría (89,5%) tienen una duración de 1 año y un total de 60 créditos ECTS (el mínimo establecido por el Real Decreto 1393/2007). Los títulos de máster en turismo ofertados por las universidades de Alicante y Girona representan una excepción siendo sus programas de 120 ECTS (el máximo establecido por el Real Decreto 1393/2007), mientras que en el caso del master en turismo de la Universidad de A Coruña el título está distribuido en 90 ECTS y, por último, en la Universidad de las Palmas de Gran Canaria se compone de 66 ECTS.

Profundizando en la estructura de los títulos, cabe reflexionar sobre la programación de prácticas externas, dado que éste es uno de los aspectos más controvertidos en la formación universitaria en turismo (Ruiz-Jiménez & Ceballo-Hernández, 2006). Hay que tener en cuenta que la programación de prácticas externas no es de carácter obligatorio, pero sí demuestra un compromiso con la empleabilidad de los alumnos. A tenor de la información recopilada para el curso académico 2016-2017, el 30% de las titulaciones no contempla la realización de prácticas externas, mientras que otros 30% les destinan 6 ECTS. Resulta llamativo el caso del Máster universitario en planificación y gestión de destinos y productos turísticos de la Universidad de A Coruña que asigna 18 de los 90 ECTS de los que se compone el plan de estudios a las prácticas externas.

La realización de un Trabajo Fin de Máster es otro aspecto que cabe analizar, dado que los créditos que se le asignan en cada titulación varía, pudiéndose situar en la franja de entre 6 y

30 créditos según el Real Decreto 1393/2007. De los datos recogidos se desprende que la opción de 12 ECTS es la más habitual y elegida por aproximadamente una tercera parte de los títulos (32%). Le sigue la opción de 6 ECTS, el mínimo exigido, con 27%. Destaca el caso del Máster Universitario en Gestión del Turismo (Erasmus Mundus European Master's in Tourism Management) de la Universidad de Girona que dedica 30 ECTS del programa curricular de la titulación a la elaboración del TFM.

La formación en idiomas y la internacionalización de las titulaciones es otro aspecto relevante, que cabe analizar. De toda la oferta de masters en turismo en España, apenas tres títulos (7,9% del total) se imparten íntegramente en inglés: Master in Tourism Management and Planning (Master Interuniversitario por la Universitat de les Illes Balears y la Universidad Pompeu Fabra); Economics of Tourism: Monitoring and Evaluation (Universitat de les Illes Balears) y Erasmus Mundus European Master's in Tourism Management (Universidad de Girona). Otros cuatro másteres han optado por ofrecer la docencia en castellano e inglés, concretamente, el Máster Universitario en Dirección y Organización de Turismo de Eventos (Universidad Autónoma de Barcelona), el Máster Universitario en Dirección y Planificación del Turismo (Universidad de Girona), el Máster Universitario en Gestión Internacional del Turismo (Universidad de Lleida) y el Máster Universitario en Dirección Internacional del Turismo (Universidad Rey Juan Carlos).

En cuanto a la internacionalización de los programas de máster en turismo, observamos que únicamente la Universidad de Girona ofrece, a día de hoy, un Master Erasmus Mundus: Erasmus Mundus European Master's in Tourism Management.

3. Conclusiones

Los objetivos del presente trabajo se centraron en el análisis de la situación actual de la formación de master en materia turística en las universidades españolas, mediante un análisis descriptivo de acuerdo a ciertos aspectos de interés. El estudio pretendía dar respuesta a la futura línea de investigación planteada por Ceballos et al. (2010) y a la vez completar el análisis de los estudios universitarios de postgrado en turismo, iniciado por Vila y Brea (2013).

De acuerdo a esos objetivos, los resultados indican que para el curso 2016-2017 la oferta de másteres en turismo asciende a 38, siendo su enfoque mayoritariamente empresarial. No obstante, observamos un amplio abanico de programas de máster más especializados, enfocados a determinados productos turísticos de elevada importancia en el mercado turístico español, entre los cuales el turismo de eventos, congresos y convenciones o el turismo urbano. Por otra parte, también se ofertan másteres cuya denominación hace hincapié tanto en la vertiente de dirección de empresas turísticas, como en la planificación y gestión de destinos. De este modo, observamos como con el paso del tiempo, el carácter generalista de los estudios en turismo, señalado por algunos autores (Huete 2008; Rebollo 1995), pierde su

papel dominante para dejar paso a titulaciones más especializadas, acorde a las necesidades de los entornos económicos y sociales de cada territorio.

El carácter multidisciplinar, que caracteriza los estudios de turismo, le confiere una identidad específica en el ámbito de los estudios de las áreas económicas y sociales, representando un número limitado aquellos másteres que se adscriben a facultades pertenecientes a la rama de humanidades (geografía e historia).

En lo concerniente al diseño curricular de los estudios de máster en turismo, cabe señalar que parece sorprendente el hecho de que el 30% de los programas no contempla la realización de prácticas externas, a pesar de su reclamo por parte de la industria. Por otro lado, se observa la importancia asignada a la elaboración de Trabajos de Fin de Master (a juzgar por la carga de créditos ECTS), lo que viene a demostrar un cierto compromiso con la investigación académica en materia turística de las universidades españolas.

La importancia de las competencias lingüísticas es indiscutible en la formación turística, pero a tenor de los datos presentados anteriormente en este trabajo, podemos constatar una escasa implantación del inglés como idioma de impartición de las clases en los másteres en turismo en España. Cabe señalar que únicamente en las comunidades autónomas de Cataluña y las Islas Baleares se ofertan titulaciones íntegramente impartidas en inglés. En este sentido, la enseñanza en idiomas extranjeros aparece como un aspecto a mejorar en el actual diseño curricular de los másteres.

Por lo que respecta al grado de internacionalización de las titulaciones de máster en turismo, cabe señalar que éste sería otro reto importante, ya que únicamente uno de los programas de máster pertenece al programa Erasmus Mundus. En vista de este panorama, se recomienda aprovechar en mayor medida las oportunidades de movilidad de estudiantes que favorece el Espacio Europeo de Educación Superior, que sin duda sería beneficios tanto para la formación profesional del alumnado, como para la investigación académica en el área.

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ANEXO I: Oferta de titulaciones oficiales de másteres oficiales en materia turística ofertadas por las universidades españolas (curso 2016-2017)

Nº	Título de máster	Universidad	Facultad
1	Máster Universitario en Turismo: Dirección de Empresas Turísticas	Universidad de Huelva	Facultad de Ciencias Empresariales
2	Máster Universitario en Turismo Electrónico	Universidad de Málaga	Facultad de Turismo
3	Máster Universitario en Dirección y Planificación del Turismo	Universidad de Sevilla	Facultad de Turismo y Finanzas
4	Máster Universitario en Dirección y Planificación del Turismo	Universidad de Cádiz	Facultad de Ciencias Sociales y de la Comunicación
5	Máster Universitario en Dirección Turística	Universidad de Zaragoza	Facultad de Empresa y Gestión Pública
6	Máster Universitario en Dirección y Planificación del Turismo	Universidad de Oviedo	Facultad de Comercio, Turismo y Ciencias Sociales
7	Máster Universitario en Dirección y Planificación del Turismo	Universitat de les Illes Balears y Pompeu Fabra	Centro de Estudios de Postgrado
8	Master in Tourism Management and Planning	Universitat de les Illes Balears	
9	Economics of Tourism: Monitoring and Evaluation	Universidad de La Laguna	Facultad de Economía, Empresa y Turismo
10	Máster Universitario en Dirección y Planificación del Turismo	Universidad de Las Palmas de Gran Canaria	Instituto Universitario de Turismo y Desarrollo Económico Sostenible
11	Máster Universitario en Economía del Turismo, del Transporte y del Medio Ambiente		Facultad de Economía, Empresa y Turismo
12	Máster Universitario en Desarrollo Integral de Destinos Turísticos	Universidad de Cantabria	Facultad de Ciencias Económicas y Empresariales
13	Máster Universitario en Dirección de Marketing (Empresas Turísticas)	Universidad Autónoma de Barcelona	Escuela Universitaria de Turismo y Dirección Hotelera
14	Máster Universitario en Dirección y Organización de Turismo de Eventos	Universidad de Barcelona	Facultad de Geografía e Historia
15	Máster Universitario en Turismo Urbano		
16	Máster Universitario en Turismo Cultural	Universidad de Girona	Facultad de Turismo
17	Máster Universitario en Dirección y Planificación del Turismo		
18	Máster Universitario en Gestión del Turismo (EMTM)	Universidad de Lleida	Ostelea Escuela de Turismo
19	Máster Universitario en Gestión Internacional del Turismo	Universitat Oberta de Catalunya	No disponible
20	Máster Universitario en Turismo Sostenible y Tic		

21	Master en Técnicas de Análisis e Innovación Turística	Universidad Rovira i Virgili	Facultad de Turismo y Geografía
22	Master Universitario en Administración de Organizaciones y Recursos Turísticos	Universidad de Extremadura	Facultad de Estudios Empresariales y Turismo
23	Master Universitario en Turismo Urbano y Gestión de Empresas Turísticas	Universidad de Santiago de Compostela	Facultad de Ciencias Económicas y Empresariales
24	Master Universitario en Dirección y Planificación del Turismo Interior y de Salud	Universidad de Vigo	Facultad de Ciencias Empresariales y Turismo
25	Master universitario en planificación y gestión de destinos y productos turísticos	Universidad de A coruña	Facultad de Sociología
26	MBA + Experto en Dirección de Empresas del Turismo	Universidad Antonio de Nebrija	Facultad de Ciencias Sociales
27	Master Universitario en Gestión del Turismo de Congresos, Convenciones y Empresas Opc	Universidad Europea de Madrid	Facultad de Ciencias Sociales y de la Comunicación
28	Master Universitario en Gestión del Turismo Ecológico y Sostenible	Universidad Politécnica de Madrid	E.T.S. de Ingeniería de Montes, Forestal y del Medio Natural
29	Master Universitario en Dirección Internacional del Turismo	Universidad Rey Juan Carlos	Unidad de Postgrado
30	Planificación y Gestión de Destinos Turísticos	Universidad Complutense de Madrid	Facultad de Comercio y Turismo
31	Dirección y Gestión de Empresas Hoteleras		
32	Master Universitario en Dirección de Empresas Hoteleras	UDIMA	Facultad de Ciencias Económicas y Empresariales
33	Master Universitario en Gestión y Dirección de Empresas e Instituciones Turísticas	Universidad Politécnica de Cartagena	Facultad de Ciencias de la Empresa
34	Master Universitario en Creación y Gestión de Empresas de Turismo Activo	Mondragón Unibertsitatea	Facultad de Ciencias Empresariales
35	Dirección de Proyectos de Ocio, Cultura, Turismo, Deporte y Recreación	Universidad de Deusto	Facultad de Ciencias Sociales y Humanas
36	Master Universitario en Dirección de Negocios de Turismo y Ocio	Universidad Católica de Valencia San Vicente Mártir	Facultad de Ciencias Económicas y Empresariales
37	Master Universitario en Dirección y Planificación del Turismo	Universidad de Alicante	Facultad de Ciencias Económicas y Empresariales
38	Master Universitario en Dirección y Planificación del Turismo	Universitat de València	Facultad de Economía

Aplicaciones de la Termodinámica a la Ciencia y Tecnología de Alimentos como elemento motivador y de aprendizaje en contexto por proyectos

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Abstract

Recent trends in educational innovation indicate that the teaching-learning process in context produces better results, especially in complex subjects, or when it is difficult to see the implementations in future work activity of the students. For this reason, problem-based or project-based learning is the current trend in active teaching methodologies.

This work evaluates the effect of introducing examples of Physical Chemistry implementations in the future work field of the students (Food Science and Technology), besides the development of voluntary projects; critical summary and expositions of works related to the field. Previous results indicate that in-context learning has positive effects on the final mark and are useful for the development and evaluation of General Competences. In this work other items are analyzed: the attendance or not to class and the reasons; if the project is done and exposed and why, as well as the benefits of doing the project.

Keywords: *implementations, physical chemistry, food science and technology, motivation, project-based learning, in-context learning, active methodologies*

Resumen

Las tendencias recientes en innovación educativa indican que el proceso enseñanza-aprendizaje en contexto produce mejores resultados, especialmente en asignaturas complejas, o cuando resulta difícil ver su aplicación a la actividad laboral. Por este motivo, el aprendizaje basado en problemas o por proyectos es la tendencia actual en metodologías activas de enseñanza.

En el presente trabajo se evalúa el efecto de introducir ejemplos de aplicaciones de la asignatura (Química Física) al futuro campo de trabajo de los estudiantes (Ciencia y Tecnología de Alimentos), además de la elaboración de proyectos voluntarios; realizar un resumen crítico y exponer

en clase trabajos relacionados con la Química Física y la Ciencia y Tecnología de Alimentos. Resultados previos indican que la puesta en contexto de la materia tiene efectos positivos sobre la calificación final de los estudiantes, así como su utilidad para el desarrollo y evaluación de Competencias Transversales. En este trabajo se analizan además otros conceptos: la asistencia o no a clase y el motivo; si se realiza el proyecto de aplicaciones y se expone, así como los beneficios derivados de realizar el proyecto.

Palabras clave: *aplicaciones, química física, ciencia y tecnología de alimentos, motivación, aprendizaje por proyectos, aprendizaje en contexto, metodologías activas*

Introducción

Dada la dificultad que presenta la química física para alumnos de grados distintos a los de Química, Física o algunas Ingenierías (Mulop et al., 2012; Sokrat et al., 2014), se hace necesaria una motivación extra para estos alumnos, con el objetivo de evitar la frustración y el fracaso en la superación de la asignatura. En ese sentido puede ser interesante la introducción de aplicaciones de la química a las futuras competencias profesionales (Woodburn, 1977), dado que los alumnos del grado de Ciencia y Tecnología de los Alimentos (CTA) no relacionan directamente esta materia con su campo de trabajo. Como se muestra en la Fig.1, otros problemas pueden ser, además de la dificultad inherente a la asignatura, la falta de conocimientos previos del alumno y el poco tiempo que es posible dedicar a resolver problemas prácticos en el aula durante el curso (Blanco-Vázquez, 2006). Según Flores y Trejo (2003), se enfatiza demasiado en los métodos matemáticos para calcular propiedades, sin dejar claro antes el significado de los conceptos, dificultando así que puedan identificarse encontrando su aplicación en situaciones reales (Durán-Aponte y Durán-García, 2013). Esta situación puede conducir a la desmotivación del alumnado; tanto por la dificultad en la comprensión de los conceptos, como por su aparente falta de aplicación práctica.

Así pues, la identificación de los conceptos químicos teóricos con situaciones reales en el campo de trabajo (enseñanza-aprendizaje en contexto, AEC), podría ayudar a la comprensión de los mismos, así como a la motivación de los alumnos (De Jong, 2006). Además, estas aplicaciones contribuirían a la identificación de la materia como relacionada con el campo de estudio elegido por el alumno, lo que sin duda haría aumentar su interés y motivación. También es conocido que, aunque los alumnos con vocación por la química per se pueden recibir un enfoque de enseñanza más académico sin desmotivarse, los estudiantes interesados en otras disciplinas necesitan una motivación extra mediante un enfoque más contextualizado (Eilks y Hofstein, 2015). En este último grupo estarían los alumnos de

CTA, ya que aunque puedan estar interesados en la química de alimentos no tienen una vocación química "pura".

Las tendencias recientes en innovación educativa indican que el proceso enseñanza-aprendizaje en contexto produce mejores resultados, especialmente en asignaturas complejas, o cuando resulta difícil ver su a la actividad laboral (Pinto y Martín, 2012). También el Aprendizaje Basado en Problemas o por proyectos (ABP) es la tendencia actual en metodologías activas de enseñanza. El ABP es una metodología de aprendizaje activo en la que el alumno se convierte en protagonista de su aprendizaje, trabajando en pequeños grupos tutorizados por el profesor (Villalobos-Delgado et al., 2016). Según Vogt (2007), la resolución de problemas puede usarse como base para alcanzar objetivos de aprendizaje y desarrollar competencias relacionadas con la futura actividad laboral. Esta metodología cambia el rol del alumno a un papel activo, responsable y autónomo; y también el del profesor, que pasa a actuar como apoyo y guía, en lugar de tener el papel central. Además, permite integrar conocimientos de diferentes áreas, por lo que, según Rodríguez-Sandoval y colaboradores (2010), se aproxima mucho más a la vida real que otras metodologías de enseñanza. Además, el ABP se ha descrito como una metodología desarrolladora de competencias transversales o genéricas (Olivares y Heredia, 2012). También se postula que el proceso de enseñanza-aprendizaje de la química se ve favorecido en un contexto de formación por competencias laborales, comparándolo con la metodología tradicional (Cejas-Yanes y Castaño-Oliva, 2014).

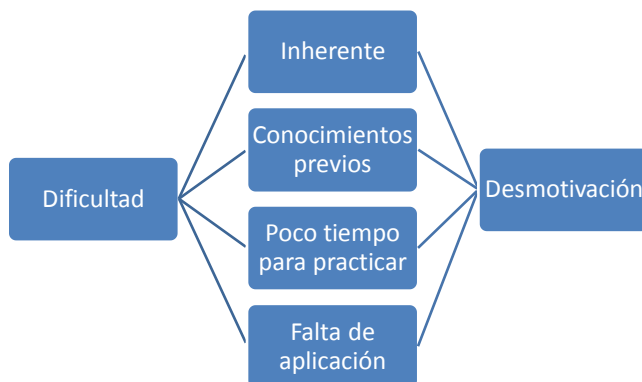


Figura 1. Factores relacionados con la dificultad y las desmotivación en la asignatura de química física en grados diferentes a los de química o física. Fuente: Elaboración propia.

Por estos motivos, en este proyecto se introdujeron en 2015 en la asignatura “Fundamentos Químicos para la CTA”, en la Unidad Didáctica 2 (UD2, Química Física), ejemplos relacionados con la CTA durante las clases, así como la posibilidad de realizar trabajos voluntarios, que los alumnos pueden exponer en clase, que deben estar relacionados con estas aplicaciones. Además, el trabajo puede realizarse en grupos, permitiendo así el

aprendizaje cooperativo, que ha demostrado su eficacia para el aprendizaje de esta materia (Méndez-Coca, 2012), y el desarrollo de la competencias de trabajo en grupo. La realización del trabajo supone para el alumno una aproximación de la asignatura al campo de trabajo de su grado, ayudando al entendimiento de los conceptos teóricos y motivando al alumno a su estudio (Cardona y Atarés, 2016).

Para ver qué resultado tenía esta variación en la metodología docente, se analizaron varios conceptos mediante encuestas: la asistencia o no a clase y el motivo; si se realiza el proyecto de aplicaciones y/o se expone y los motivos para hacerlo. Otro dato obtenido fue la percepción de la asignatura respecto a su aplicación a las competencias laborales, así como si el proyecto ayuda a mejorarla. También se les encuestó respecto a si les resulta útil y ameno, tanto la realización del proyecto en sí como escuchar las presentaciones de los compañeros.

1. Objetivos

1-Introducir el ABP y el AEC en la UD2 de la asignatura "Fundamentos Químicos para CTA", incorporando dos tipos de actividades:

- ejemplos de aplicaciones reales de la materia a la CTA durante las clases magistrales
- trabajos voluntarios que suben nota sobre aplicaciones de la materia a la CTA

2-Evaluar el impacto sobre la motivación de los alumnos en el estudio de la asignatura y sus beneficios en el proceso de enseñanza-aprendizaje., evaluando los siguientes ítems:

- interés por la actividad
- beneficios generados de su realización
- efecto sobre las calificaciones finales obtenidas

2. Desarrollo

Esta experiencia se llevó a cabo con alumnos de primer curso del grado de CTA (Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural), de la Universitat Politècnica de València. La asignatura es anual de 12 créditos repartidos en tres unidades didácticas.

Desde el curso académico 2014-2015 se introdujeron ejemplos reales de aplicaciones de la materia al futuro campo laboral de los estudiantes (AEC). Además, se planteó a los alumnos la posibilidad de realizar trabajos sobre aplicaciones de la Química Física a la CTA (ABP). Los trabajos eran voluntarios y servían para subir la nota final de la UD2 hasta un punto. Los alumnos tenían la posibilidad de hacerlo individual o en grupo (hasta un máximo de 3 participantes), así como de exponer el trabajo en clase o no, sabiendo que la exposición se tendría en cuenta positivamente a la hora de puntuarlo. El trabajo escrito

incluye un resumen del contenido y una crítica sobre su aplicabilidad. La exposición en forma de seminario incluye una exposición de un máximo 15 minutos (a dividir entre varios alumnos si el trabajo se realiza en grupo) y un turno de preguntas de los compañeros de clase y el profesor. Con una encuesta posterior se midió la percepción de los alumnos sobre estas metodologías, así como los beneficios que aportan a su formación, representando los resultados mediante los gráficos obtenidos mediante la herramienta online utilizada para la encuesta (<https://www.onlineencuesta.com>).

3. Resultados y discusión

3.1. Distribución de la muestra

De los alumnos encuestados, 32 (71.1%) asistía siempre a clase, 9 (20.0%) asistía regularmente, 3 (6.7%) ocasionalmente y 1 (2.2%) no asistía nunca (Fig. 2).



Figura 2. Distribución de la muestra empleada en el estudio según la asistencia a clase.

Fuente: Elaboración propia.



Figura 3. Motivos de asistencia (A) o no asistencia (B) a clase en la asignatura. Fuente: Elaboración propia.

En cuanto a la asistencia a clase, se observa que la mayoría de los alumnos encuestados asiste a clase al menos regularmente (91,1%). Los motivos por los que los alumnos asisten a clase, así como los motivos por los que no asisten, se muestran en la Fig. 3. Se observa que en general piensan que es bastante necesario hacerlo para comprender bien los conceptos.

3.2. Interés en la realización de los proyectos de aplicaciones de la materia a la CTA

Del total de alumnos examinados (83), 53 (63.85%) participaron voluntariamente en el ABP y del total de matriculados 45 (54.2%) realizaron la encuesta, aunque algunos no la terminaron. De éstos 45, 41 habían realizado el proyecto y 4 no, y 26 (63.4%) lo habían expuesto en clase. En la Fig. 4 se muestran los porcentajes de alumnos que realizan el proyecto, además de si lo exponen o no, y si acuden a ver las presentaciones de los compañeros o leen sus trabajos escritos (conocen el contenido de los trabajos de los compañeros).

De estos resultados (Fig. 4), podemos concluir que más de la mitad de los alumnos encuestados (51%) tiene verdadero interés por el ABP, ya que realiza el proyecto, lo expone, y se interesa por los trabajos de los compañeros. Casi la cuarta parte (24,4%) no expone el trabajo, pero muestra interés al acudir a escuchar la exposición del trabajo de los compañeros, o leer sus trabajos.

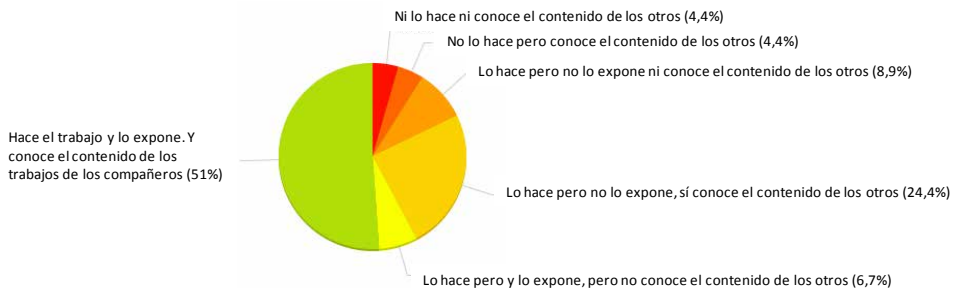


Figura 4. Interés por la realización de los trabajos de aplicaciones. Fuente: Elaboración propia.

En cuanto a los motivos por los que no exponen los proyectos, se muestran en la Fig. 5A, siendo el principal motivo la falta de dominio de la materia, seguido por la percepción de falta de rentabilidad del esfuerzo invertido y el resultado obtenido; y el miedo a hablar en público. Es importante señalar, que según la encuesta realizada, de los alumnos que no expusieron el trabajo un 43% sí lo expondría después de ver las intervenciones de los compañeros. Un 4,4% no realiza el trabajo, pero acude a ver el de los compañeros, lo que demuestra cierto interés por su contenido (Fig. 4). Un 15,6% del alumnado parece motivarse únicamente por la subida de nota que representa, ya que lo realiza (lo exponga o no), pero no se interesa por el contenido del resto de trabajos (Fig. 4). Entre los motivos

alegados para no asistir a ver las exposiciones o leer los trabajos de los compañeros, el principal fue la falta de tiempo o incompatibilidad de horarios, seguido por la creencia de que no compensa el esfuerzo y por no considerarlo interesante (Fig. 5B). Un 4,4% no muestra ningún interés ni por el contenido ni por la subida de nota que pueda generar realizar el proyecto (Fig. 4), ya que ni lo realiza ni se interesa por los trabajos de los compañeros.



Figura 5. Motivos para no exponer los trabajos (A) o acudir a ver las presentaciones de los compañeros (B). Fuente: Elaboración propia.

3.3. Percepción de los beneficios aportados por la realización de los proyectos de aplicaciones

Para conocer los beneficios que perciben los alumnos al realizar los proyectos sobre aplicaciones, se evaluó los beneficios que perciben al realizar el trabajo, al exponerlo, y al escuchar o leer los trabajos de los compañeros.

Los resultados demuestran que los alumnos que realizan el trabajo escrito (Fig. 6A), perciben que, además de mejorar la calificación final, obtienen como beneficio el hecho de ver las aplicaciones de la asignatura a su futuro campo de trabajo. Los que además exponen el trabajo (Fig. 6B), destacan la mejora en la capacidad de hablar y presentar trabajos en público, además de mejorar la comprensión de los conceptos que se exponen. En cuanto a la asistencia a la exposición de los trabajos de los compañeros o la lectura de sus trabajos escritos, parece que la utilidad encontrada, siendo buena, no lo es demasiado, probablemente debido a que las exposiciones no resultaron muy amenas, lo que podría ser debido a la elevada complejidad de la materia (Fig. 6C).

3.4. Evolución general de las calificaciones al introducir el aprendizaje en contexto y por proyectos

Para evaluar el efecto de la introducción del ABP y el AEC en las actividades realizadas en la asignatura, se comparó la media del curso completo de los alumnos, como indicador de los buenos resultados globales, para relizar una comparación interanual, con el objetivo de comprender mejor los resultados obtenidos al introducir el aprendizaje en contexto.

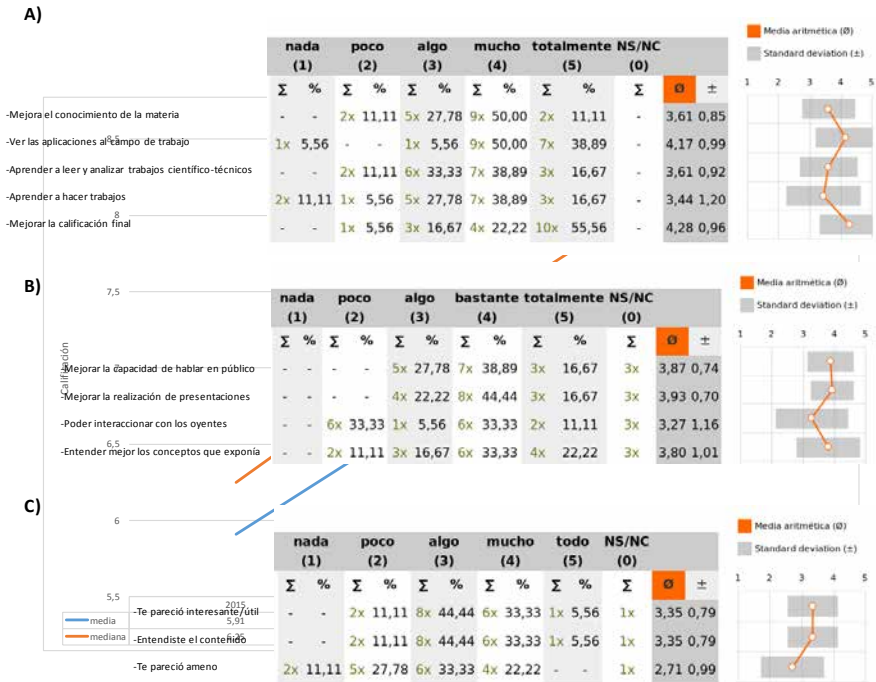


Figura 6. Percepción de los beneficios obtenidos por realizar los trabajos (A), exponerlos (B) o acudir a ver las exposiciones de los compañeros (C). Fuente: Elaboración propia.

En el año 2017 se obtuvo una nota media de 7,53 y una mediana de 8,15, frente a una media 5,91 y una mediana de 6,25 en 2015. En 2016 la mediana y la media fueron 6,8 y 7,25, respectivamente (Fig. 7). Si dividimos las calificaciones en cuatro bloques (Fig. 8): nota inferior a 4, nota inferior a 5, nota superior a 7 y nota superior a 9, se observa que disminuyen los valores de los bloques de notas bajas y aumentan los de notas altas, si bien aumenta de forma más importante en el bloque de notas mayores de 7 en 2016, y en el bloque de notas mayores de 9 en el 2017. Estos resultados muestran un efecto positivo del cambio en la metodología docente, en cuanto mejora las calificaciones de los alumnos en general, y de los alumnos con notas altas en particular.

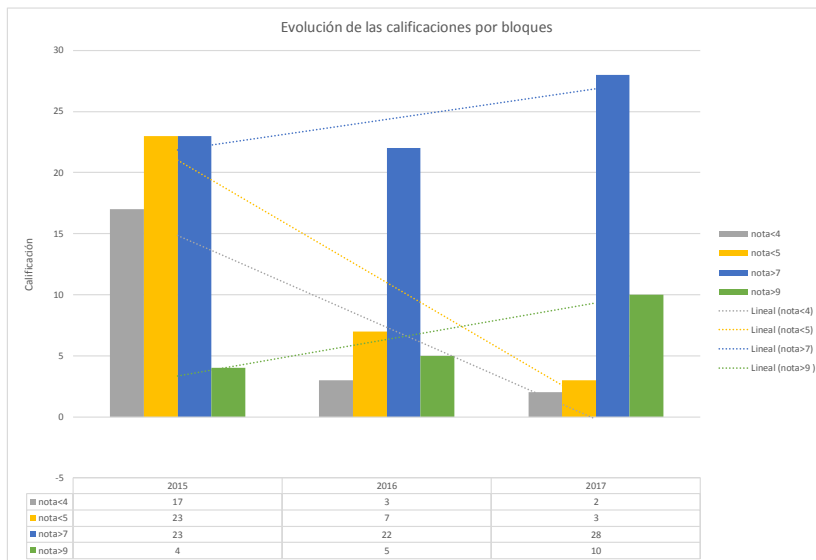


Figura 7. Evolución de la media y la mediana de las calificaciones del año 2015 al 2017.

Fuente: Elaboración propia.

4. Conclusiones

La introducción del ABP y AEC, introduciendo trabajos sobre aplicaciones de la materia en el campo laboral y ejemplos reales durante las clases de aula:

1. Despierta el interés de los alumnos por estas actividades, a pesar de la falta de tiempo para realizar el trabajo y lo elevado que resulta el nivel de los contenidos para alumnos de primer curso.
2. Se percibe que la realización del proyecto aporta beneficios claros, como mejorar el conocimiento de la materia y conocer sus aplicaciones.
3. Estas metodologías (ABP y AEC) mejoran las calificaciones de los alumnos, no sólo por el aumento de nota que supone para el alumno que lo realiza, sino en general para todo el curso.

5. Perspectivas

A la vista de los resultados, parece interesante seguir con la metodología iniciada, si bien convendría corregir algunos defectos detectados en los proyectos propuestos, como son el elevado nivel de los conceptos tratados y el esfuerzo que necesita emplear el alumno para realizarlos. Los ejemplos introducidos durante las clases de aula parecen del nivel correcto.

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Técnicas de Gamificación Aplicadas al Diseño de Asignaturas de Primero de Ingeniería

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Abstract

This paper presents the key points to design subjects based on gamification technics using Poliformat, the online standard educational platform from Sakai. We introduce intrinsic motivation (competition, autonomy, relationship) with a system based on points and rankings, which is a feature of extrinsic motivation. Additionally, flip-teaching is used, which makes the students be the center of their learning process. On the one hand, we try to hold the students' interest with the creation of a motivating and funny learning environment in a subject of the first semester that is totally new for them. On the other hand, we aim to consolidate and expand the students' knowledge and emphasize the acquirement of transversal skills in the second semester. All in all, our main purpose is to reduce the number of students who drop out of the subject, to improve their academic achievement and efficiently train future professionals.

Keywords: *skills, methodology, assessment, flip-teaching, gamification, motivation*

Resumen

En este artículo se exploran las claves para diseñar asignaturas basadas en técnicas de gamificación, utilizando una plataforma educativa online estándar como es poliformaT (Sakai). Se han equilibrado las características de la motivación intrínseca (competencia, autonomía y relaciones), con un sistema de premios basado en puntos y rankings, característico de la motivación extrínseca, todo ello combinado con una metodología de clase inversa que permite que los alumnos sean el centro de su proceso de aprendizaje. El objetivo perseguido es doble, por una parte enganchar a los estudiantes en el primer semestre al aprendizaje de una disciplina totalmente nueva para ellos, creando un entorno de aprendizaje motivador y divertido, y por otra en el segundo semestre, consolidar e incrementar los conocimientos haciendo énfasis en la adquisición de competencias transversales necesarias para la maduración en el ámbito profesional. Todo ello para minimizar el índice de

abandono de la asignatura, mejorar el rendimiento y contribuir de forma efectiva al proceso de formación de futuros profesionales.

Palabras clave: *competencias, metodología, evaluación, Flip-Teaching, Clase-Inversa, gamificación, motivación.*

Introducción

La llegada de los estudiantes a la universidad suele ser un trámite duro, especialmente en las carreras de ciencias e ingenierías. En estas carreras se encuentran con asignaturas conocidas como matemáticas o física, donde el estudiante amplía los conocimientos obtenidos en su etapa formativa anterior. Por el contrario, también se encuentran con otras asignaturas totalmente desconocidas como es el caso de Teoría de Circuitos y Dispositivos Electrónicos en carreras del área de la Ingeniería Electrónica. Estas asignaturas requieren empezar desde cero y subir hasta un nivel de conocimientos aceptable para que en las asignaturas de cursos posteriores los alumnos sean capaces de diseñar circuitos electrónicos.

Si bien los estudiantes se sienten atraídos por la novedad, el reto al que nos enfrentamos los profesores es la lucha contra la desmotivación que puede producir la sensación de falta de capacitación ante tan gran cantidad de nuevos conceptos. Sensación que puede incrementarse debido a la sobrecarga de trabajo provocada por el seguimiento de todas las asignaturas del primer curso y que puede provocar el abandono de algunas asignaturas o incluso de la carrera. En este artículo se exploran las claves para diseñar esta asignatura basada en técnicas de gamificación (Urha, 2015) (Werback y Hunter, 2012), utilizando una plataforma educativa online estándar como es poliformaT (Sakai <https://sakaiproject.org/>). Se han equilibrado las características de la motivación intrínseca (competencia, autonomía y relaciones), con un sistema de premios basado en puntos y rankings, característico de la motivación extrínseca, todo ello combinado con una metodología de clase inversa que permite que los alumnos sean el centro de su proceso de aprendizaje y adquieran las competencias necesarias para afrontar los retos profesionales del siglo XXI (Johnson y otros, 2015).

El trabajo presenta un estudio en profundidad de dos niveles de aplicación de la metodología de clase inversa, en lo que se refiere fundamentalmente a la evaluación de la misma. Un primer nivel de aplicación pone el énfasis en la evaluación del trabajo no presencial (online) del alumno mientras que un segundo nivel lo hace en la evaluación del trabajo presencial. Con esta diferenciación se persigue un doble objetivo: por una parte enganchar a los estudiantes en el primer semestre al aprendizaje de una disciplina totalmente nueva para ellos, creando un entorno de aprendizaje motivador y divertido, y por otra en el segundo semestre, consolidar e incrementar los conocimientos haciendo énfasis en la adquisición de competencias transversales necesarias para la maduración en el ámbito profesional

En el capítulo 1 del documento se realiza una descripción detallada del contexto académico de las asignaturas, diferenciando claramente los objetivos de aprendizaje perseguidos en ambos semestres. Estos objetivos diferenciados, dan lugar a la aplicación de las dos

metodologías docentes expuestas en el capítulo 2, donde se desgranar las claves del desarrollo de las mismas tanto en aula como en laboratorio, los recursos tecnológicos utilizados y una comparativa de los sistemas de evaluación empleados.

En el capítulo 3 se presentan los resultados de la aplicación de estas metodologías, mediante encuestas a estudiantes y resultados académicos obtenidos para finalmente en el capítulo 4 exponer las conclusiones y los planes de mejora.

1. Descripción de la asignatura

Las asignaturas que presentamos se imparten en el Campus de Gandia de la Universitat Politècnica de Valencia por el Departamento de Ingeniería Electrónica (DIE) en el Grado en Ingeniería de Sistemas de Telecomunicación, Sonido e Imagen (GISTSI). Se trata de Teoría de Circuitos (TDC) y Dispositivos Electrónicos (DE), que se imparten en el primer curso de la titulación.

El Grado en Ingeniería de Sistemas de Telecomunicación, Sonido e Imagen en la Escuela Politécnica Superior de Gandia abre sus puertas para 50 alumnos, que reciben sus clases en un único grupo de teoría, pero se dividen en dos para resolución de problemas (seminarios) y para la realización de prácticas de laboratorio.

TDC (semestre A) y DE (semestre B) constituyen la puerta de entrada al área de ingeniería electrónica y, haciendo un símil con las matemáticas, en TDC enseñamos a sumar y restar y en DE a multiplicar y dividir. TDC desde cero y con DE se consigue subir hasta un nivel de conocimientos aceptable para que en cursos posteriores los alumnos sean capaces de diseñar circuitos electrónicos.

El equipo de profesores (autores de este artículo) hemos diseñado en común y coordinadamente la estrategia docente de ambas asignaturas, partiendo de una metodología común (clase inversa) pero con objetivos de aprendizaje distintos.

1.1. Contexto

La cercanía con el grado en Ingeniería de Tecnologías y Servicios de Telecomunicaciones GITST que nuestra propia universidad imparte en el campus de Vera, junto con la abundancia de oferta de estudios similares en la Comunidad Valenciana, y con la reducción de alumnado que se ha experimentado en estos últimos años, debido a la evolución demográfica y a la crisis vocacional en las TICs, han hecho caer la nota de corte para acceder al grado hasta prácticamente el 5, es decir, no hay ninguna restricción de entrada. Este hecho ocasiona una enorme dispersión de niveles académicos de los alumnos aspirantes al grado que a groso modo podríamos clasificar en dos grupos:

1. **Alumnos vocacionales**, que en su mayoría provienen de la comarca o comarcas colindantes con estudios de bachillerato o ciclos formativos. Ocasionalmente vienen alumnos que no acceden a estudiar el GITST en Valencia por tener una nota de corte inferior a la solicitada.

2. **Alumnos no vocacionales**, que aunque pueda resultar paradójico ocurre con frecuencia debido a la inexistencia de nota de corte. Cabe destacar aquellos que acceden a este grado porque su nota final no les llega para hacer aquello que querían y prueban fortuna impulsados, en la mayoría de los casos, por la cercanía geográfica a su lugar de residencia.

1.2. Objetivos de Aprendizaje

Los objetivos de aprendizaje se plantean de forma incremental de semestre a semestre para alcanzar unos resultados de aprendizaje que posicionen a los estudiantes en un nivel de capacitación suficiente para afrontar las asignaturas del área electrónica del segundo curso, dónde los estudiantes serán capaces de diseñar circuitos electrónicos especializados de la ingeniería.

A continuación se enumeran los seis objetivos planteados para el primer curso divididos por semestres:

1.2.1 TDC. Semestre A

La asignatura Teoría de Circuitos se imparte en el primer semestre del grado y, salvo para aquellos estudiantes que hayan cursado algún módulo (ciclo formativo) relacionado con la electrónica, es totalmente desconocida. En este escenario planteamos los siguientes objetivos de aprendizaje:

- 1.- Identificar y medir señales eléctricas en el laboratorio de electrónica así como calcular los parámetros y especificaciones que las identifican.
- 2.- Identificar los elementos básicos que conforman los circuitos electrónicos y definir y aplicar las leyes fundamentales del análisis de circuitos para calcular las variables eléctricas.
- 3.- Aplicar metodologías sistemáticas para resolver circuitos electrónicos.

Estos objetivos están fundamentalmente posicionados en los dominios cognitivo y psicomotriz en cuanto a que corresponden a la integración de nuevos conocimientos teóricos y de laboratorio. En un segundo plano quedan sin embargo las competencias transversales con bajos niveles de adquisición en esta asignatura.

1.2.2 DE. Semestre B

La consecución de estos tres primeros objetivos de aprendizaje capacita a los estudiantes para enfrentarse a los objetivos planteados en el segundo semestre por la asignatura Dispositivos Electrónicos, que se resumen en los siguientes:

- 4.- Identificar y analizar diferentes tipos de dispositivos semiconductores y sus aplicaciones en diferentes circuitos electrónicos.
- 5.- Diseñar y montar circuitos electrónicos para aplicaciones reales con dispositivos como diodos, transistores y amplificadores operacionales.

6.- Elaborar documentos técnicos con formato de proyecto de ingeniería donde se realiza el análisis teórico de los circuitos, se exponen las medidas realizadas sobre los montajes de laboratorio y se comparan y justifican las diferencias con los resultados alcanzados.

Este último, constituye el pilar sobre el que se apoya la adquisición de competencias transversales tan importantes como comprensión e integración (CT-01), análisis y resolución de problemas (CT-03), diseño y proyecto (CT-05) y comunicación efectiva (CT-08). Es además, con la consecución de este objetivo se consolida la adquisición de los objetivos de Análisis de Circuitos del primer semestre a través de la integración de las herramientas de análisis en la resolución de problemas con aplicación práctica real.

2. Metodología docente

El equipo de profesores involucrado en ambas asignaturas ha diseñado dos metodologías basadas en el concepto de clase inversa (Strayer, 2012) pero con matices adaptados, no sólo a la consecución de los objetivos de aprendizaje, sino también a las circunstancias (contexto) que rodean las asignaturas en cada semestre.

En este sentido se podría decir que para la asignatura TDC (semestre A) la metodología adaptada es “Landing Flipped Classroom” (Clase inversa de aterrizaje), mientras que para la asignatura DE (semestre B) es “Consolidating Flipped Classroom” (Clase inversa de consolidación).

2.1. La metodología “Landing Flipped Classroom” (Clase inversa de aterrizaje)

La metodología “Landing Flipped Classroom” (Clase inversa de aterrizaje) nace para los estudiantes que llegan por primera vez a la universidad. Es una metodología de clase inversa que incorpora elementos de gamificación con el objetivo de incrementar la motivación y de reducir la tasa de abandono. En definitiva, lo que se pretende con la aplicación de esta metodología es maximizar el número de estudiantes que pasan al semestre B para cursar la asignatura DE.

2.1.1. Actividades de aula

La siguiente figura muestra cómo se desarrolla esta metodología:



Figura 1. Metodología Landing Flipped Classroom. Unidad didáctica. Fuente: Elaboración Propia.

Cada unidad didáctica se compone de módulos de aprendizaje (máximo 4) de nivel cognitivo incremental. Un módulo de aprendizaje (Martínez y otros 2007) es una sesión de formación implementada en Lessons (herramienta para la creación de contenidos desarrollada bajo la plataforma de aprendizaje online PoliformaT). Los módulos de aprendizaje se desarrollan por semanas y en ellos los alumnos reciben los contenidos teóricos a través de videos polimedia fuera del aula. En las clases presenciales los alumnos practican la resolución de ejercicios/problemas con la ayuda del profesor con el objetivo de preparar un cuestionario de PoliformaT temporizado que realizarán durante la semana, fuera del aula, este tipo de actividades hace que los alumnos se transformen en sujetos activos (Felder y Woods, 2000). Este cuestionario se divide en dos partes “Basic” y “Extra”, de forma que para acceder al segundo el alumno tiene que obtener como mínimo un 7 en el primero. Las clases presenciales se graban mediante videoapuntes como refuerzo al trabajo personal del alumno.



Figura 2. Metodología Landing Flipped Classroom. Módulo de aprendizaje. Fuente: Elaboración Propia.

La unidad didáctica finaliza con el concurso “Naranja-Limón” donde a equipos de dos alumnos se les plantean cuestiones temporizadas (1 o 2 minutos). El equipo ganador gana un premio (merchandising donado por Cátedras o Escuela) y el perdedor lee un poema (fábula con mensaje). Finalmente los alumnos demuestran los conocimientos adquiridos mediante

un examen escrito presencial en aula dónde resuelven ejercicios similares a los planteados y resueltos en los módulos de aprendizaje.

2.1.2. Actividades de laboratorio

Las prácticas se realizan cada dos semanas en el laboratorio de electrónica. A los alumnos se les transmite desde el primer día que el laboratorio es un recurso limitado y muy costoso que la universidad pone a su disposición para complementar su formación teórica con prácticas. Desde esta perspectiva gana importancia la preparación previa de las mismas para conseguir un máximo aprovechamiento del tiempo limitado que disponen para la realización de los montajes y las medidas en el laboratorio. En la siguiente figura se muestra de forma esquemática como se desarrolla cada una de las 6 prácticas que se realizan en el semestre.



Figura 3. Metodología Landing Flipped Classroom. Práctica de laboratorio. Fuente: Elaboración Propia.

Los estudiantes visualizan fuera del aula videos didácticos donde se les explica el funcionamiento de los equipos de laboratorio así como la realización de montajes y medidas. Tras la visualización de estos videos los estudiantes responden a unas preguntas sobre el video. Los videos se encadenan unos detrás de otros, de manera que si no han visualizado y respondido las preguntas de un video, no pueden acceder al siguiente. Tras la visualización de estos videos los estudiantes realizan los cálculos teóricos previos sobre los circuitos objeto de la práctica. Los resultados numéricos quedan reflejados en un cuestionario de PoliformaT. Todos los alumnos pueden acceder al laboratorio a realizar la práctica, pero sólo aquellos que hayan realizado el trabajo previo y obtenido más de 5 en el estudio previo pueden introducir las medidas en el cuestionario de PoliformaT sólo accesible desde el laboratorio.

2.2. La metodología “Consolidating Flipped Classroom” (Clase inversa de consolidación)

La metodología “Consolidating Flipped Classroom” (Clase inversa de consolidación) constituye una evolución sobre la anterior en la dirección de dotar de profundidad y madurez el aprendizaje del alumno. En este sentido la metodología incide más en la integración de conocimientos, muchos de ellos adquiridos en el primer semestre, que en la adquisición y evaluación de los mismos por separado.

2.2.1. Actividades de aula

La dinámica general de la asignatura es similar a la del primer semestre en el sentido de que las unidades didácticas se dividen en módulos de aprendizaje semanales. Estas unidades se cierran tras la consecución de 3 o 4 módulos de aprendizaje de nivel cognitivo incremental mediante un examen escrito donde los alumnos demuestran la adquisición de conocimientos. Para esta metodología no se utiliza el concurso “Naranja-Limón” debido a que se abordan problemas de mayor complejidad, no resolubles en 1 o 2 minutos.



Figura 4. Metodología Consolidating Flipped Classroom. Módulo de aprendizaje. Fuente: Elaboración Propia.

La figura anterior muestra como se desarrolla un módulo de aprendizaje de duración semanal. Como diferencia fundamental con la metodología anterior se aprecia el incremento del trabajo previo a las clases presenciales y del control del mismo, además de que los alumnos cuentan con más recursos “Flip”, videos polimedia con explicaciones teóricas y screencast con resolución de problemas. A los alumnos se les pide que visualicen los recursos multimedia antes de la clase y que trabajen en la lectura y comprensión de un capítulo de libro donde se explican los conceptos del módulo de aprendizaje y las claves para poder resolver los ejercicios/problemas del módulo semanal. Previo a la clase presencial el alumno tiene que entregar dos cuestionarios de PoliformaT:

- Cuestionario sobre los vídeos y la lectura del libro para estimular el trabajo previo.

- Cuestionario de resolución de ejercicios/problemas para aflorar dudas sobre la resolución.

En las clases presenciales se resuelven dudas sobre los contenidos que han trabajado en casa y se resuelven ejercicios/problemas relacionados con el módulo semanal. Tras resolver sus dudas en clase pueden volver a realizar el cuestionario de resolución de ejercicios/problemas, pero solo aquellos alumnos que lo han intentado antes de la clase presencial. Las clases presenciales se graban mediante videoapuntes como refuerzo al trabajo personal del alumno.

2.2.2. Actividades de laboratorio

En las prácticas los alumnos tienen que ser capaces de realizar medidas sobre circuitos con dispositivos electrónicos, usando los conocimientos adquiridos en la asignatura TDC. Para repasar disponen de los vídeos didácticos de TDC sobre el funcionamiento de los equipos de laboratorio y la realización de montajes y medidas. Antes de cada práctica, los alumnos en grupos de 2 analizan el circuito que se montará en la sesión presencial. Durante la práctica, realizan las medidas sobre el circuito y entregan una hoja de resultados. El trabajo posterior a la sesión de laboratorio consiste en elaborar un documento técnico (memoria final) con formato de proyecto de ingeniería donde se realiza el análisis teórico de los circuitos, se exponen las medidas realizadas sobre los montajes de laboratorio y se comparan y justifican las diferencias con los resultados alcanzados. Esta memoria se corrige minuciosamente y se devuelve a los alumnos de manera que tengan una rápida realimentación que les sirva para aprender a elaborar documentos técnicos. De este modo se trabaja en profundidad la competencia CT-08 comunicación efectiva (en este caso escrita).



Figura 5. Metodología Consolidating Flipped Classroom. Práctica de laboratorio. Fuente: Elaboración Propia.

2.3. Evaluación

El sistema de evaluación planteado en cada una de las asignaturas es diferente. En la siguiente tabla se muestra cada uno de los sistemas de evaluación empleados:

Tabla 1. Sistema de evaluación. Fuente: Elaboración Propia.

Elemento de evaluación	TDC	DE
Tareas clase inversa	40%	15%
Exámenes presenciales	40%	60%
Prácticas	10%	25%
Participación clase	10%	

Los pesos otorgados a cada elemento de evaluación están altamente relacionados con el objetivo que persigue cada metodología:

1. La asignatura TDC pretende “enganchar” a los nuevos estudiantes minimizando el abandono de los mismos. Esta función se cumple otorgando mayor peso al trabajo realizado fuera de clase (denominado como tareas clase inversa) para reforzar las características de la motivación intrínseca especialmente la competencia (superación de dificultades y aprendizaje de nuevos conceptos) y la autonomía (necesidad innata de dirigir la vida de uno mismo). El estudiante tiene la percepción de que va avanzando en su aprendizaje, y que este avance se refleja claramente en las calificaciones.
2. La asignatura DE persigue la consolidación de conocimientos, pretende que el alumno sea capaz de demostrar que ha adquirido los conocimientos y habilidades de ambas asignaturas, por lo que los exámenes presenciales y la evaluación de las prácticas presentan un peso mayor.

Cabe destacar que, en la asignatura DE, cuando se detecta que la motivación de los alumnos baja se reabren exámenes en Poliformat (tareas clase inversa), incluso se les permiten varios intentos para poder obtener mayor nota (gamificación). También se reabren para que preparen los exámenes (parciales o finales). El peso de las tareas clase inversa es bajo, así que esto no hace que aprueben la asignatura sin merecerlo, sino que les ayuda a preparar los exámenes.

2.4. Elementos y recursos utilizados

Los contenidos de ambas asignaturas se han desarrollado a través de la herramienta Lessons incluida en PoliformaT. Esta herramienta es tremendamente versátil, ya que permite estructurar los contenidos de diferentes maneras, adaptándose a las características de cada asignatura. En los casos que nos ocupan la plataforma Lessons se utiliza como una guía de

aprendizaje, en la cual el alumno tiene trazado el camino a seguir para adquirir los resultados de aprendizaje de cada una de las asignaturas. Para ello se han diseñado módulos de aprendizaje que contienen los siguientes recursos:

- **Enlaces a recursos:** conteniendo textos, boletines de problemas, presentaciones etc.
- **Enlaces a exámenes:** los exámenes y cuestionarios que tienen que resolver los alumnos se han implementado gracias a la realización de baterías de preguntas (más de 2000 preguntas diferentes). De cada concepto a evaluar se tiene un elevado número de preguntas, de manera que a cada estudiante le aparecen variantes distintas. Los profesores revisan los resultados obtenidos en estos exámenes y adaptan las clases presenciales en función de qué conceptos hay que reforzar.
- **Enlaces a tareas:** la herramienta tareas se utiliza para gestionar la entrega de las memorias de prácticas
- **Enlaces a foros:** se utiliza el foro de la asignatura para que los alumnos planteen y resuelvan dudas. Se trata de una herramienta muy útil para crear sentimiento de comunidad y promover la solidaridad entre los estudiantes.
- **Videos Polimedia:** se han realizado más de 100 videos didácticos Polimedia, en ellos se exponen los conceptos teóricos
- **Videos Screencast:** se utilizan para explicar diferentes métodos de análisis de circuitos electrónicos. Se han elaborado con la herramienta VideoScribe.
- **Videos de laboratorio:** en ellos se explica el funcionamiento de la instrumentación electrónica a utilizar en el laboratorio. Resultan muy útiles para que el alumno pueda sacar el máximo provecho a las sesiones prácticas.
- **Enlaces a webs:** de diferentes fabricantes de dispositivos electrónicos en las que pueden encontrarse notas de aplicación, hojas de características, etc. De este modo el estudiante comienza a trabajar con los documentos técnicos que deberá manejar a lo largo de su carrera profesional, y no solo con documentos académicos.
- **Enlace a calificaciones:** a través de estos enlaces el alumno puede realizar un seguimiento de los resultados que va obteniendo, de este modo comprobará cual es el alcance de su progreso. El apartado calificaciones de PoliformaT se ha configurado utilizando categorías y pesos. De este modo el alumno sabe en todo momento cual es la nota de la asignatura hasta ese momento.

Como ayuda al **seguimiento de la asignatura** los profesores utilizan la herramienta **Estadística** de PoliformaT. Esta herramienta incluye la posibilidad de revisar el trabajo realizado por los alumnos. Se pueden realizar informes que detallan qué recursos son los más utilizados, qué hábitos de estudio presentan los estudiantes, incluso qué estudiantes son los más activos. Por otro lado, la revisión de los exámenes PoliformaT realizados por los alumnos, permite ir adaptando las clases de manera que se refuerzan aquellos conceptos en los que los estudiantes fallan más.

Con el objetivo de incrementar la gamificación de las asignaturas cada cierto tiempo se publica el **ranking de notas**, en el cual se presentan los alumnos (identificándolos con las cuatro últimas cifras de su DNI) ordenados en función de las calificaciones obtenidas hasta ese momento. Esta actuación incita a los alumnos a querer mejorar sus calificaciones para ir avanzando puestos y situarse entre los primeros de la clase.

3. Evaluación de la experiencia

En las figuras 6 y 7 se pueden observar los resultados de los cuestionarios que se han realizado a los alumnos de TDC sobre la metodología empleada en el curso 2016/2017. De las encuestas anteriores se puede remarcar un alto grado de satisfacción del alumnado que ha seguido esta metodología, destacando que los recursos presentados han sido útiles para preparar la asignatura y han permitido que los profesores pudieran dedicar las clases presenciales a resolver dudas y trabajar aspectos más avanzados.

Respecto a los resultados de las encuestas a los profesores, no se observan cambios significativos en la valoración que los alumnos hacen de los profesores implicados en estas asignaturas antes y después del uso de la metodología clase inversa.

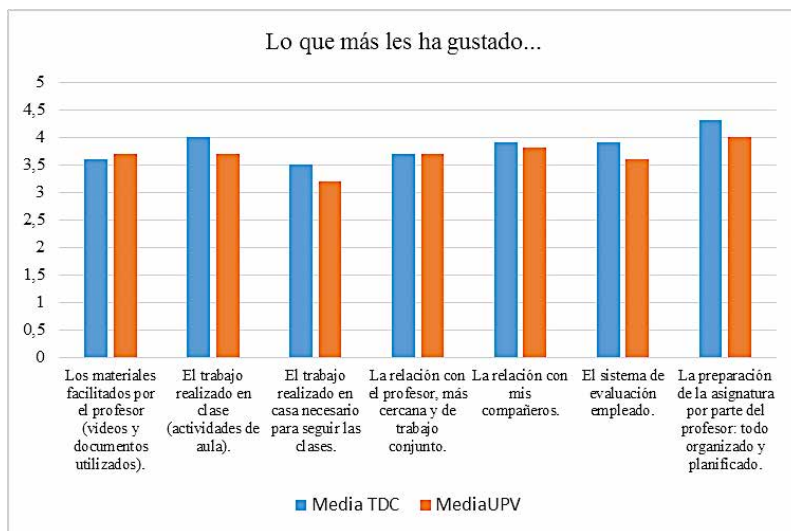


Figura 6. Opinión de los alumnos sobre la metodología Landing Flipped Classroom. Lo que más les ha gustado. Curso 2016/2017. Fuente: Elaboración Propia.

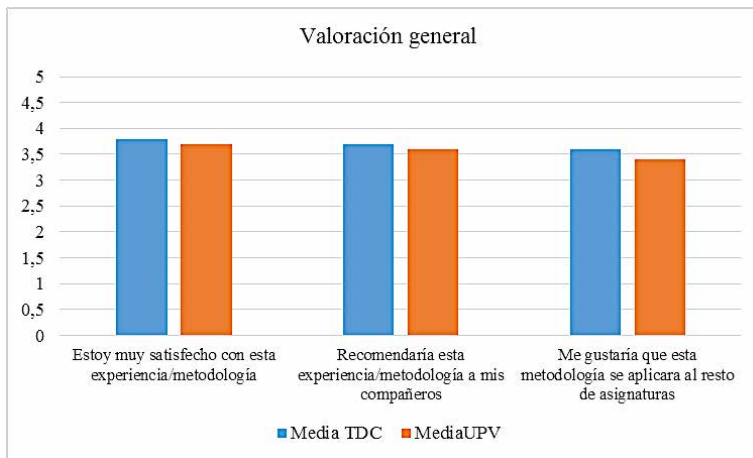


Figura 7. Opinión de los alumnos sobre la metodología Landing Flipped Classroom. Valoración general. Curso 2016/2017. Fuente: Elaboración Propia.

En cuanto al rendimiento, el de la asignatura TDC ha permanecido constante (antes y después de la aplicación de la clase inversa, Fig. 8). Sin embargo sí que se ha notado un incremento en el rendimiento de la asignatura DE (que partía de niveles muy bajos, Fig. 9) y sobre todo un aumento en la nota media de los alumnos que aprueban la asignatura. Cabe señalar que la metodología expuesta en este artículo se ha aplicado en los cursos 2015-2016 y 2016-2017. Por otro lado, cabe destacar que el uso de esta metodología no mejora el abandono en la asignatura DE. Se observa que este abandono está correlacionado con los resultados de TDC (Fig. 10), de manera que aquellos alumnos que no aprueban TDC abandonan DE durante el primer mes, probablemente porque se dan cuenta de que no han adquirido los conocimientos previos adecuados para seguir esta asignatura.

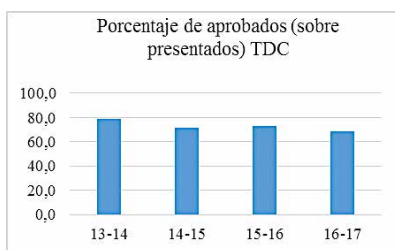


Figura 8. Rendimiento en TDC

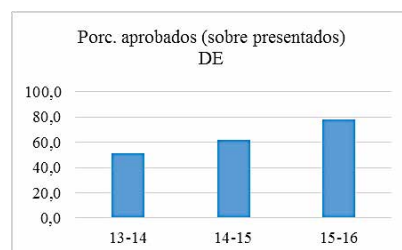


Figura 9. Rendimiento en DE

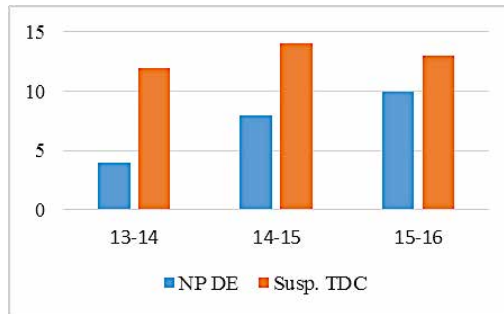


Figura 10. Número de no presentados en DE y suspendidos en TDC

4. Conclusiones y planes de mejora

La experiencia está resultando gratificante tanto para los profesores como para los alumnos ya que:

- La plataforma implementada permite realizar un seguimiento exhaustivo del trabajo de los alumnos
- El enorme trabajo de preparación realizado por los profesores durante los años previos está comenzando a dar sus frutos ya que en este momento ambas asignaturas se encuentran totalmente implementadas. Actualmente el trabajo de los profesores se centra más en incrementar la participación de los alumnos en las sesiones presenciales.
- Los profesores de asignaturas posteriores han notado una mejoría en los conocimientos y habilidades de los alumnos que les llegan tras cursar estas asignaturas siguiendo la metodología de clase inversa.

Tras la experiencia en estos dos últimos cursos, hemos detectado varios planos de mejora:

- Renovar las baterías de preguntas haciendo uso de los nuevos tipos de preguntas especialmente de “respuesta calculada”, incluido en el último curso en PoliformaT. Este tipo de pregunta soluciona algunos de los errores con los que se encuentran los alumnos debidos a fallos en la precisión de los cálculos.
- Incidir en la búsqueda de mecanismos que mejoren la asistencia a clase y la participación de los alumnos.
- Balancear el binomio Autonomía/Control especialmente en TDC mediante la inclusión de preguntas empotradas en los videos. El hecho de no controlar la visualización de los videos “flip” mediante preguntas posteriores incrementa la libertad de elección del alumno provocando que algunos de ellos asistan a clase sin haber visualizado los videos.

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Nuevo Diseño de Estudios de Ingeniería para el Siglo XXI

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Abstract

Polytechnical schools emerged during the 19th century provided the foundations for the engineering curricula. At the beginning, the goal of these schools was to cover the industry demand of technical skills but, over the years, these school's founders were replaced by lecturers hired on the basis of their achievements in engineering science and laboratory work, transforming these schools into scientist factories, who tend to lack industry-demanded skills.

At the beginning of the 90s, world's top universities encouraged by the need of entrepreneurial skills began to swing the pendulum towards project based learning and, in the year 2007, the proposal "Rethinking Engineering Education: The CDIO Approach" appeared. This proposal establishes a new way to teach based on CDIO (Conceive, design, implement and operate).

In this paper, we present the key to designing a new degree, based on CDIO philosophy and project-based learning. This work explores the difficulties in the implementation of this new methodology over degree structures, which were not conceived initially in this way and are unprepared to deal with the XXI century challenges.

Keywords: CDIO, PBL, projects, skills, learning, Valencia, methodology, evaluation, degree, curricula, studies.

Resumen

Las escuelas de maestría creadas en el siglo XIX dan paso en el siglo XX a los estudios de ingeniería. Si bien inicialmente el objetivo de estas escuelas era cubrir la demanda de la industria, con el paso de los años los profesores fundadores de estas escuelas fueron sustituidos por los titulados con un perfil investigador. Lo que provocó que las escuelas se convirtieran en fábricas de científicos con carencias, en la mayoría de los casos, de las competencias profesionales básicas demandadas en la empresa.

A principios de los 90 universidades punteras de todo el mundo, espoleadas por la demanda empresarial de profesionales formados con competencias de empresa, impulsan nuevos estudios basados en la enseñanza basada en proyectos (PBL) y en el año 2007 aparece la propuesta "**Rethinking**

Engineering Education: The CDIO Approach “ que sienta las bases para una nueva forma de enseñar las ingenierías basada en CDIO (Concebir, Diseñar, Implementar y Operar).

En este trabajo presentamos las claves para diseñar un título de ingeniería orientado a proyectos con filosofía CDIO. El trabajo explora las dificultades a las que se enfrenta la implementación de estas nuevas metodologías en estructuras de grado no pensadas ni preparadas para estos nuevos retos del siglo XXI.

Palabras clave: CDIO, PBL, proyectos, competencias, formación, Valencia, metodología, evaluación, grado, plan, estudios.

Introducción

Las escuelas de ingeniería nacidas hasta la década de los 50 se formaron integrando como profesores a profesionales de la industria. Éstos imprimían a la formación de los ingenieros un alto carácter práctico, así como los valores y las competencias demandadas por las empresas del momento. Fue en esta década cuando nació la ciencia aplicada a la ingeniería mediante la integración de científicos jóvenes, en la mayoría de los casos titulados de la propia universidad, en las escuelas de ingeniería. En la década de los 60 la formación en ingenierías ya era mixta, en el sentido de que la formación más práctica la impartían los viejos profesionales de la empresa mientras que los jóvenes ingenieros, recién incorporados, dotaban de perfil científico a los títulos y desarrollaban su carrera profesional, dentro de las universidades, a través de la producción de resultados científicos con aplicación práctica a la ingeniería. La desaparición de los viejos profesionales en los 70 y la práctica sustitución de éstos por profesores con perfil científico provocó el giro definitivo de las enseñanzas de ingeniería hacia la ciencia de la ingeniería. Las escuelas se convirtieron en fábricas de científicos carentes, en la mayoría de los casos, de las competencias profesionales básicas demandadas en el mundo empresarial (Sheppard y otros, 2009).

En el plano internacional, en los años 80 y 90 comienza la discusión de lo que, hasta el momento, no se había percibido como un problema para la industria. Ingenieros de la industria, gobiernos y profesionales de la enseñanza universitaria empezaron a plantear la necesidad de introducir mejoras en la enseñanza de las ingenierías, manteniendo como objetivos clave el mantenimiento de los niveles de especialización y conocimientos específicos y al mismo tiempo no sólo el desarrollo de competencias personales e interpersonales sino además aquellas relacionadas con el desarrollo de productos, procesos y sistemas.

La figura 1 describe las diferentes olas de innovación (Smith, 2013) acontecidas en los dos últimos siglos. En ella puede apreciarse cómo las primeras olas han ocupado prácticamente casi todo el espacio, lo que ha permitido a los sistemas educativos adaptarse a las necesidades de los cambios, ofreciendo trabajadores cualificados para ocupar los puestos de trabajo

demandados por el sistema. La dos últimas, referidas a las tecnologías de la información y las comunicaciones (TICs), ha sucedido en los últimos 30 años y su crecimiento ha sido exponencial. Quizás por este motivo no ha sido hasta 2007 cuando se ha publicado el documento “Rethinking Engineering Education: The CDIO Approach“ (Crawley y otros, 2007) proponiendo un cambio en las enseñanzas de la ingeniería.

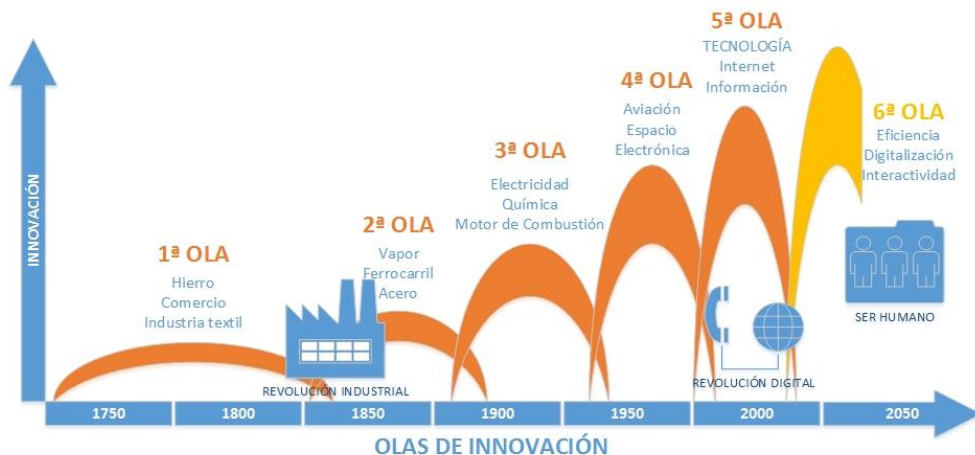


Figura 1. Olas de la innovación. Fuente: Adaptado de Smith (2013)

Con esta perspectiva el Campus de Gandia de la Universitat Politècnica de València (UPV) en el año 2014 aborda como proyecto la creación de un nuevo grado siguiendo un modelo innovador, no explorado hasta el momento en el mapa de titulaciones de España. En este trabajo se describe el proceso de desarrollo del mismo, empezando en el capítulo 1 con la descripción del marco de desarrollo y la concepción de la idea. En el capítulo 2 se describen el proceso y la metodología de desarrollo del plan de estudios y en el capítulo 3 se explican los detalles de implantación y puesta en marcha. Finaliza el artículo con la exposición de las conclusiones.

1. Marco de desarrollo y concepción de la idea

La Escuela Politécnica Superior de Gandia (Campus de Gandia de la UPV) nace en el año 1993 con la vocación de nutrir de profesionales universitarios a una sociedad que reclamaba la vuelta a Gandia de una universidad que 221 años antes había desaparecido tras la expulsión de los jesuitas.

1.1 Evolución de las TICs en el Campus de Gandia

El Campus de Gandia arranca sus estudios con dos líneas maestras, TICs y medio ambiente, que no le han abandonado tras el paso del tiempo y a las que en su día se incorporaron

Turismo, Comunicación Audiovisual y finalmente ADE, para complementar y enriquecer su carácter multidisciplinar.

La apuesta estratégica que en su día se hizo por las TICs encaja con la demanda social de ingenieros TICs que refleja el pico de la quinta ola de innovación de la figura 1. En concreto se impartieron las extintas Ingenierías Técnicas de Telecomunicación, con diferentes especialidades como Sistemas de Telecomunicación, Sistemas de Imagen y Sonido y Sistemas Electrónicos. Tras el proceso de adaptación de los estudios superiores al Espacio Europeo de Educación Superior se comenzó a impartir el Grado en Sistemas de Telecomunicación, Sonido e Imagen (GISTSI).

En paralelo, desde el curso 2004-2005, se imparte la Licenciatura en Comunicación Audiovisual, la cual se convirtió en el Grado en Comunicación Audiovisual (GCAV) durante el proceso anteriormente citado. Este Grado contenía en su memoria de verificación una intensificación llamada Diseño Multimedia, que, a pesar de contar con profesorado capacitado, nunca llegó a impartirse. Sin embargo sí que se abrieron unas pocas asignaturas optativas relacionadas con esta intensificación.

1.2 Factores de Contexto

Aunque aparentemente esta evolución de títulos encaja con la idea de adaptación a los cambios que las universidades deben hacer, hay una serie de factores externos e internos que han abocado al Campus de Gandia a dar el paso a introducir un nuevo título TIC en su portafolio de grados:

1. La adaptación al Espacio Europeo de Educación Superior (EEES) que, como ya se ha comentado, supuso la desaparición de las antiguas ingenierías técnicas y la adaptación de las mismas a un sólo grado.
2. El enorme desequilibrio entre la oferta y la demanda de estudios TICs en la Comunidad Valenciana motivado por:
 - a. el incremento de oferta de títulos TICs que las universidades valencianas han realizado en respuesta a la quinta ola de innovación,
 - b. la inversión de la pirámide demográfica que ha reducido el número de candidatos,
 - c. la disminución de las vocaciones TIC entre nuestro jóvenes,
 - d. y el problema, ya endémico, del alejamiento de las mujeres de las TICs.
3. La existencia en la UPV de únicamente títulos TICs de corte tradicional como lo son las Ingenierías de Telecomunicación e Informática.
4. La dificultad que supone para Gandia la captación de estudiantes de Valencia debido a la distancia física entre las dos ciudades.

Estos factores han originado que en pocos años, el campus más joven y moderno de la UPV pase de tener 2700 alumnos a no más de 1200, manteniendo las mismas infraestructuras y

prácticamente el mismo profesorado. Este hecho, unido a la necesidad que se percibe en la sociedad de una titulación tecnológica capaz de nutrir al mercado de profesionales TIC con visión de proyecto, para concebir, diseñar, implementar y operar productos de mercado (Clough y otros, 2005), adaptada a las nuevas generaciones de jóvenes tecnólogos que el siglo XXI nos ha traído, impulsó al campus de Gandia poner en marcha un nuevo título haciendo valer los recursos públicos, humanos y materiales, disponibles.

2. Metodología seguida para desarrollar el Plan de Estudios

Desde la perspectiva descrita en el punto anterior el reto al que se enfrentaba el campus era el diseño de un título innovador, no sólo en cuanto a contenidos, sino en cuanto a metodologías académicas con capacidad de atraer a estudiantes. La metodología seguida para desarrollar el plan de estudios se describe a continuación por pasos, empezando desde la concepción de la temática y terminando con el proceso de verificación del por parte del comité evaluador de la ANECA.

2.1. Concepción de la temática del Grado

Desde un principio la temática debía estar relacionada con las TIC, para así aprovechar la experiencia de los profesores que habían estado impartiendo clase en GISTSI así como aquellos de la rama multimedia que apenas habían tenido la posibilidad de mostrar todo su potencial en GCAV. De esta manera se elaboró un primer informe con la propuesta de un tema que en aquel momento se denominó “Grado en Tecnologías de Interactividad Multisensorial”.

Básicamente, la esencia del título es la formación de profesionales con capacidad para diseñar los sistemas tecnológicos que interaccionan con los cinco sentidos del ser humano y del medio ambiente, entendiendo este último como un ser vivo que se comunica. Por sistemas tecnológicos se entiende el conjunto o cadena de tecnologías (hardware) y aplicaciones (software) necesarias para que esta interactividad se produzca. Hay multitud de ejemplos de aplicación como la industria del entretenimiento, la educación y teleeducación, el medio ambiente, etc.

Sin embargo, la creación de una nueva titulación de grado debe tener en cuenta todos los agentes implicados: estudiantes, el personal facultativo, la industria y la sociedad. En nuestro trabajo de creación del mismo orientamos nuestra mirada hacia los dos últimos agentes puesto que son las entidades que mayor beneficio obtendrán a largo plazo.

2.1.1. Entrevistas con las empresas del sector

Es por ello que el primer paso consistió en realizar una serie de entrevistas con empresas del sector tecnológico ubicadas en la provincia de Valencia. Las entrevistas se realizaron por varias vías: a través de llamadas telefónicas, visitas personales y contacto por correo electrónico.

Se les transmitió un cuestionario en el que se les informaba de la posibilidad de crear un nuevo grado asociado a las tecnologías de la información y las comunicaciones, que pusiera un énfasis especial en la formación en competencias transversales y en el desarrollo de todas las fases de creación de un producto industrial (Concepción, Diseño, Implementación y Operación).

Los resultados de estas entrevistas fueron muy reveladores. En primer lugar nos permitió afianzar la idea de que los estudios tecnológicos necesitaban un cambio de enfoque: todos los empresarios entrevistados remarcaron la idea de que se deberían trabajar más las competencias transversales además de involucrar a los estudiantes en un entorno de trabajo más cercano al mundo laboral.

Los entrevistados también señalaron la idoneidad de la temática elegida, que sin duda iba a ser puntera en la sexta ola de la innovación según se aprecia en la figura 1.

2.1.2. Estudio de viabilidad

Una vez recogidas las aportaciones de las empresas se elaboró un segundo documento a modo de presentación del grado, cuyo nombre ya había evolucionado a “Grado en Tecnologías Interactivas”. Este documento sirvió de base para realizar un estudio de viabilidad, paso obligatorio en la Universitat Politècnica de València para poder comenzar a diseñar un nuevo plan de estudios. El objetivo y la metodología seguida en este estudio de viabilidad tienen sus bases en el documento “Propuesta metodológica para la evaluación de la implantación de nuevos grados en la UPV” (Aldás, 2009) elaborado por el Instituto Valenciano de Investigaciones Económicas (IVIE) y presentado a la Universitat Politècnica de València (UPV) en 2010. En la Propuesta Metodológica se señalaba que, en opinión del IVIE, toda propuesta de nuevos grados debía ir acompañada, entre otros elementos que se detallan, de una evaluación de la demanda potencial del nuevo título. En este estudio se entrevistó al alumnado procedente del bachillerato que potencialmente elegiría este título. La estimación está basada en dos encuestas realizadas a alumnos de primero de carreras afines a la propuesta tanto en la UPV como en otras universidades valencianas: Universitat de València (UV), Universidad Miguel Hernández de Elche (UMH), Universitat Jaume I de Castellón (UJI), Universidad de Alicante (UA) y Universidad Católica San Vicente Mártir (UCV).

Las conclusiones de este estudio de viabilidad (Aldás, 2015) reflejan una demanda potencial de 135 estudiantes, la cual, teniendo en cuenta que el número de alumnos de nuevo ingreso se fijaría en 50, daría lugar a una tasa de demanda del 270%. Este indicador se encuentra muy por encima de la media obtenida en GISTSI en los últimos años.

2.2. Formación de la comisión del plan de estudios

Una vez concebida la idea y validada por los agentes externos llegó el momento de formar la comisión del plan de estudios. La vocación orientada a desarrollo de productos de mercado del grado, a través metodologías académicas orientadas a proyecto, para la formación de ingenieros con la visión global del problema/solución, requería un equipo de trabajo de carácter ampliamente multidisciplinar. Para conseguir este objetivo se invitó a participar a todos los departamentos de la UPV y finalmente la comisión se formó con representantes de los doce departamentos siguientes: comunicaciones; ingeniería electrónica; sistemas informáticos y computación; comunicación audiovisual, documentación e historia del arte; expresión gráfica en la ingeniería; matemática aplicada; estadística; urbanismo; organización de empresas; lingüística aplicada; dibujo y física aplicada.

Cabe destacar que varios de estos representantes son profesores a tiempo parcial que compaginan sus labores docentes con su trabajo como profesionales del mundo de la ingeniería gráfica, multimedia y la industria de los videojuegos. La aportación de estos profesionales fue muy valiosa a la hora de diseñar un plan de estudios cercano a la realidad profesional.

2.3. Brainstorming – Proyectos

Desde el primer momento la comisión adoptó una filosofía de trabajo “Top-Down”, que permitió alinear a todos los miembros en los objetivos finales perseguidos por el grado.

Esta filosofía se materializó en primer lugar con la generación de un listado de productos/servicios concretos relacionados con las tecnologías interactivas. Básicamente cada miembro de la comisión contribuyó con ejemplos de su ámbito profesional, personal o extraídos directamente de búsquedas en internet. El número y diversidad de los componentes de la comisión permitió recopilar un listado muy amplio de aplicaciones reales de las tecnologías interactivas.

En un segundo nivel de la filosofía “Top-Down” los ejemplos de aplicación se agruparon formando diferentes categorías, para de esta manera determinar las temáticas de los proyectos a desarrollar en el grado y por lo tanto las futuras capacidades de los egresados. Finalmente los temas fueron los siguientes:

- productos de monitorización,
- aplicaciones multimedia interactivas,
- aplicaciones de Internet de las cosas,
- productos de diseño y programación web,
- aplicaciones relacionadas con la salud/biometría y medio ambiente,
- aplicaciones de robótica y control,
- y productos relacionados con la realidad virtual y/o aumentada.

A partir de estas ideas de proyectos se redactaron las competencias del grado, las cuales pueden consultarse a través de la [página web](#) del mismo.

2.4. Creación de la estructura: Módulos y Materias

En paralelo se decidió cuál sería la estructura del grado. Durante esta fase la comisión consultó numerosos planes de estudios, principalmente de universidades de otros países europeos y que estuvieran incluidas en la iniciativa internacional CDIO. Varios de ellos sirvieron de inspiración a los miembros de la comisión al tratarse de planes innovadores de los que tenemos buenas referencias. Entre ellos podemos destacar algunos grados de la Universidad de Aalborg (Dinamarca) como Medialogy, Electronics and Computer engineering o IT Communication and New Media.

A la hora de diseñar la estructura del plan de estudios se optó por crear semestres temáticos, en cada uno de los cuales se trabajaría en profundidad una de las temáticas presentadas. Para ello se consensuó dedicar, a partir del semestre 1B¹, 12 créditos (ECTS) para una materia proyecto que engloba una serie de talleres necesarios para poder abordar con éxito el proyecto, junto con las contribuciones del resto de asignaturas (18 ECTS) del semestre. En definitiva, las materias proyecto se convierten en el hilo conductor de la actividad académica de cada semestre, siempre dirigido a la elaboración de un producto de mercado con la filosofía CDIO.

El semestre 1A tendría que ser diferente ya que era necesario impartir una serie de conocimientos básicos sin los cuales no podría abordarse ningún proyecto. En este primer semestre se imparten materias de formación básica (matemáticas, física, electrónica y programación). Además se decidió crear una asignatura de 6 créditos en la que se introdujera al alumno en la filosofía del CDIO y en la gestión de proyectos utilizando la metodología ágil (Scrum). Para ello se plantea la realización de un proyecto de monitorización muy básico, que sirve de excusa para practicar los conceptos abordados y presentar la cadena completa de procesado de la información (sensor, acondicionamiento, microprocesador, internet y almacenamiento y procesado de datos en servidores en la nube). El resto de semestres contienen la materia proyecto anteriormente citada, más una serie de asignaturas en las que se imparten conocimientos que se van a utilizar en varios proyectos (por ejemplo, conocimientos de telemática, procesado de señal, algorítmica etc.), tal y como puede verse en la Tabla 1.

¹ Un curso académico consta de dos semestres, A y B. De este modo, el semestre 1B es la segunda mitad del primer curso, el 2A es la primera mitad del segundo curso, etc.

Tabla 1. Estructura del plan de estudios del Grado en Tecnologías Interactivas. Fuente: Adaptada de la memoria de verificación del grado en Tecnologías Interactivas.

CUR/SEM.	ECTS	TIPO (*)	ASIGNATURA	CUR/SEM.	ECTS	TIPO (*)	ASIGNATURA
1 A	6	FB	Álgebra matricial y geometría	3 A	4,5	OB	Cálculo. Ecuaciones diferenciales
1 A	6	FB	Electrónica básica	3 A	4,5	OB	Tecnologías de la información geográfica
1 A	6	FB	Fundamentos físicos	3 A	4,5	OB	Tratamiento de señal
1 A	6	FB	Programación 1	3 A	4,5	OB	Tratamiento digital de imagen. Visión Artificial
1 A	6	OB	Desarrollo de un proyecto electrónico utilizando metodología CDIO	3 A	12	OB	Proyecto Aplicaciones de Biometría y Medio Ambiente
1 B	6	FB	Diseño de interfaces y experiencia de usuario	3 B	4,5	OB	Control
1 B	6	FB	Programación 2	3 B	4,5	OB	Integración de redes
1 B	6	FB	Redes y servicios telemáticos	3 B	4,5	OB	Medios de interconexión, energía y alimentación
1 B	12	OB	Proyecto diseño y programación Web	3 B	4,5	OB	Seguridad en redes y sistemas
				3 B	12	OB	Proyecto de Robótica
2 A	4,5	OB	Aplicaciones para dispositivos móviles				
2 A	4,5	OB	English for software developers	4 A	4,5	OB	Aspectos legales, sociales y éticos de los productos y servicios tecnológicos
2 A	4,5	OB	Microprocesadores y acondicionadores de señal	4 A	4,5	OB	Ciencia de datos. Estadística
2 A	4,5	OB	Redes de área local	4 A	4,5	OB	Inteligencia Artificial
2 A	12	OB	Proyecto Internet de las cosas (IoT) y Aplicaciones móviles	4 A	4,5	OB	Tecnologías realidad virtual/realidad aumentada
2 A	6	FB	Algorítmica y matemáticas para juegos	4 A	12	OB	Proyecto Entornos Interactivos Avanzados
2 B	6	FB	Economía de la empresa	4 B	4,5	OPT	Big Data
2 B	6	FB	Introducción al tratamiento digital de señal	4 B	4,5	OPT	Dirección de producción y operaciones
2 B	12	OB	Proyecto Multimedia Aplicaciones Interactivas. Videojuegos	4 B	4,5	OPT	Innovación y emprendimiento
				4 B	4,5	OPT	Plataformas e-commerce

(*)Tipos de asignaturas: FB: Formación básica (60 ECTS), OB: Obligatoria (150 ECTS), OPT: Optativa (18 ECTS) y TFG: Trabajo fin de grado (12 ECTS).

2.5. La importancia de las materias Proyecto

La principal novedad que presenta este plan de estudios es el hecho de incluir materias Proyecto que se dedicarán por entero a abordar la concepción, diseño, implementación y operación del proyecto a realizar durante el semestre.

Estas materias contendrán algunos talleres, los cuales dependen del proyecto a realizar durante ese semestre. La temática del proyecto queda fijada en el plan de estudios, pero no cierra del todo el tipo de proyecto, de manera que queda cierto grado de libertad para poder ir adaptando el grado a la evolución tecnológica del momento.

En estas materias se trabajará en grupos de hasta cinco estudiantes y se pondrá un énfasis especial en el desarrollo de las [competencias transversales de la UPV](#).

La metodología de gestión de proyectos que se va a seguir durante todo el título es la misma, de manera que los alumnos practicarán año a año como trabajar en un entorno similar al que podrán encontrarse al iniciar su vida profesional. Inicialmente se ha escogido como metodología la gestión ágil de proyectos Scrum (Kniberg, 2007) debido a que se trata de una de las más utilizadas en las empresas tecnológicas del momento.

El sistema de evaluación de los proyectos es el mismo en todos los semestres, permitiendo cierta libertad en relación con el porcentaje establecido para cada elemento. En general se establecen los siguientes elementos para realizar la evaluación:

- se evalúan cada uno de los diferentes *sprints* (fases o iteraciones en las que se implementan las funcionalidades de un producto en la metodología *Scrum*) acometidos durante el semestre (entre un 10% y un 40% de la nota final)
- se evalúa el producto final a través de una presentación pública ante tribunal y una memoria del mismo. En esta evaluación se tendrá en cuenta la creatividad, el grado de innovación así como el nivel de alcance de las competencias transversales. Esta prueba contará entre un 30% y un 40% de la nota final.
- se permite hasta un 10% de nota por observación del trabajo personal. Se trata de un elemento subjetivo que se deja a criterio del profesor.
- si el responsable del proyecto lo cree necesario podrían hacerse pruebas escritas (entre un 0% y un 30% de la nota final)

2.6. Proceso de verificación

Durante el proceso de verificación del plan de estudios la comisión se encontró con algunas reticencias por parte del comité evaluador de la ANECA. En su informe de evaluación de la solicitud de verificación el comité se mostraba inquieto ante algunos aspectos que tuvieron que ser explicados con detalle. Entre ellos cabe destacar:

- La ausencia de referentes de títulos similares en universidades españolas: efectivamente este hecho avala que se trata del primer grado de estas características que aparece en España, no así en el extranjero. Sin embargo sí que existen algunos postgrados de contenidos similares, como el Diploma de especialización en tecnologías interactivas (UPV), el Experto universitarios en tecnologías interactivas y fabricación digital (UPV) y el Máster en tecnologías interactivas y fabricación digital (UPV).
- La manera de presentar los contenidos de formación básica extrañó también al comité evaluador ya que estos no se agrupan todos entre primer y segundo curso sino que quedan diseminados a lo largo de la titulación, impartándose en el momento en el que son más necesarios. Consecuencia directa de este hecho es la ruptura de la programación tradicional. Desde el principio la comisión del plan de estudios tuvo clara la necesidad de presentar los contenidos en el momento en el que se van a utilizar, manteniendo la fidelidad a los principios básicos y fundamentales

de la enseñanza basada en proyectos (PBL). Un ejemplo es la asignatura de cálculo diferencial que se impartirá en tercer curso, cuando los alumnos se encontrarán con la necesidad de controlar sistemas automáticos y para ello tendrán que aplicar ecuaciones diferenciales. De esta manera se pretende conseguir que se vea claramente la aplicación de las técnicas matemáticas impartidas en el proyecto del mismo semestre. Durante todo el grado se trabaja siguiendo una filosofía top-down: los primeros cursos se trabaja a nivel de sistemas y a medida que va avanzando la carrera los estudiantes van accediendo a proyectos y asignaturas relacionadas, que requieren un nivel de profundización mayor.

Tras realizar las alegaciones oportunas la memoria del Grado en Tecnologías Interactivas fue verificada en Noviembre de 2016.

3. Implantación del Plan de Estudios

La implantación de un grado que cambia la manera de trabajar de los profesores del sistema público universitario español no es trivial. Los factores de contexto descritos en el capítulo 1 de este trabajo han ayudado a que la voluntad de cambio se extienda entre un profesorado que ve como de año en año va mermando la población de estudiantes TIC, que llegan a la universidad con perfiles que nada tienen que ver con los mismos de unos años atrás.

Desde este punto de vista la comisión académica del grado, heredera de de la comisión del plan de estudios, ha sentado las bases de la implantación del grado construyendo los cuatro pilares que a continuación se describen.

3.1. Principios del grado GTI

Con la finalidad de guiar a los profesores en el proceso de implantación del plan de estudios y de ser incorporada al documento promocional del Grado, la comisión académica creó un decálogo en el que se define la filosofía del mismo. Este decálogo incluye los siguientes puntos:

1. **Teoría sí, pero aplicada:** los contenidos teóricos carecen de sentido por sí mismos, sólo tienen sentido si están orientados a concebir, diseñar, implementar y operar productos de mercado.
2. **Aprendizaje sí, autoaprendizaje también:** no hay barreras para el conocimiento y para la curiosidad de aprender. El autoaprendizaje como herramienta de profundización y ampliación de conocimientos se contempla y valora en todas las asignaturas y proyectos.
3. **Conocimientos para resolver problemas reales:** los estudiantes se enfrentan siempre a problemas complejos de carácter multidisciplinar y son ellos los que tienen que encontrar la solución a través de los conocimientos transmitidos por los profesores y de su auto aprendizaje.

4. **Trabajo en equipo para abordar grandes proyectos:** el trabajo en equipo se establece como metodología para desarrollar productos de mercado. Los estudiantes trabajarán en equipo utilizando dinámicas de empresa.
5. **Creatividad e innovación como valor diferencial:** la creatividad y la innovación constituyen un valor diferencial del Grado. En todos los proyectos del Grado se establecerá una escala que premie aquellos aspectos diferenciales e innovadores de los productos de mercado desarrollados.
6. **Proyectos que se adaptan a los cambios:** los proyectos desarrollados en el Grado y los conocimientos necesarios para su puesta en marcha no son estáticos. Evolucionarán con el tiempo y se adaptarán a las tecnologías emergentes y a las nuevas demandas del mercado.
7. **Interactividad online en un grado presencial:** todas las asignaturas y proyectos de la carrera serán diseñadas online a través de las herramientas interactivas que la universidad pone a disposición de los profesores. El valor que aporta la presencialidad del grado lo aportan la tutorización y seguimiento por parte de los profesores, las aulas, laboratorios, personal técnico especializado y los recursos materiales aportados.
8. **Relaciones profesionales como medio para conocer el mercado:** las relaciones con empresas y profesionales prevalecen frente a los actos académicos puntuales. Se programan seminarios, talleres y visitas a empresas en el calendario académico y se facilitará el acceso a grupos de networking empresarial.
9. **Exposición de productos para llegar al mercado:** los productos desarrollados por los estudiantes en los proyectos se expondrán al público, especialmente en un entorno profesional como lo es la feria de la innovación y el emprendimiento que se enmarca dentro de las acciones del ForoE2 de la UPV.
10. **Empresa, emprendimiento o I+D+i al final del camino:** el carácter profesional del Grado, orientado a la empresa o al emprendimiento, no cierra el camino hacia la investigación, que es una elección personal que se abordará a través de los másteres, posgrado de especialización y programas de doctorado.

En el decálogo se resumen la esencia de la filosofía CDIO para las nuevas enseñanzas de la ingeniería, la metodología de enseñanza basada en proyectos (PBL), la importancia de competencias tan importantes como las de trabajo en equipo, resolución de problemas, creatividad, innovación, autoaprendizaje y conocimiento de problemas del mundo contemporáneo con la vocación de acercar al estudiante y por ende a la universidad a la empresa y al mundo profesional.

3.2. Formación de profesores

Para lograr que el equipo de profesores que impartirá docencia en el grado esté bien coordinado y siga la filosofía del título se impartieron una serie de cursos de formación. Estos cursos versaban acerca de diferentes aspectos como técnicas de generación de ideas, técnicas de resolución de conflictos en equipos de trabajo, metodología ágil de gestión de proyectos, buenas prácticas en programación y, por último, técnicas para conseguir mejorar la experiencia de usuario. Estos cursos cumplieron un doble papel. Por un lado actualizar los conocimientos de los profesores y por otro crear equipos de trabajo en los que empezar a desarrollar los proyectos interdisciplinarios a abordar en el grado.

Tras el periodo de formación, los profesores comenzaron a trabajar en el desarrollo de los proyectos de cada semestre, siguiendo la misma metodología CDIO que se utilizará con los alumnos.

3.3. Infraestructuras y equipamientos

Desde el punto de vista de las infraestructuras necesarias para impartir el grado también ha sido necesario realizar algunos cambios. Para facilitar el desarrollo de los proyectos se establece como aula principal del grado un aula de trabajo en grupo, dotada con 11 mesas con capacidad para grupos de 5 personas. Estas mesas están preparadas para posibilitar que los alumnos utilicen sus propios portátiles. Cada grupo poseerá, además de la mesa de trabajo, un panel en el que poder colgar las tareas a realizar durante cada sprint Scrum. El aula posee también una red wifi local para que los alumnos puedan realizar todas las conexiones que necesiten sin afectar a la red del Campus.

Se facilitará un kit a cada grupo con todo el material disponible para el desarrollo del proyecto.

Además del aula de trabajo en grupo los alumnos realizarán prácticas en laboratorios de electrónica, comunicaciones, multimedia y laboratorios informáticos. Estos laboratorios disfrutarán de un horario de libre acceso para facilitar que los alumnos puedan trabajar fuera del horario lectivo.

Con la finalidad de hacer más eficiente el trabajo de los grupos se promoverá el uso de herramientas de trabajo colaborativo (Google drive, Trello, Skype, GitHub etc.) de manera que los alumnos puedan seguir trabajando en grupo desde sus domicilios.

Por otro lado, también se les familiarizará con el uso de herramientas de control de versiones de modo que aprendan desde el principio a trabajar de un modo profesional.

3.4. Promoción

Uno de los aspectos claves a la hora de lanzar un grado tan novedoso es darlo a conocer. La UPV cuenta con un servicio de información que se encarga de la promoción de sus títulos a través de diferentes acciones como visitas a ferias de estudiantes, jornadas de puertas abiertas, mantenimiento de la web de los grados etc. Sin embargo, la problemática (situación

geográfica) del Campus de Gandia obliga a tener que llegar más lejos en la promoción de sus grados. Por ello se realizan visitas a institutos, se invita a los mismos a la semana de la ciencia y se realizan jornadas de puertas abiertas en el propio Campus.

Por otro lado también se realizó una [guía del futuro alumno](#) en el que se explica la temática y plan de estudios del grado y la filosofía del mismo a través de su decálogo. Esta guía se envió vía mail a los institutos de la zona y se le dió publicidad en la web. Siguiendo la misma línea de actuación se creó un [video promocional](#) en el que se destacan los aspectos más innovadores y creativos del grado. El video se difundió a través de youtube y las redes sociales del Campus de Gandia.

4. Conclusiones

Se ha desarrollado un nuevo plan de estudios cuya misión será formar profesionales que sean capaces de enfrentarse a los retos del siglo XXI, capaces de crear **productos que interaccionen** con los cinco sentidos del ser humano y su entorno, para cubrir las necesidades de la **sexta ola de la innovación** (Smith, 2013).

Las principales novedades que introduce este nuevo grado se pueden resumir en los siguientes puntos:

1. Se utiliza el **aprendizaje basado en proyectos** en todos los semestres del Grado sin renunciar a profundizar en los contenidos teóricos promoviendo el auto-aprendizaje.
2. Se fomenta la **creatividad y la innovación**, trabajándolas desde el primer curso premiando aquellos proyectos que presenten aspectos diferenciales.
3. La estructura del Grado se ha diseñado de manera que rompe con la rigidez de los planes de estudio tradicionales, creando **materias proyecto** de 12 créditos en las cuales se irán adaptando los contenidos a los cambios tecnológicos del momento.
4. Se fomentan las relaciones profesionales y empresariales, se trata de un Grado **conectado con el ámbito empresarial**.
5. Se hace uso de las nuevas **tecnologías de la sociedad de la información y las comunicaciones**: las asignaturas se diseñan haciendo uso de las herramientas interactivas que facilita la universidad, además se utilizan herramientas de trabajo colaborativo,
6. Las **competencias transversales** se hallan perfectamente imbricadas en el plan de estudios. No se trabajan de manera aislada si no que se hallan completamente intregradas en las materias proyecto de cada semestre. De esta forma se da respuesta a las reivindicaciones del mundo empresarial.

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El rol de las TIC en los postgrados universitarios analizados desde la perspectiva de los costos de transacción

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Abstract

In this paper, the "governance" concept is analyzed and some economic applications are presented, making a distinction between agency theory and transaction costs in the Information and Communication Technologies (ICTs) role of postgraduate programs in E-learning in Colombian universities, with the purpose of reviewing the improvement of the educational service and its efficiency.

We are just facing the Globalization era which involves the opening of markets and the proliferation of economic integration deals, which makes our E-learning graduate programs rigorous as a result of the different rules of the game that interact with each other within organizations and the market, forcing Institutions of Higher Education (HEIs) to encourage, motivate the creation of new knowledge and inventions, and build innovative activities that contribute to the development of technological management of our country, processes is important for improving competitiveness such as productivity and thus expanding the coverage of knowledge management and innovation.

The technology itself does not contribute to economic growth, but the good use of them, that is, the people are not more productive thanks to the computers or the simple fact of selling these increases the Gross Domestic Product (GDP), but the good use of these helps to move the engine of economic growth in the new technological factors and the new knowledge that emerges when the cyberspace of the knowledge is explored, assimilating a low transaction cost, therefore we can say that the Growth in postgraduate programs in HEIs is due to the increase in the value of information and innovation and not so much because of the impact of ICTs.

Keywords: *postgraduate student, transaction costs theory, Theory of agency, Educational concession, privatization, ICTs, e-learning education.*

Resumen

En esta ponencia se analiza el concepto de “gobernabilidad” y se muestra algunas aplicaciones económicas haciendo una distinción entre la teoría de la agencia y los costos de transacción en el rol que desempeña las TICs en los programas de postgrado E-learning en las universidades colombianas, con el propósito de revisar el mejoramiento del servicio educativo y su eficiencia.

Actualmente, estamos en la era de la globalización que implica la apertura de mercados y la proliferación de acuerdos de integración económica, lo cual hace que nuestros programas de postgrado E-learning sean rigurosos como consecuencia de la diferentes reglas de juego que interactúan constantemente dentro de las organizaciones y el mercado, forzando a las instituciones de educación superior (IES) a incentivar, motivar la creación de nuevos conocimientos e invenciones y construir actividades innovadoras que coadyuven al desarrollo de la gestión tecnológica de nuestro país.

El rol de las tecnologías de la información y la comunicación (TICs) en los procesos de los programas de postgrados son importantes para mejorar la competitividad como la productividad y por ende ampliar la cobertura de la gestión del conocimiento y la innovación. La tecnología en sí no aportan al crecimiento económico sino el buen uso de ellas, es decir, las personas no son más productivas gracias a los computadores o por el simple hecho de la venta de estos se incrementa el PIB, sino el buen uso de estos ayuda a mover el motor del crecimiento de la economía en los nuevos factores tecnológicos y el nuevo conocimiento que conlleva cuando se explora el ciberespacio del conocimiento, asimilando un bajo costo de transacción, por lo tanto, podemos decir, que el crecimiento en los programas de postgrado en las IES se da por el aumento del valor de la información y la innovación y no tanto por el impacto de las tics.

Palabras clave: *postgrados, teoría de los costos de transacción, teoría de la agencia, concesión educativa, privatización, TIC, educación e-learning, postgrados.*

Introducción

En la actualidad los programas de posgrados e-learning o a distancia ofertados por las instituciones de educación superior (IES), están pasando por una etapa crítica, consecuencia de las innovaciones e invenciones tecnológicas y por falta de una estructura flexible de información y comunicación, aunque, vivimos el inicio de una verdadera revolución tecnológica cuya característica principal que el conocimiento, producción, transmisión y sus efectos constituyen la principal fuente de valor agregado para la economía. Ello lo convierte

en el elemento central de la planeación y la evaluación en la educación, en cualquiera de sus niveles. Hopenhayn Martín, Ottone Ernesto, (2001).

La finalidad de los programas a distancia es formar hombres para la sociedad, es decir, formar seres humanos “en lo superior” y “para lo superior” desde el punto de vista personal y social. La educación entonces tiene por protagonista al hombre, a la persona con sus valores y potencialidades y al grupo social dentro de la cual vive y sobre la cual debe actuar para consolidarlo o transformarlo.

Por lo tanto, los programas virtuales deben ser concebidos como espacios para pensar la relación entre ciencia y desarrollo, generar conocimiento sobre la realidad del entorno, desarrollar la capacidad de convivencia y promover los procesos de transformación social. Igualmente, buscar la construcción de un pensamiento abierto para participar en una sociedad globalizada, el cual implica la capacidad para el encuentro intercultural y transcultural para trascender el tiempo y el espacio, acceder a información actualizada, participar e innovar en ambientes de aprendizaje mediados por las Tecnologías de la Información y la Comunicación (TIC) y para utilizar tales avances de manera creativa impactando los procesos de apropiación, recreación, producción e interacción de conocimiento.

Estas razones nos lleva a plantear estrategias que permitan cubrir los requerimientos de diversos grupos de población, utilizando todos los recursos nuevos y tradicionales para traspasar las barreras regionales, nacionales e internacionales que impone la distancia y la inequidad, aunque el problema de la exclusión no es algo que la educación pueda resolver de fondo, si es posible generar opciones de educación que atiendan las necesidades de aprendizaje de la población con desventajas económicas y sociales.

En la propuesta de esta ponencia se parte de la concepción constructivista del aprendizaje de ella, retomo las teorías de Piaget, Bruner, Vygotsky, y Ausubel la cual abordare algunos presupuestos tomados de estas teorías.

Se llevará a cabo unas acciones dialógicas con docentes, alumnos, como norma de acción académica y como principio de democracia participativa, la cual exige reconocer en la práctica la autonomía de los estudiantes para que asuman por sí mismo los procesos de aprendizaje y de formación integral.

La pedagogía dialógica incluye el paradigma de formación de una conciencia de autonomía de los alumnos en el aprender a aprender, a ser, a hacer, a convivir, a evaluar la realidad, a vislumbrar el futuro, a autoevaluarse críticamente para lograr un desarrollo personal integral, a procesar y seleccionar información a generar o transformar conocimiento, a expresar sentimientos, intereses y valores.

además, el eje del proceso de la educación a distancia (ED) es el auto aprendizaje; dada la relatividad del conocimiento y su rápida obsolescencia, se puede afirmar que las personas van a tener que estar aprendiendo permanentemente, teniendo en cuenta la movilidad profesional y el surgimiento de nuevos perfiles laborales. En consecuencia, se requiere

formar alumnos más flexibles y autónomos con habilidades para aprender, desaprender y reaprender, y dotados de la capacidad para transformar los conocimientos que reciben.

La metodología propia de la educación a distancia (ED) se orienta a ayudar al alumno a adquirir conocimientos, a aprender, a desarrollar competencias, actitudes y valores que lo habiliten para continuar aprendiendo en la sociedad del siglo XXI, sociedad del conocimiento y de la incertidumbre.

Por dichas razones, los posgrados universitarios virtuales o e-learning deben enfocarse desde la mirada de herramientas de las telecomunicaciones y la informática, las cuales poseen dimensión de tiempo sincrónico y asincrónico cubriendo geográficamente grandes distancias, propiedades que dan fuerza a los conceptos "virtual" y "virtualidad" los que a su vez dan cuenta de la recreación de funciones sustitutivas de tal o cual entorno. Chibas Ortiz, F. (2014). Al mismo tiempo, debe concebirse el concepto de gobernabilidad, la jerarquización y la gobernanza interna de los programas de posgrado virtuales en las IES y revisar costos ex ante y ex post. El primero hace referencia a los costos que se incurre en la búsqueda de información, diseño y negociación del contrato, mientras que los segundos están ligados al control del cumplimiento de los términos específicos en el contrato, incluyendo las cláusulas compromisorias en caso de litigios.

Más aun, se revisará algunas aplicaciones económicas haciendo una distinción entre la teoría de la agencia y los costos de transacción (CT) en el rol que desempeña las tecnologías de la información y la comunicación (TIC) en los programas de posgrado a distancia en las universidades colombianas con el propósito de buscar un mejoramiento del servicio educativo y su eficiencia.

Su objetivo es ofrecer posgrados e-learning a través de la IES centrado en el estudiante, que trasciendan, utilizando herramientas tecnológicas de forma que el alumno tenga ocasión de experimentar con procedimientos, contenidos, perspectivas docentes variadas y complementarias nuevas formas de gestionar conocimientos que coadyuven al desarrollo tecnológico del país o de su comunidad, al mismo tiempo, obtenga un progreso informático que le permita posicionarse dentro de un mercado competitivo y global.

Ciertamente, P.F. Drucker (1994) dice que la sociedad del conocimiento será más en todos los niveles, dado que el conocimiento es ahora universalmente accesible. En la lógica de Drucker, no existirán países pobres; sólo países incapaces de crear, adquirir y/o aplicar el conocimiento. En consecuencia, las personas necesitan una educación continua, capacidad de adaptación, buenas prácticas de trabajo y nuevos modelos de interacción al interior de las organizaciones.

De esta forma, podemos formular la siguiente pregunta. ¿Cuáles serán los roles que debe asumir las TIC en los posgrados universitarios analizados desde la perspectiva de los costos de transacción?

1. Marco Referencial de los Programas de Formación de E-Learning en IES.

1.1. Fundamentos Teóricos

La Sociedad del conocimiento está afectada por falta de incorporación de nuevas formas de aprender a apprehender y hacer, de manera autónoma e independiente que conlleve a los alumnos a obtener conocimientos sólidos y significativos mediante el uso de herramientas tales como Internet, la telecomunicación, la informática, la electrónica, impulsado fuertemente por la globalización de los mercados y por la globalización de la producción, por tal razón, la educación superior presencial y más aún, los programas e-learning, se encuentra inmerso dentro del mundo cibernético e intangible, en la que alumnos, profesores, personal administrativo se comunican a través de estos medios conformando redes virtuales, como el chat, WhatsApp, correo electrónico, teleconferencias, entre otros recursos tecnológicos.

Rama (2003), afirma que la “transformación de las industrias culturales sienta las bases de la sociedad de la información y de la transformación de la “fábrica educativa” a la educación descentralizada de una sociedad de acceso”. Cabero Almenara, J. (2012) retoma la propuesta de Dobrov de analizar el hecho educativo a distancia o virtual a partir de elementos identificados del hardware, del software y del orgware. Cejudo, M. D. C. L., & Cabero-Almenara, J. (2008), menciona que las publicaciones al menos en los congresos organizados por la asociación para el desarrollo de la tecnología educativa y de las nuevas tecnologías aplicadas a la educación (EDUTEK) abordan los cambios que han generado la introducción de las tecnologías en los procesos de aprendizaje, y que han posibilitado la creación de un nuevo espacio, es decir, enfatizan en los recursos educativos y no en los sistemas de gestión, lo cual permite a las instituciones de educación superior (IES) introducir nuevas reglas, roles y perfiles.

El constructo que identifica el tipo de educación virtual en la cual se comparte los posgrados a distancia toma como antecedente la IES en formato político-administrativo y formatos tecnológicos. Borrego, N., Rodríguez, H., Walle, R., & Ponce, J. (2008), el primero formato hace referencia a las categorías de virtualidad planteadas, y las segundas a las etapas de educación virtual para realizar una interpretación aproximada al orgware en cuanto a tipos de gestión que desarrolla la IES en la virtualidad.

Ortega Legazpi, A. (2014). Expresa que el acto instruccional debe girar en torno al estudiante y las estrategias adaptarse a las características psicológicas de los estudiantes para la participación activa de su proceso formativo. Carmen, J. M. C. M. y., & Celis, C. (2017), dice que los elementos integrantes de los medios, también presta atención al denominado orgware como el conjunto de medidas socioeconómicas, de organización y de gestión destinadas a asegurar la identificación y la utilización eficaz de una técnica y de conocimientos científicos-técnicos, así como la capacidad potencial del sistema tecnológico para adaptarse, desarrollarse y auto perfeccionarse.

Por su parte Beade Duarte, L. (2016). expresa que existe cuatro grupos de formatos tecnológicos que se aplican en los programas de posgrados e-learning, dado que la virtualidad no tienen una forma física, solo son controladas a través de conexiones en el ciberespacio, estos formatos son los siguientes: Tele intercambio: es el trabajo que realiza el estudiante en casa, son trabajos independientes donde el estudiante a través de las telecomunicaciones utiliza un terminal lejano para acceder al sistema y avanzar de manera autónoma e independiente en su aprendizaje.

Intercambio de lugar de estudio: (Universidad-casa-oficina) es un avance relacionado con el aula temporal, se basa en que los estudiantes no tienen necesidad de ir a la universidad, utilizan las instalaciones de su casa u oficina de trabajo y pueden mantenerse en contacto entre estudiante-estudiante, estudiante-docente, estudiante-universidad a través de las redes informáticas.

Equipos virtuales: son otra forma de organización virtual o remota adoptado por grupos o equipos de estudiantes que tienen un objetivo común pero cuya presencia no están físicamente juntos. Atención virtual: es un servicio que permite a los alumnos realizar diferentes solicitudes a través de la plataforma virtual (conexiones informáticas y de comunicación electrónica) reduciendo costos por desplazamiento, tiempo, seguridad.

Estos grupos de formatos permiten transacciones a la comunidad estudiantil a través de herramientas cuyo elemento posibilitan la virtualidad, ha sido analizado en educación a distancia por Testa, M. G. (2002), la cual afirma que los distintos programas educativos pueden diferenciarse según el grado existente de estructura (o la cantidad de control ejercida por el formador o la institución educativa) y diálogo (o la cantidad de control ejercido por el alumno).

Estos factores "estructura y dialogo" definen el campo virtual, a mayor estructura, se produce un aumento de la distancia, mientras que a mayor diálogo menor distancia. Por ende, se llama así a la operación que modifica el estado de un hecho educativo, sin que los elementos en sí mismos pierdan consistencia alguna, posible de realizar mediante los sistemas de realidad virtual.

La educación virtual es un modelo educativo cuyo diseño está definido por la incorporación de la gestión denominada transacción con nuevas formas organizativas y diferentes opciones de entrega de contenidos e interacción. Esta transformación conduce las universidades a distancia, a plantear seriamente un cambio en los recursos para la entrega de sus programas. Fernández, A. A. (2015). Dice que el concepto e-Learning (aprendizaje en línea), no debe entenderse como sinónimo de educación a distancia, sino como una de las formas que ésta puede adoptar en la práctica. Posteriormente, el mercado del aprendizaje en línea comenzó a generar otro concepto: el "campus virtual" el cual es frecuentemente mezclado con conceptos como universidad virtual, campus virtual o cursos en línea los cuáles se suele atribuir las mismas características de enseñanza.

Sangra (2001) citado por Osma, J. I. P., Molano, J. R., & Pinzón, D. F. (2015). Expresa que el término universidad virtual con campus virtual, debe englobar una noción sistémica de la universidad ofrecida a los estudiantes y a la comunidad docente e investigadora. Igualmente, identifica varios tipos de universidades virtuales con base en el tipo de oferta educativa: Universidad presencial la cual comúnmente introduce elementos de virtualidad en su dinámica educativa; universidad presencial con extensión universitaria virtual; espacios compartidos de cursos virtuales que ofrecen las universidades presenciales; universidad virtual adosada a la universidad tradicional; universidad virtual como organización virtual y espacios virtuales interuniversitarios comunes.

Dentro de la identificación de universidades encontramos instituciones de menor complejidad organizacional la cuales son más eficientes que las de mayor complejidad, pero, como expresa Misas (2003), esta conclusión es apresurada, porque la eficiencia de las IES no se mide por su capacidad para minimizar los costos, debido a que su modo de producción no es en cadena, donde la sustitución entre factores es mayor. En esa misma medida, aunque el gasto por alumno en Colombia sea inferior al promedio latinoamericano, algunas IES muestran una menor complejidad (predominio de la docencia sobre la investigación y la extensión). Un indicio de ello se encuentra en la baja inversión en ciencia y tecnología o en el número de doctores por cada millón de habitantes. Holm-Nielsen (2003) citado por Londoño, M. O., Canavire-Bacarreza, G., Bohórquez, S., & Cuartas, D. (2015).

Ciertamente, la educación superior es el determinante estructural de la creación y difusión del conocimiento, de la formación y consolidación del capital humano avanzado y de la generación de movilidad social, por tal razón, debe tomarse en cuenta los planteamientos de Piaget, Bruner, Vygotsky, y Ausubel con el fin de aplicar estos conocimientos y lograr un servicio eficaz y eficiente en los programas de posgrado virtual, debido a que estos conocimientos ayudan a direccionar estrategias educativas en pro del desarrollo y el crecimiento de nuestra población educativa.

Para la teoría del aprendizaje por descubrimiento, aprender es un proceso autónomo de descubrimiento personal, es un proceso activo de dialogo personal, así el sujeto de manera activa, autónoma y creadora se compromete consigo mismo en la tarea de aprender y crea las condiciones para lograrlo. (Piaget, J. 1981; Bruner, J. S. 2001).

Aprender también es un proceso de construcción social, de carácter dialógico, interactivo, inter e intra subjetivo. El estudiante aprende en la interacción con otros, aprende de los otros y con los otros, poniendo en juego la inteligencia práctica y la inteligencia reflexiva, haciendo y conceptualizando. La función docente es de guiar, estimular y potenciar la zona de desarrollo próximo y desarrollar el espíritu investigativo del estudiante poniendo de relieve el sentido histórico de la ciencia y promoviendo el método de resolución de problemas. Vygotsky, L. S. (1995).

La teoría del aprendizaje significativo propone que el estudiante aprende cuando los conocimientos son significativos para él, cuando pone en conexión los conocimientos previos

con los nuevos, cuando tiene oportunidad de organizar, relacionar y ensamblar o encadenar distintas ideas y puede transferir el conocimiento a situaciones y contextos diferentes. Ausubel, D. (1983).

1.2.- Perspectivas de los Costos de Transacción en los Programas Virtuales en las IES.

Tomando en consideración, las perspectivas de los costos de transacción en los programas de posgrado ineludiblemente se debe citar la teoría de la agencia de Jensen y Meckling que define la relación de agencia como un contrato social en la que en su estructura se pactan cláusulas entre los distintos sujetos intervinientes con base en el principio de la autonomía, la cual uno es el dominante o principal (rector IES) y el otro el agente (subordinado/profesor o empleado) acuerdan realizar un determinado servicio en su nombre, lo que implica cierto grado de delegación de autoridad en el agente, Jensen, M. C., & Meckling, W. H. (1976).

Igualmente, se debe tomar atenta nota de los trabajos de Ronald Coase y Oliver Williamson los cuales establecieron los cimientos del origen contractual desde la perspectiva diacrónica. (Coase, R. H. 1998, 2012, 2013; Williamson, O. E. 1979, 1991, 1996, 2013), Es decir, en la contratación se acuerda de manera explícita y eficiente las partes actuantes de lo acordado de manera de poder dirigir adecuadamente esta relación tomando como punto de partida las características de los agentes implicados y el hecho de que su entorno altamente dinámicos e inciertos y los costos de consecución de información, coadyuve a obtener un monitoreo eficiente del agente.

Por lo tanto, la teoría de agencia ofrece una adecuada explicación acerca de las relaciones de la institución con el exterior, estudiándola en el contexto global de la economía de mercado y sus correspondientes mecanismos de control externo y también internos (Álvarez et al., 2000; Pérez y Mozo, 1999; Camarero, 2002).

Al mismo tiempo, en esa relación de agencia, surgen algunos riesgos como es que el agente o empleado se comporte de manera diferente a lo deseado por el principal, y actué en función de sus propios intereses, hecho que resulta muy difícil para el empleador poder monitorearlo. Es decir, el empleador o principal no puede observar ex ante las acciones del agente, la cual es difícil formular previamente condiciones o estrategias al respecto a la hora de firmar el contrato, en otra palabra hay un riesgo moral (Holmstrom, 1979; Usategui, 1999; Gorbaneff, 2003; Tarzuján, 2003; Arévalo y Ojeda, 2004).

Más aún, el riesgo moral aparece como fruto de las asimetrías o fallas in-formativas precontractuales, es decir, cuando se contrata a un agente que no posee el perfil y las competencias profesionales adecuadas para asumir con eficiencia la responsabilidad que se le ha encomendado. Esta circunstancia ocurre cuando en una relación entre el principal y el agente, el primero puede observar el resultado de la organización ex post, pero desconoce el ex ante y su comportamiento y las características y competencias del segundo.

Por tal razón, estas fallas que se presentan sobre el futuro agente acarrearán contratos no eficientes para las expectativas y objetivos de las IES. Milgrom y Roberts, (1993).

Enfatizando, Los costos ex ante son costos que se incurren en la búsqueda de información, diseño y negociación del contrato, mientras que los costos ex post son aquellos ligados al control del cumplimiento de los términos específicos en el contrato incluyendo las cláusulas compromisorias en caso de un litigio.

O. Williamson considera que las estructuras de costos de “governance”, es decir costos de transacción internos deben ser descubiertos y diferenciados de los costos de coordinación. Estos costos de governance están influenciados por el ambiente institucional a nivel macro y por el individuo a nivel micro. Igualmente, se hace hincapié sobre la importancia del individuo “human actors” como la parte central de las IES. Oliver Williamson (1993).

Generalmente, cuando en un proceso académico actúan las dos partes el agente y el principal, y se involucra activos específicos se hace preciso establecer algún mecanismo de salvaguarda que impida a la parte que no ha invertido comportarse de forma oportunista aprovechando de la dependencia que la otra parte tiene hacia la transacción. En las relaciones con el mundo externo, tal protección sólo se puede lograr mediante el establecimiento de un contrato “lo más completo posible”, que además de tener altos costos de transacción asociados generalmente no impide la aparición de contingencias imprevistas que anulen el contrato inicial y requieran de otro sí, en el contrato.

Desde la teoría de la agencia (relación agente-principal), se establecen estrategias que reduzcan las ineficiencias provocadas por la existencia de información asimétrica entre las partes. Es así, que el principal careciendo de estrategias de control establece una relación contractual con el agente quien en su nombre debe desarrollar un proyecto o producir un bien o servicio mientras, que el agente cuenta con la posibilidad de actuar de modo oportunista reduciendo el nivel de esfuerzo o los costos necesarios para ejecutar la tarea. Por tal razón, el contrato debe ser diseñado con el fin de alinear los objetivos de las partes.

2.- Caso de Estudio

Una de las experiencias llevadas a cabo en una universidad privada en la ciudad de Manizales, se fundamenta en bases conceptuales de la corriente neo-institucionalista, enmarcada en modelos microeconómicos y neoliberales interpretados a luz de la teoría de la agencia.

La medición de los factores se realizó a través del análisis de datos, la relación principal-agente (P-A) se da por factores motivacionales externos e internos que por el factor salario. Los resultados muestran una mejora en la eficiencia de la institución.

Igualmente, se determina que los agentes tienen unos objetivos al ingreso y estos coinciden con la percepción que tienen los principales del porque ingresan a la IES, siendo representativo el crecimiento profesional, el salario y el reconocimiento. Las estrategias utilizadas por los principales para la evaluación y seguimiento a los agentes son reuniones de trabajo y acuerdos informales, los que se pueden verificar en el autocontrol que tienen en los equipos de trabajo.

El contrato con la IES permite que la relación P-A sea eficiente, porque el contrato de acuerdo con el principal es un mecanismo de control y para el agente un elemento que induce o hace que se cumplan los compromisos adquiridos en este, y de esta forma los objetivos tanto el principal como el agente se logran. Torres, T. M., Buitrago, M. T., Vélez, P. G., & Sánchez, J. H. P. (2014).

También, la aplicación de la teoría de la agencia evidencia el sistema de com-pensación e incentivos que ayuda a los agentes a motivarse y comprometerse con la institución mejorando las relaciones interpersonales y generando un clima organizacional sano (Ganga y Burotto, 2012). Por otra parte, se destaca la aplicación de la teoría de la agencia en la relación profesor-alumno dentro del aula, mejorando la calidad de la educación superior (Burgos y Cárcamo, 2010).

3.- Conclusiones

Las TIC son herramientas fundamentales en la evaluación de eficiencia y productividad en las IES, demandan niveles de calidad y excelencia en el accionar de la Sociedad y por ende los programas de posgrado e-learning deben cumplir su cometido como es la formación del capital humano, así como la investigación y la creación de conocimientos con el fin de coadyuvar al crecimiento y desarrollo económico de nuestro país.

La educación continua y la movilidad social son roles que debe cumplir las IES, al igual que los estándares de calidad que cada día son mayores y constituyen una espiral sistemática de mayores exigencias entre los mercados globales la cual las instituciones educativas y los sujetos intervinientes en ella deben desenvolverse con énfasis social para cumplir con su cometido en la Sociedad de consumo.

Cabe destacar que las actividades de creación de conocimiento son fundamentales para el progreso de los países debido a que contribuyen a un mejoramiento sistemático de las actividades de investigación, desarrollo e innovación en aquellas instituciones que consideren esta actividad dentro de su proyecto institucional.

Las IES para ser competitivas deben invertir en investigación, desarrollo e innovación, además si la institución dispone de una oferta de programas e-learning en lo posible mejorar su potencial de innovación tecnológica y, por ende, su capacidad de ancha de banda, recurso humano especializado para competir en los mercados globales y suplir necesidades globales que superen la simple extracción de información.

Las instituciones de educación superior deben constituirse en una fuente esencial de las oportunidades de formación continua y de movilidad social. Ciertamente, la rentabilidad privada de la educación superior universitaria es significativa y es probablemente una de las mejores inversiones que una persona puede realizar en la sociedad actual.

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Educación para el Desarrollo para la Ciudadanía Global: ¿currículum oculto del Aprendizaje-Servicio?

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Resumen

El sistema universitario se encuentra actualmente afectado por tres fenómenos que confluyen en la determinación de las prácticas docentes, estos son, entre otros: el propio proceso de adaptación al Espacio Europeo de Educación Superior, la corriente de la Responsabilidad Social Universitaria y el empuje de la Declaración de los Objetivos de Desarrollo Sostenible de Naciones Unidas.

En un contexto de absoluta incertidumbre sobre el futuro ejercicio profesional de los universitarios y de exigencia de capacidad de resolución de los problemas que atañen al planeta, la praxis concreta y local educativa está obligada a la consideración de reflexionar sobre estas condiciones con la finalidad de adoptar criterios coherentes y en sintonía a lo que el entorno demanda de la universidad, como currículum contextual.

Dado que la práctica docente concreta viene definida en el currículum de las asignaturas, en este trabajo se persigue analizar la aplicación del Aprendizaje-Servicio (ApS) como metodología que favorece, al margen de las competencias explícitas definidas en los proyectos docentes específicas de la asignatura, la adquisición de atributos actitudinales definidos por la Educación para el Desarrollo para la Ciudadanía Global (EDCG) en el marco del currículum oculto.

Al hilo de esta finalidad, los resultados de la presente comunicación exponen la valoración que han realizado los estudiantes respecto a la adquisición de atributos asociados a la EDCG, tras ejecutar un trabajo académico con el enfoque del ApS.

Palabras clave: Educación para el Desarrollo para la Ciudadanía Global, atributos actitudinales, Aprendizaje-Servicio, currículum oculto.

Introducción

Durante la celebración de INNODOCT16 los autores presentaron la comunicación con título “Estudio sobre la adquisición de los atributos actitudinales de la Educación para el Desarrollo para la Ciudadanía Global como resultado del Aprendizaje-Servicio”. En ella se presenta un análisis sobre la valoración que, los estudiantes de los cursos 2012-13 y 2013-14, expresan con relación a la adquisición de los atributos actitudinales que Boni propone dentro del enfoque educativo de la Educación para el Desarrollo para la Ciudadanía Global (EDCG).

Como ya se anunciara entonces, en el contexto de cambios docentes que experimenta la Universidad en estos últimos años, la finalidad del proyecto pedagógico que se impulsa con esta experiencia docente viene motivada por el interés de llevar a cabo una iniciativa de innovación docente, con la aspiración de buscar alternativas al modelo tradicional, que favorezca la adquisición de aprendizajes que supongan un impacto en la formación de los estudiantes.

En este sentido, se emprende, a lo largo de los años, diversas experiencias dotadas de un mismo eje vertebrador que es la indagación de estrategias que proporcionen al estudiantado el desarrollo de capacidades orientadas a la EDCG. La experiencia presentada en la pasada edición de INNODOCT se centra en desvelar, una vez finalizados los semestres académicos y careciendo de una búsqueda intencionada y consciente por parte de los destinatarios, cuáles son los atributos actitudinales que éstos identifican han experimentado durante el trabajo realizado en la asignatura cuya metodología docente aplicada se funde en el Aprendizaje-Servicio.

En el actual trabajo se persigue analizar los atributos actitudinales de la EDCG que, aquellos estudiantes, sumados a los que experimentaron el ApS en el presente curso 2016-17, con un enfoque distinto de trabajo pero con estrategias metodológicas similares, reconocen haber vivenciado. De esta manera se aspira a aportar evidencias sobre el potencial del ApS para impulsar aprendizajes para una ciudadanía global y de desarrollo humano. Se persigue con ello realizar un estudio longitudinal que permita profundizar en este conocimiento, a la vez que comprobar que las diversas formas de aplicar el ApS, favorece la adquisición de actitudes en coherencia con la EDCG.

1. La Experiencia de Aprendizaje-Servicio en Grado de Trabajo Social

Las experiencias que son objeto de atención aquí se caracterizan porque, de un lado, la primera experiencia se desarrolla durante años académicos 2012-13 y 2013-14; el proceso de trabajo seguido se apoya en la propuesta basada en un “Bloque Optativo de Actividades” (en adelante BOA) que incluye el Aprendizaje-Servicio (ApS). El BOA se oferta a los estudiantes de Grado de Trabajo Social de la Universidad de Las Palmas de Gran Canaria, en las asignaturas de Organización de los Servicios Sociales (1º curso, segundo semestre) y

Trabajo Social con Grupos (2º curso, segundo semestre)¹. De otro lado, la segunda experiencia se realiza en el año académico 2016-17; guiada por aprendizaje basado en un proyecto, en la asignatura Programas y Prestaciones de los Servicios Sociales (2º curso; primer semestre); como opción que voluntariamente escogieron los estudiantes, frente al modelo de trabajo grupal obligatorio convencional².

Se resume de lo anterior que uno de los criterios que favorecen el éxito de las experiencias del ApS es el carácter de “voluntariedad” que experimentan los estudiantes a la hora de decidir la realización de la experiencia. No obstante, decir que la forma de adoptar la decisión divergen, en tanto que la primera experiencia es individual, y la segunda es de los subgrupos de trabajo que conllevará a la adopción de una única decisión del gran grupo aula.

La experiencia de los dos primeros años se caracterizaba porque la decisión de escoger el ApS era individual (con opción de retrotraerse), y como alternativa a la modalidad de evaluación “examen”. Sin embargo, y atendiendo a los condicionantes del currículum institucional que determina la imposibilidad de incorporar este enfoque metodológico y de evaluación en el currículum ofrecido (esto es, en los proyectos docentes), se valora la posibilidad de que el ApS pueda ser puesto en práctica a través del trabajo grupal obligatorio que contempla el plan de estudios y, por consiguiente, la guía docente de la asignatura. En este sentido, los estudiantes asumen valorar y adoptar la decisión para posicionarse ante el proceso de aprendizaje alternativo. En esta ocasión, la decisión última de acogerse al ApS proviene de la decisión por mayoría de votos a favor proveniente de las decisiones de los 16 subgrupos de trabajo constituidos en el aula.

2. Marco Teórico

Se adopta en este trabajo la definición de ApS como “una forma de educación basada en la experiencia, en la que el aprendizaje se produce a través de un ciclo de acción y reflexión gracias al cual los estudiantes trabajan con otros compañeros en un proceso de aplicación de lo que han aprendido a los problemas de la comunidad y, al mismo tiempo, reflexionan sobre la experiencia de perseguir objetivos reales para la comunidad e incrementar su propia comprensión y destrezas, es decir, desarrollan de manera conexas las múltiples dimensiones humanas y cultivan la responsabilidad cívica y social” (Eyler & Gilers, 1999, citado en Francisco y Moliner, 2013:71).

¹ La experiencia del curso 2013-14 en Cano, A., Díaz, N. y G. D. (2013). *Aprendizaje-Servicio: una práctica docente que acerca a los estudiantes de Grado de Trabajo Social a la realidad social y profesional*. XII Congreso Estatal De Trabajo Social. Málaga.

² La experiencia del curso 2016-17 en Cano, A. y Cabrera, F (2017). *ApS y procesos de empoderamiento de los estudiantes a través de la organización de un evento: II Encuentro de Sensibilización sobre Realidades Sociales en la Universidad de Las Palmas de Gran Canaria*. VIII Congreso Nacional y III Internacional de Aprendizaje-Servicio Universitario. Sevilla.

Esta definición sostiene hilos de conexión con lo que viene a definirse como EDCG, al entenderse esto como aquella que “está dirigida a todas las comunidades del planeta, busca la participación y la transformación social en claves de justicia y solidaridad, para ello se propone como finalidad favorecer una ciudadanía informada, responsable, políticamente activa, con herramientas, estrategias y medios, con autonomía personal, crítica sobre la realidad mundial y local, generadora de una cultura de la solidaridad, comprometida tanto en la lucha contra la erradicación de la pobreza y la exclusión, como en la promoción del desarrollo humano justo, equitativo y sostenible, haciendo pleno el ejercicio de los derechos” (Cano-Ramírez, 2014:302).

Consideradas las definiciones ApS y de la EDCG, se desprende que sostienen una íntima relación en tanto que una se constituye en oportunidad pedagógica de la otra. La primera se ajusta a la inserción a la realidad con base a atender necesidades reales y concretas de la comunidad, mientras que la otra lo hace añadiendo a ello el espíritu crítico y transformador de esas realidades, que permita la promoción de la ciudadanía y la satisfacción de los derechos humanos. El matiz que sustancialmente añade la EDCG al ApS, es justo el que se acaba de señalar, esto es que se aleja de procesos de carácter asistencialistas, guiados por el gatopardismo. Cabe por tanto decir que, desde la perspectiva de la EDCG, todas las experiencias de ApS, no son asimilables al enfoque de la EDCG, en tanto que esta última aglutina y requiere de la adquisición de un conjunto de atributos que desarrollan las capacidades de las personas atendiendo a conocimientos sobre la realidad (saber), habilidades/destrezas (saber hacer) y actitudinales (saber ser).

Dicho esto, este trabajo pretende evidenciar en qué medida, el ApS contribuye a aprendizajes desde el enfoque de la EDCG, al identificar la adquisición de los atributos actitudinales que esta plantea, en el marco del currículum oculto.

Hablar de currículum oculto, es referir a aquel que refiere a los aprendizajes que adquieren los estudiantes sin que éstos sean objeto intencionado ni consciente del currículum institucional (marco normativo) ni del currículum ofrecido (guías docentes). De alguna manera, el currículum oculto se aproxima más al “currículum asimilado” en tanto que refiere a lo que realmente los estudiantes finalmente aprenden (Zabalza, 2003: 32-33; Álvarez Méndez, 2009: 208; Acaso, 2012: 45).

Así, los atributos actitudinales que se propone la EDCG, sobre los que este estudio se desarrolla, son: 1. Conciencia crítica; actitud investigadora y no conformista; 2. Empatía: sensibilidad hacia los sentimientos, necesidades y vidas de otras personas en el mundo; sentido de una humanidad común, de necesidades comunes y derechos; 3. Identidad y autoestima: sentimiento de la propia valía e individualidad; 4. Voluntad de vivir con las diferencias y de resolver conflictos de manera no violenta; 5. Compromiso con la justicia social y la equidad: interés y preocupación por los temas globales. Compromiso con la justicia y disposición para trabajar para un mundo más justo; 6. Respeto y reconocimiento por el medio ambiente y la vida dentro de él. Voluntad de considerar las futuras generaciones

y actuar de manera responsable; 7. Sentido de la eficacia y de que se puede tener un impacto en la vida de los demás. Optimismo hacia la transformación social (Boni et. al., 2013).

3. Metodología

Como ya se ha dicho, la finalidad del trabajo es demostrar si la puesta en práctica de metodologías docentes basadas en el ApS, permiten el aprendizaje de los atributos actitudinales que definen a la EDCG. La hipótesis de trabajo es que el ApS es una metodología docente que contribuye a la adquisición de los aprendizajes de las actitudes que la EDCG propone.

El proceso del trabajo de indagación que se realiza consiste en la elaboración del cuestionario, recogida de datos, transcripción de la información al programa excel, presentación de resultados, análisis de los datos obtenidos y elaboración de conclusiones.

El instrumento de recogida de datos es la encuesta, con tipo de pregunta cerrada (¿cuál de las siguientes actitudes se adquiere con la experiencia Aps?), con opción de respuesta dicotómica (“sí” o “no”).

4. Resultados y Análisis

Datos obtenidos de las valoraciones que los estudiantes realizan sobre la adquisición de atributos actitudinales de la EDCG como consecuencia del ApS.

Los resultados y análisis que se presentan se ordena con base a identificar como “primera” experiencia la que se vive en los dos años académicos 2012-13 y 2013-14 por tratarse de un similar proceso de trabajo, mientras que se identifica como “segunda” experiencia a la celebrada en el año 2016-17.

El cuestionario de evaluación final que cumplimentan los estudiantes que realizan ApS, permite obtener datos respecto a la valoración que éstos hacen sobre la contribución de esta metodología respecto a los atributos actitudinales de la ciudadanía global.

De la primera experiencia, de 202 encuestas recogidas (esto es el 69% de los estudiantes que hicieron el ApS), se obtuvieron 129 respuestas a la sección del cuestionario que contempla los atributos actitudinales (lo que equivale a un 63% de las encuestas respondidas). En la segunda experiencia se recogieron 52 encuestas y todas (100%) respondieron a la sección. Con ello se obtiene un total de 181 encuestas.

Tabla 1. Número de encuestas respondidas por grupo de estudiantes

GRUPOS DE ESTUDIANTES	Nº de encuestas recogidas / Nº encuestas con la sección atributos actitudinales respondida		
	CURSO 2012-13	CURSO 2013-14	CURSO 2016-17
1 grupo de primer curso	68 / 39	38 / --	--
1 grupo de segundo curso	71 / 65	25 / 25	52 / 52
Total	139 / 104 100% / 75%	63 / 25 100% / 40%	52 / 52 100% / 100%

Fuente: Elaboración propia.

De la experiencia de los cursos 2012-14, las respuestas obtenidas y siguiendo el orden de mayor elección a menor elección de cada atributo actitudinal (Fig. 1), señalan que tanto “la empatía: sensibilidad hacia los sentimientos, necesidades y vidas de otras personas en el mundo; sentido de una humanidad común, de necesidades comunes y derechos” (atributo 2), como el “sentido de la eficacia y de que se puede tener un impacto en la vida de los demás. Optimismo hacia la transformación social” (atributo 7), son las actitudes más trabajadas y adquiridas a través de la experiencia del ApS, siendo escogidas por el 96,9 % de todos los estudiantes que dieron respuesta a la encuesta.

Los atributos actitudinales que escoge un 86,8% y un 86 % de los estudiantes, son la “identidad y autoestima: sentimiento de la propia valía e individualidad” (atributo 3) y la “voluntad de vivir con las diferencias y de resolver conflictos de manera no violenta” (atributo 4), respectivamente.

Siguiendo en el orden se tiene que un 83,7% de los estudiantes identifican que el ApS les permite desarrollar su “compromiso con la justicia social y la equidad: interés y preocupación por los temas globales. Compromiso con la justicia y disposición para trabajar para un mundo más justo” (atributo 6).

Le sigue el despertar de la “conciencia crítica; actitud investigadora y no conformista” (atributo 5), con un 81,4% del total de las respuestas que escogen esta actitud.

En último lugar, y con distancia en comparación a los anteriores atributos actitudinales seleccionados por los estudiantes, se encuentra el “respeto y reconocimiento por el medio ambiente y la vida dentro de él. Voluntad de considerar las futuras generaciones y actuar de manera responsable” (atributo 1), con un 50,4 %.



Figura 1. Porcentajes atributos actitudinales 2012-2014

De la experiencia de los cursos 2016-17 se obtuvo 52 encuestas (100%) (Fig. 2). Los estudiantes de la segunda experiencia manifiestan un elevado grado de acuerdo con un 94.2 % de respuestas obtenidas, en que aquella les ha permitido desarrollar actitudes relacionadas con la “empatía: sensibilidad hacia los sentimientos, necesidades y vidas de otras personas en el mundo; sentido de una humanidad común, de necesidades comunes y derechos” (atributo 2); y el “sentido de la eficacia y de que se puede tener un impacto en la vida de los demás. Optimismo hacia la transformación social” (atributo 7).

A continuación, y también con porcentajes elevados se tiene que desarrollan el “conciencia crítica, actitud investigadora y no conformista” (atributo 5) con un 90,4 %.

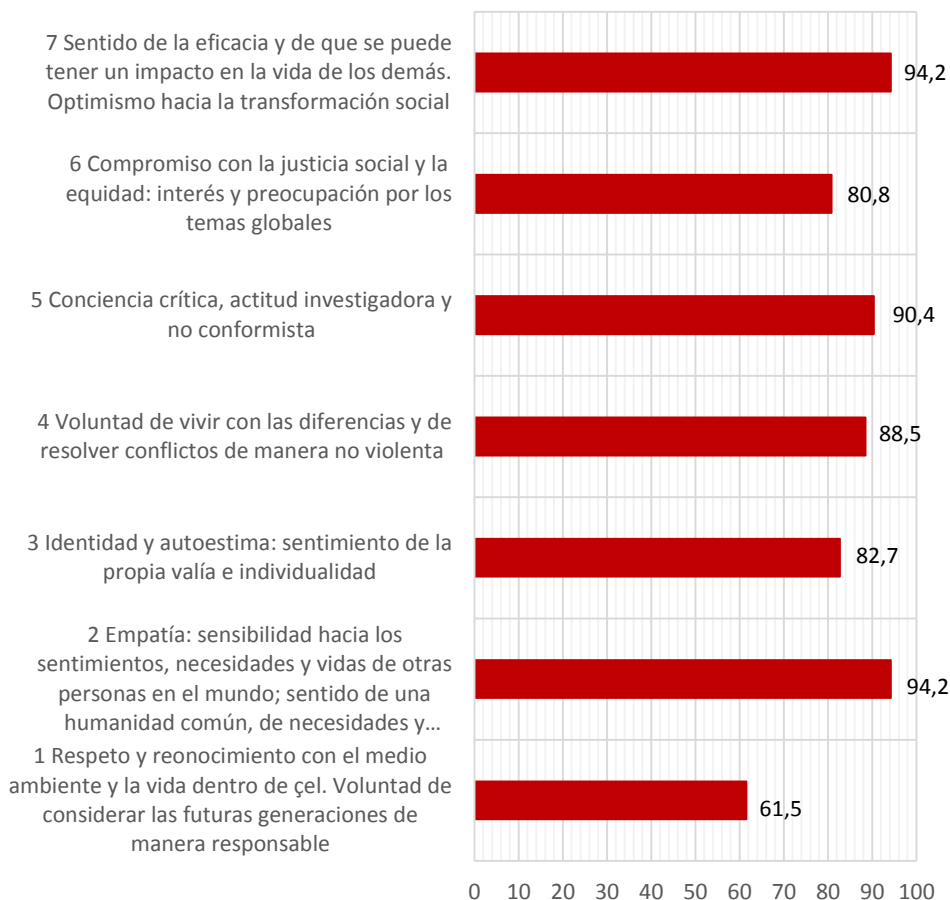


Figura 2. Porcentajes atributos actitudinales 2016-2017

Los atributos 4 (“voluntad de vivir con las diferencias y de resolver conflictos de manera no violenta”), el 3 (“identidad y autoestima: sentimiento de la propia valía e individualidad) y el 6 (“compromiso con la justicia social y la equidad: interés y preocupación por los temas globales. Compromiso con la justicia y disposición para trabajar para un mundo más justo”) con un 88.5 %, un 82,7 % y un 80,8 % respectivamente, son los que también son valorados de manera destacada por el alumnado, quedando por encima del 80 %.

En último lugar y con cierta distancia se encuentra el atributo 1, referido al “respeto y reconocimiento por el medio ambiente y la vida dentro de él. Voluntad de considerar las futuras generaciones y actuar de manera responsable”, con un 61,5 %.

En cualquiera de los casos, todos son valorados por más de la mitad de los estudiantes, siendo algunos muy cerca de la totalidad.

Realizando un análisis de los datos sumando ambas experiencias (Fig. 3), se desprende que el atributo 2, esto es el desarrollo de la “empatía: sensibilidad hacia los sentimientos, necesidades y vidas de otras personas en el mundo; sentido de una humanidad común, de necesidades comunes y derechos”, y el atributo 7, que refiere al “sentido de la eficacia y que se puede tener un impacto en la vida de los demás. Optimismo hacia la transformación social.”son los más valorados por los 181 estudiantes que respondieron la encuesta con un 92,4%.

Se constata que el atributo 1 es el que valoran como el que menor aprendizaje han desarrollado, ocupando puestos intermedios los atributos 3, 4 y 6 con un 82,3%, 88,5% y 80,8% respectivamente.

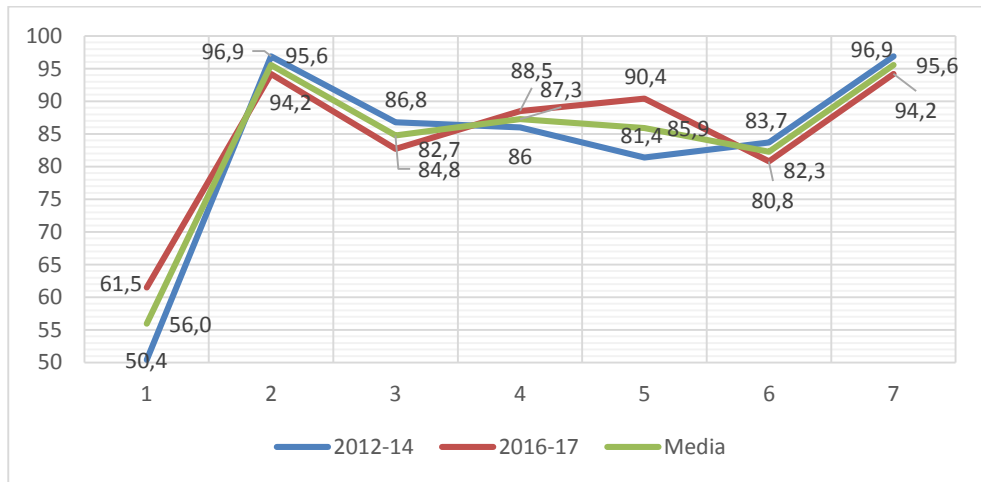


Figura 3. Media porcentual resultados obtenidos en 2012-2014 y 2016-2017

5. Conclusiones

Se puede afirmar que en ambas experiencias reciben una misma proporción de valor porcentual de los atributos actitudinales.

Se constata que el atributo 1 “respeto y reconocimiento por el medio ambiente y la vida dentro de él. Voluntad de considerar las futuras generaciones de manera responsable”, es el que valoran como el que menor aprendizaje han desarrollado. Este aprendizaje es esencial en los procesos de EDCG, en tanto que es necesario que el alumnado adopte una relación respetuosa con su entorno natural, como ejercicio de su responsabilidad social. Se hace necesario analizar qué y cómo se está abordando estas experiencias de ApS para poder introducir elementos que favorezcan su adquisición.

Los atributos 2 y 7 son los que mayor desarrollo de aprendizajes se valora (“empatía: sensibilidad hacia los sentimientos, necesidades y vidas de otras personas en el mundo; sentido de una humanidad común, de necesidades comunes y derechos”; y el “sentido de la

eficacia y de que se puede tener un impacto en la vida de los demás. Optimismo hacia la transformación social.”, respectivamente). Estos dos atributos protagonizan un papel relevante en una EDCG en tanto que posiciona al alumnado en una sensibilidad y empatía con las realidades, y en una actitud positiva para que estime que puede hacer algo que permita cambiarlas y mejorarlas

En conclusión, y como resultado global, se evidencia que los formatos de experiencia ApS llevados a cabo permite la adquisición de los atributos actitudinales que Boni propone para la EDCG, vertebrándose en el seno del currículum oculto.

Con ello se constata que los atributos actitudinales reseñados son factibles de adquirirlos por el alumnado cuando se combina una estrategia metodológica del ApS con enfoque de EDCG, incluso cuando, a priori, no son conscientemente buscados.

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De la monodisciplinarietà a la transdisciplinarietà. La complejidad como encuadre metodològico para Investigaciones Educativas

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Abstract

The theoretical approach of different research practices today, is framed in a dynamic and complex environment, that demands greater visions and worldviews to analyse and understand contemporary educational phenomena. Hence the individual becomes an actor, promoter, spectator or co-creator of his surrounding social reality. Therefore, current Educational Systems demand holistic proposals with systemic approach, that bring together the efforts of all the members of a department, area, institution or set of organisms, so that, in an articulated way, so that the professional formation of different profiles and / or disciplines, as well as the resources of each subsystem, the potentialities, characteristics and circumstances of the totality of the construct, contribute to the knowledge of the field, involving experience and tacit knowledge to provoke a synergistic effect that disrupts the mental structures of researchers and decision makers of the education sector, in order to understand and properly conduct the subsystems, systems and macro systems that encompass educational work.

The present work is the result of an exploratory and applied research where the impedance and challenges of the educational sector, work in a transdisciplinary way for the development of educative investigations. The methodological approach is raised in the case study of Institutions of Higher and Higher Education in Mexico

who, from a theoretical perspective, are analyzed in their disciplinary, multidisciplinary, interdisciplinary and transdisciplinary research practices

Keywords: *Complexity, Transdisciplinarity, Research in Education.*

Resumen

El abordaje teórico de diferentes prácticas de investigación en la actualidad, se enmarca en un entorno dinámico y complejo que demanda de mayores visiones y cosmovisiones de análisis y comprensión de la fenomenología educativa contemporánea, donde el individuo se convierte en actor, promotor, espectador o cocreador de la realidad social en la que se desenvuelve. En este entendido, los Sistemas Educativos demandan de propuestas holísticas de enfoque sistémico, que aglutinen los esfuerzos de todos los integrantes de un departamento, área, institución o conjunto de organismos, para que, de forma articulada, la formación profesional de distintos perfiles y/o disciplinas, los recursos de cada subsistema, las potencialidades, características y circunstancias del total del constructo, que aporte los conocimientos de su campo, así como su experiencia y conocimientos tácitos para provocar un efecto sinérgico que trastoque las estructuras mentales de investigadores y tomadores de decisiones del sector educativo, a fin de comprender y conducir apropiadamente los subsistemas, sistemas y macrosistemas que engloba la labor educativa.

El presente trabajo es resultado de una investigación de tipo exploratoria y aplicada donde se parte de la impedancia y retos que implica que diversos integrantes del sector educativo trabajen transdisciplinariamente para el desarrollo de investigaciones educativas. El abordaje metodológico se plantea en el estudio de caso de Instituciones de Educación Media Superior y Superior mexicanas que, desde una perspectiva teórica, son analizadas en sus prácticas de investigación disciplinar, multidisciplinar, interdisciplinar y transdisciplinar.

Palabras clave: *complejidad, transdisciplinariedad, Investigación en Educación*

Introducción

Actualmente los cambios son tan vertiginosos, rápidos y fluidos que corresponden a una “modernidad líquida” caracterizada por un constante, imparable y acelerado estado de transformación, modificación y al mismo tiempo ausencias de compromiso, debido a que esto implica responsabilidad y represente estar atado a un lugar, (*Bauman, 2002*) esto impacta

inclusive en la educación, la cual es considerada como algo que se puede consumir y desechar; que no es para siempre, pues es resultado de la modernidad líquida y que tiene como ingredientes esenciales la cultura y la educación.

La educación, misma que enfrenta retos ante esta modernidad líquida entre ellos el síndrome de la impaciencia, lo que en la educación se traduce como, una creciente tendencia a considerarla como un producto antes que como un proceso, implica estar al pendiente de las tendencias, o bien como algo que se usa, se desecha y requiere actualizar; el cambio contemporáneo involucra la relevancia del tema según el momento para ser consumido por única vez. Esto genera desafíos a todos los actores inmersos en la educación, entre ellos el vivir en un mundo sobresaturado de información, lo que representa un constante dinamismo y complejidad (*Bauman, 2008*).

Ante esta complejidad, abordada desde distintas disciplinas y conformada como cuerpo sólido de conocimientos en la llamada teoría del caos, principalmente en los sistemas complejos definidos como colecciones de unidades en constante interacción que generan nuevas propiedades también llamadas emergencias. De este modo, la educación como sistema adaptativo complejo, no es ajena a este fenómeno y presenta como vía para la comprensión de tal complejidad, una visión holística (*Martínez M. , 2012*). Tal visión deriva del término holón para referir a aquello que, siendo una totalidad en un contexto, es simultáneamente una parte de otro contexto, y que fue propuesto por Arthur Koestler (*Wilber, 2013*) fundamento en la teoría de las totalidades u holismo.

El enfoque holístico implica una visión multidimensional, que lleva a entretrejer diversas variables que interactúan entre sí, (*Gluyas, Esparza, Romero, & Rubio, 2015*) es decir mediante el enfoque sistémico, puesto que sistema se puede definir como el conjunto de elementos que interactúan entre sí para lograr un fin, o como Ackoff puntualizó, un sistema es más que un simple concepto. Es una forma de vida intelectual, una visión del mundo, un concepto acerca de la naturaleza de la realidad de como investigarla- un *Weltanschauung*, (*Ackoff, 2007*) es decir, lo que requiere una nueva visión y cosmovisión mediante una integralidad no solo de saberes, sino de actores inmersos en el proceso de enseñanza – aprendizaje.

1. Desarrollo

1.1 Marco teórico. Integralidad desde la monodisciplinariedad a la transdisciplinariedad

Los pilares de la educación según la Comisión Internacional sobre la Educación y la Cultura (UNESCO), son: aprender a conocer, lo que implica conocimientos disciplinares; aprender a hacer es decir, el desarrollo de habilidades que demuestran la aplicación de los conocimientos disciplinares; aprender a vivir juntos o a vivir con los demás, esto involucra la actitud para afrontar las adversidades y retos que se presentan en la vida y, aprender a ser, o sea el desarrollo

y fomento de valores (UNESCO, 1998). Lo anterior incluye una formación integral del estudiante, e independientemente de su área disciplinar, se reconoce que el estudiante es la razón de ser y existir de toda institución educativa y en él se centran todos los esfuerzos para formar a una persona competente, que cuente con un conjunto de conocimientos, habilidades, actitudes y valores. Es decir, atender estos pilares de la educación. Sin embargo, es menester precisar que esto requiere identificar y reconocer a cada uno de los actores, promotores y cocreadores de este proceso, además de los directivos y personal de apoyo, es esencial el docente pues es el principal agente de cambio y el que debe de tener y fomentar esta formación integral.

Para el logro de esta formación integral se debe reconocer que en el campo académico está presente la fragmentación del saber en múltiples disciplinas (Martínez M., 2011) lo que al vincularse con procesos de investigación, implica a lo largo del desarrollo de este, diferentes niveles que van desde la monodisciplinariedad, multidisciplinariedad, interdisciplinariedad, hasta la transdisciplinariedad, como se puede observar en la primer columna de la tabla 1, seguida con las columnas que describen la naturaleza de la integración, el proceso, en énfasis y en caso de presentarse, lo que se descuida en cada nivel de investigación, resaltando que en los últimos dos niveles de investigación no se identifican estas áreas de oportunidad, partiendo de lo simple entendido como monodisciplinariedad a lo complejo o transdisciplinar, definiendo este como un conocimiento superior emergente, fruto de un movimiento dialéctico de retro y pro alimentación del pensamiento, que permite crear imágenes de la realidad más complejas, más integradas y por ende más verdaderas (Martínez M., 2015).

Tabla 1. Niveles de investigación de la monodisciplinariedad a la transdisciplinariedad

Investigación	Naturaleza de la integración	Proceso	Enfatiza	Descuida
Monodisciplinaria	Una sola disciplina. Levada a cabo por 1 o varios investigadores que comparten un determinado paradigma científico	Hiperespecialización Reduccionista Ignora la complejidad de las realidades	La comprensión o profundidad a expensa de la extensión	Nexos y relación con el todo
Multidisciplinaria	Diferentes investigadores colaborando en un proyecto en común Diversas disciplinas y cada uno son independientemente en su trabajo, no se necesita conocer el trabajo de los demás.	Existe un director o coordinador del proyecto, el cual planea y asigna tareas a cada integrante, supervisa el avance sin ingerir en la misma	La integración precede a los resultados con una introducción y una integración de términos y conceptos	Explicaciones integrales, estas se hacen a partir de cada disciplina que conforma el proyecto
Interdisciplinaria	Diversas disciplinas integran terminología, conceptos y resultados Integración sistémica, la autoría compartida es norma	Integración desde unas mismas bases epistemológicas, en el proceso y en el plan de acción. Cada miembro toma en cuenta los procedimientos y trabajo de los otros de acuerdo con una meta común de la investigación	La coordinación, la comunicación, el dialogo y el intercambio, para traducir en términos propios y aclarar lenguajes ambiguos y	
Transdisciplinaria	Añade el hecho de que está constituida por una completa integración teórica u práctica Un ideal muy escasamente alcanzado a	Los participantes trascienden las propias disciplinas, logrando u nuevo mapa cognitivo	Compartir un marco epistémico amplio y una cierta meta- metodología que sirve para integrar conceptualmente las diferentes orientaciones de sus análisis	

Fuente: Martínez, M. (2015)

Otra manera de definir la transdisciplinar como la forma de conocimiento integral o sistémico que vincula el conocimiento interdisciplinario de expertos teóricos, con el conocimiento empírico o tácito de expertos prácticos y sus visiones del mundo o valores (*Peón & Aceves, 2013*). Lo anterior se puede apreciar de manera esquemática en la figura 1.



Figura 1. Trandisciplinariedad. Fuente: Peón, I.E. (2017)

1.2 Marco contextual. Las Instituciones de Educación Media Superior y Superior en México

En México la Secretaría de Educación Pública es el ente que se encarga de coordinar, y desarrollar todo lo relacionado con la educación como lo son las Instituciones de Educación, tanto en las de nivel Media Superior (IEMS) como en la Educación Superior (IES), a fin de aplicar una visión holística, mediante un diagrama de Venn, del sistema educativo mexicano en la figura 2. En este diagrama se puede observar que en el penúltimo nivel se encuentran los Subsistemas Educativos. En ellos se enmarca la Educación Media Superior (EMS) y la Educación Superior (ES), ambas reguladas desde el artículo tercero constitucional, donde se menciona que “La educación preescolar, primaria y secundaria conforman la educación básica; ésta y la media superior serán obligatorias“ (Const., 1917, art.3) y por ello se reconocen tres niveles de educación: Básica, Media Superior y Superior. Para efectos de este análisis, la investigación se centra en estas dos últimas y, por Educación Media Superior, se comprende el nivel de bachillerato, así como los demás niveles equivalentes a éste, y la educación profesional que no requiere bachillerato o sus equivalentes. La Educación Superior es entendida como la que se imparte después del bachillerato o de sus equivalentes. Está compuesta por la licenciatura, la especialidad, la maestría y el doctorado, así como por opciones terminales previas a la conclusión de la licenciatura, como los

estudios de Técnico Superior Universitario o el Profesional Asociado. Comprende la educación normal en todos sus niveles y especialidades. (Secretaría de Educación Pública, 2017).

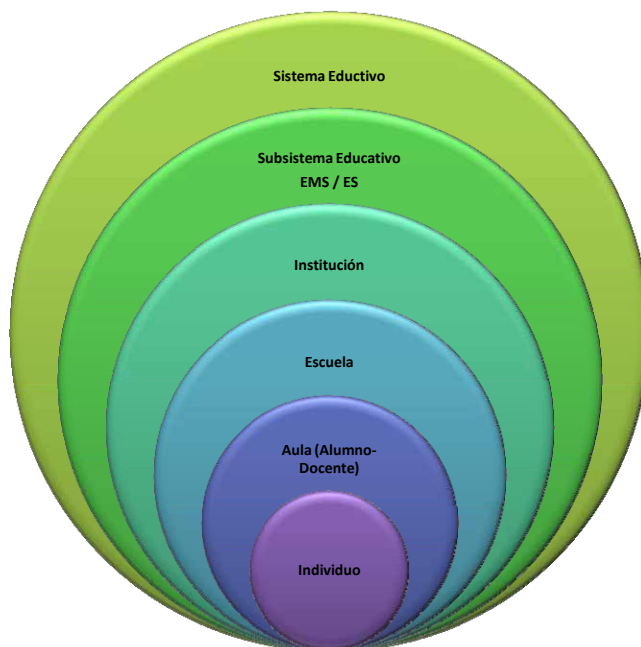


Figura 2. Visión Holística de la Sistema Educativo Mexicano. Fuente: Licona, J. Ortega, O. (2017)

También es pertinente precisar que al respecto de la Educación Superior en México, en el artículo 3 constitucional en la fracción VII menciona que “Las universidades y las demás instituciones de educación superior a las que la ley otorgue autonomía, tendrán la facultad y la responsabilidad de gobernarse a sí mismas; realizarán sus fines de educar, investigar y difundir la cultura de acuerdo con los principios de este artículo, respetando la libertad de cátedra e investigación y de libre examen y discusión de las ideas; determinarán sus planes y programas; fijarán los términos de ingreso, promoción y permanencia de su personal académico; y administrarán su patrimonio“. (Const., 1917, art. 3, fracc. VII)

En cuanto a la conformación o dimensión estructural tanto la Educación Superior como la Media Superior consideran diferentes subsistemas, si bien es cierto que un gran número de las IES pertenecen a subsistemas de orden federal, muchas de las entidades federativas también ofrecen bachillerato y, cada una desarrolla su propio modelo educativo, esto puede dar un referente de la complejidad de factores o variables que se pueden encontrar en cada nivel de educación. Aunado

a lo anterior y a manera de compendio, la contextualización de estos niveles educativos identificando las diferencias y similitudes de la Educación Superior y Media Superior, se pueden observar en la tabla 2.

Tabla 2. Diferencias y Similitudes de la IES / IEMS Mexicanas

Nivel Educativo	Diferencias	Similitudes
<i>Media Superior</i>	<ul style="list-style-type: none"> ● Se considera como educación obligatoria ● Los estudiantes en edad de cursar es de 15 a 18 años ● En 2008 inicio la implementación de la Reforma Integral de Educación Media Superior (RIEMS) ● La RIEMS tiene como objetivo la creación del Sistema Nacional de Bachillerato (SNB) ● Los planteles son evaluados por el Consejo para la Evaluación de la Educación del Tipo Medio Superior A.C.(COPEEMS) y si cumplen se pertenece al SNB ● La RIEMS se basa en el Marco Curricular Común (MCC), en el marco de la diversidad ● Se desarrollar Perfil de egreso basado en competencias genéricas, disciplinares y específicas ● Perfil docente basado en competencias que profesionaliza a los docentes mediante el (Programa de formación de docentes de Educación Media Superior) PROFORDEMS ● Regulada por la Leyes Federales Vigentes de : Ley General de Educación, Ley del Instituto Nacional para la Evaluación de la Educación, Ley General de la Infraestructura Física Educativa y Ley General del Servicio Profesional Docente 	<ul style="list-style-type: none"> ● Diversidad de Subsistemas Educativos ● Especialización y formación disciplinar de los docentes pero no didáctica pedagógica ● El alumno es la razón de ser y existir de la Institución ● El docente se considera el principal agente de cambio
<i>Superior</i>	<ul style="list-style-type: none"> ● Estudiantes en edad de cursar de 18 a 24 años ● Debe de cumplir con indicadores de calidad como que los docentes pertenezcan al Sistema Nacional de Investigadores (SNI) o Programa para el Desarrollo Profesional Docente, para el Tipo Superior (PRODEP) ● Que los posgrados pertenezcan al Programa Nacional de Posgrados de Calidad (PNPC) ● Acreditación de programas educativos con los organismos evaluadores a nivel nacional ● Perfil de Egreso y Perfil de ingreso preestablecido por cada IES ● Cada IES desarrolla su Modelo Educativo ● Los estudiantes deben de tener para ingresar un nivel de bachillerato ● Los regulan la Ley para la Coordinación de la Educación Superior y además cada IES determina y desarrolla su propia normatividad 	

Fuente: Licona, J. Ortega, O. (2017).

Para la determinación de la ejecución de la transdisciplinariedad tanto en las Instituciones de Educación Superior (IES), e Instituciones de Educación Media Superior (IEMS) se identificaron los principales actores que intervienen. Independientemente del nivel educativo como se mencionó anteriormente, se reconoce que el más importante de todos, por ser la razón de ser y de existir de este tipo de organizaciones es el alumnado, en el cual se pretende lograr una formación integral y se menciona que el principal agente de cambio es el docente. Además se identifica la necesidad e importancia de la profesionalización docente y de los directivos como otro de los actores de la tanto de las IES, siendo necesario considerar a las personas o áreas de apoyo en las que sobresalen los coordinadores o responsables de los diversos programas educativos, tutores (académicos y/o personales), trabajadores sociales, personas encargadas de actividades como la vinculación, comunicación, becas, y demás personal o áreas que para cuestiones de este trabajo, se denomina personal directivo de mandos medios, y a los que apoya en la operatividad como intendentes, secretarías, vigilantes -entre otros dependientes de la estructura del plantel- se denomina, personal de apoyo. Todos los anteriores pertenecen a actores internos (Licona & Ortega,2017)

Sin embargo, es pertinente mencionar que los padres y madres de familia o tutores son actores externos a la IES pero generalmente se involucran de manera pasiva y en el menor y mejor de los casos, activamente cuando la situación académica implica algún riesgo de abandono de los estudios o casos extremos de salud que puedan desencadenar, propiciar o generar algún tipo o modo de violencia. Por ello se considera en el esquema de la IES que es la figura 3.

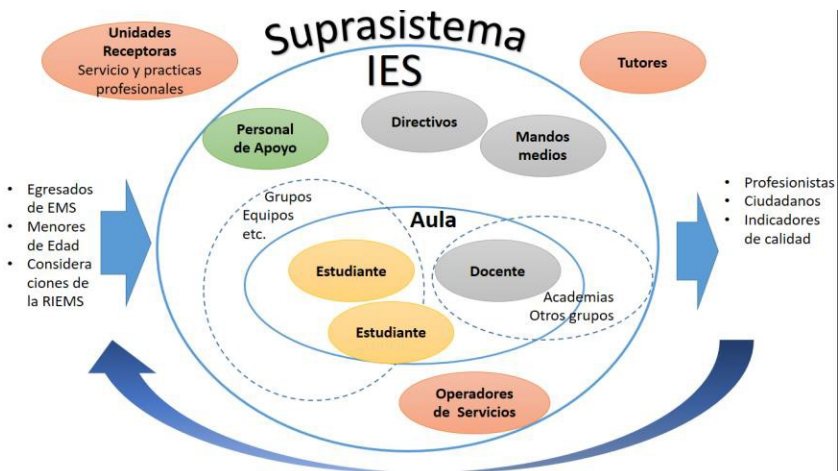


Figura 3. Modelo de una Institución de Educación Superior. Fuente: Licona, J. Ortega, O. (2017).

1.3 Aproximaciones teóricas a la medición de la transdisciplinariedad

A manera de análisis gráfico, el esquema anterior muestra una relación directa entre las IES y las IEMS, puesto que los egresados de educación media superior son los que ingresan a nivel superior. Es pertinente mencionar que en 2008 se inició la Reforma de Educación Media Superior (RIEMS), la cual reconoció la necesidad de profesionalizar a los docentes, en el entendido de que la mayoría de ellos, poseen formación disciplinar pero no didáctica-pedagógica. Asimismo, la profesionalización de directivos apela al trabajo integral y multi y transdisciplinario; sin embargo se reconoce que las reformas o documentos no materializan los cambios como una realidad palpable. También a nivel superior el discurso versa en una formación integral donde todos los actores deben participar de manera activa, pero en la realidad esto implica romper en muchos casos los paradigmas y malas prácticas del trabajo en equipo. Ello no solo se aprecia en lo académico, sino también en la investigación y en el desarrollo de nuevas visiones o emergencias, pues los medios para avalar las metodologías y/o resultados de las mismas, son las propuestas de expertos disciplinares que establecen mecanismos rígidos y monodisciplinares que, para lograr la transdisciplinariedad, requieren desarrollos complementarios que fomenten la misma. Así, para que estas no sean solo simples visiones basadas en la experiencia, se observa la necesidad de evaluar si se está trabajando de manera transdisciplinar, por ello es que en esta primera fase de la investigación se realizó una búsqueda sobre instrumentos que a manera de termómetro nos permitan realizar esta evaluación.

A partir de este encuadre teórico contextual, fue posible mediante una revisión de la literatura, la selección del instrumento para evaluar el grado de transversalidad que se aplica en las IES e IEMS, el cual es una adecuación de una serie de preguntas propuestas por Julie Thompson en su artículo titulado “*Transdisciplinariedad: Discurso, Integración y Evaluación*”, que originalmente consta de 47 preguntas divididas en 5 categorías que consideran las etapas del ciclo de vida de un proyecto que a saber son:

- A. Fase Inicial,
- B. Marco Organizacional y Conceptual,
- C. Aprendizaje y Comunicación Social,
- D. Colaboración e interpretación y
- E. Evaluación, Innovación y Diseminación.

Así, esta investigación considera aplicar este instrumento a los diferentes actores de las IES e IEMS antes mencionados, buscando enfatizar en el nivel directivo. Por ello el instrumento a aplicar solo considera las categorías C y D, mismas que, al comprender actitudes y opiniones, se adecuaron en una escala de Likert, la cual se desarrolló en 1932 y abarca cinco niveles que son:

Muy de acuerdo, algo de acuerdo, ni de acuerdo ni en desacuerdo, algo en desacuerdo y muy en desacuerdo, (*Full Service Research Company, s.f.*). La tabla 3 muestra la adecuación del instrumento a aplicar mismo que se conforma de 30 preguntas.

Tabla 3. Instrumento para evaluar el grado de transdisciplinariedad en las Instituciones de Educación Media Superior y Superior

Nombre del directivo: _____	Sexo M / H _____
Tipo de Institución IEMS /IES _____	
Eda _____	
d Formación Académica _____	E mail: _____
Grado académico _____	
Lee y coloca dentro del recuadro un numero del 1 al 5 considerando que:	
1. Totalmente en desacuerdo	2. Algo en desacuerdo
3. Ni de acuerdo ni en desacuerdo	4. Algo de acuerdo
	5. Muy de acuerdo
Aprendizaje y Comunicación Social	
1 ¿Existen espacios físicos y temporales para la comunicación entre territorios disciplinarios?	
2 ¿Hay compromiso entre los participantes hacia la clarificación y negociación de roles para definir qué es lo que cada quien necesita del otro y en qué medida puede contribuir?	
3 Los participantes, ¿han clarificado las diferencias de sus presupuestos disciplinarios, así como lenguajes, métodos, herramientas, conceptos, teorías, epistemologías e ideologías?	
4. ¿Se han realizado las provisiones necesarias de tiempo para el aprendizaje cruzado entre los integrantes del equipo?	
5 ¿Existe un plan para las comunicaciones regulares –formales e informales– y el intercambio de información?	
comunicación electrónica a través de correos electrónicos y mailing lists	
reuniones cara a cara	
video-conferencias interactivas	
investigación y trabajo de campo colaborativo	
6 Cuando surgen conflictos, ¿se ignoran o se usan de manera creativa para refinar y avanzar en el proyecto?	
7 El equipo, ¿ha creado un “lenguaje interno de comunicación” (con características coloquial/local o lenguaje de intercambio)	
o incluso un “creole” (una nueva subcultura o lenguaje nativo)?	
8 ¿Existen recursos para comunicación con proyectos y programas emparentados, para intercambiar ideas, técnicas y resultados?	
9 ¿Existe un plan para recuperar o integrar producción de conocimiento?	
documentos conceptuales e informes	
productos instrumentales como gráficos, matrices de datos	
productos efímeros como representaciones, diagramas en pizarra, transcripciones, notas	
instrumental utilizado para la gestión de información y toma de decisiones como computadoras, editores de texto y drawing media, instrumental de grabación de audio y/o video	
intercambio por e-mail	
10. Cuando surgen conflictos, ¿se ignoran o se usan de manera creativa para refinar y avanzar en el proyecto?	
Colaboración e Integración	
11 ¿La estructura y el plan de trabajo facilitan la interacción?	
12 ¿Existen estructuras de incentivo que han sido incluidas para estimular la colaboración y la comunicación entre territorios disciplinarios?	

Fuente: Thompson, J., (2004)

Tabla 3. Instrumento para evaluar el grado de transdisciplinariedad en las Instituciones de Educación Media Superior y Superior (Continuación)

13 ¿Se presta atención a la forma como las tareas serán coordinadas en la progresión temporal?	
Los participantes trabajarán juntos	
Los participantes trabajarán separados	
Los participantes trabajarán de una manera seriada	
14 ¿La integración será permanente y no postergada a la fase final?	
15 ¿El equipo se compromete en actividades conjuntas?	
la corresponsabilidad de documentos de trabajo y publicaciones	
presentaciones	
Talleres y seminarios	
informes de avance y finales a las agencias donantes, contrapartes y otros equipos de investigación	
trabajos legislativos	
aplicaciones prácticas	
16 ¿El equipo trabaja con instrumental común?	
formularios de registro de datos	
métodos de recolección y análisis de datos	
procedimientos, equipamientos y facilidades	
17 ¿Es la interacción utilizada para obtener evaluaciones y productos en común?	
lecturas colectivas	
ediciones	
críticas cruzadas de los trabajos de los demás	
revisiones de los presupuestos iniciales sobre bases recursivas y retorno a estadios iniciales para identificar las contribuciones individuales	
resoluciones colectivas de diferencias	
revisión de conclusiones provisionales	
18 ¿Se utilizan técnicas multi- e interdisciplinarias conocidas?	
método Delphi	
análisis de escenarios	
método de sondeos	
teoría general de sistemas	
tormenta de ideas	
modelos de procesos interdisciplinarios	
19 ¿Se ha constatado evolución de la sinergia del equipo, transitando desde una concepción de grupo secundario sobre el “yo” auto-defensivo, a la relación de grupo primario del “nosotros” común?	
20 ¿Se ha establecido la colegiatura y la confianza definida por la honestidad apertura, consistencia y respeto?	
21 ¿El balance de poder entre campos disciplinarios/profesionales es equitativo?	
22 ¿El balance de poder entre campos disciplinarios/profesionales hay disciplinas e individuos subordinados a un rol reducido (registro o búsqueda de datos, tareas aditivas pero no integrativas)?	
23 ¿Es el resultado una síntesis interdependiente y colaborativa o una compilación multidisciplinaria de componentes separados al respecto de diferentes fenómenos o sólo un compartir información?	

Fuente: Thompson, J., (2004)

Tabla 3. Instrumento para evaluar el grado de transdisciplinariedad en las Insituciones de Educación Media Superior y Superior (Continuación)

24 ¿Existe un principio unificador, un principio teoría o cuerpo de preguntas unificadoras que provean coherencia y/o unidad?	
25 ¿Hay conceptos y preguntas globales salientes usadas para promover la integración?	
26 ¿Se han previsto recursos para la reflexión colectiva sobre la naturaleza interdisciplinaria y colaborativa del trabajo, incluyendo el tipo de interdisciplinariedad que está siendo practicada?	
27 Profundidad, amplitud y síntesis, ¿son trianguladas en un proceso orgánico?	
28 ¿Los participantes han experimentado cambios como resultado del proceso, comenzando a pensar de una nueva manera?	
29 ¿La concepción del proyecto se ha mantenido a lo largo del proyecto?	
30 ¿Se han previsto formas para la evaluación de aspectos interdisciplinarios, y colaborativos del trabajo?	
Aplicador y Fecha de aplicación	
Observaciones	

Fuente: Thompson, J., (2004)

2. Conclusiones

El análisis transdisciplinar de los procesos de gestión en la Educación Media Superior y Superior constituye un desafío para comprender el grado de adopción y aplicación de los postulados teórico filosóficos aceptados por la UNESCO como paradigmas de la educación en el siglo XXI. La presente propuesta, representa un intento por escudriñar la realidad institucional de los niveles educativos en México, particularmente en el campo de trabajo y zona de influencia profesional y laboral de los autores.

Si bien el desarrollo se plantea a nivel teórico conceptual con aproximaciones metodológicas, es el avance del presente proyecto, lo que permitirá generar el antecedente en torno a la adopción de la cosmovisión sistémico – transdisciplinar en estos ámbitos. Así, se podrán presentar con sustento científico, propuestas y políticas que permitan contribuir a la integración de la visión holística en los procesos de gestión, para que pasen de la monodisciplinariedad a la transdisciplinariedad.

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Implementación de la metodología de Clase Inversa en el campo de la Ingeniería del Terreno

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Abstract

The subject belong to the Civil Engineering Degree. Usually, students that arrive to the course are accustomed to classical higher education. Both morning and evening lectures are given at 8 am and 3 pm, so many student either arrive later or do not assist. Besides, motivation of students is scarce, and most of them are interested mainly in obtaining the Degree itself, more than learning. Consequently, in this article we show a learning base on autolearning, with help of the teacher, and series seminars and workshops for involving the student in the subject.

Keywords: *Teaching innovation, higher education, participative methodology, formative assesment, profesional development.*

Resumen

La asignatura se enmarca dentro del cuarto curso de una titulación de grado en el marco del Plan Bolonia y los alumnos que la cursan son personas que están acostumbradas a una educación muy reglada. La docencia se imparte por la mañana y por la tarde y a una hora poco recomendable y los alumnos se encuentran escasamente motivados. Por ello, se ha decidido apostar por una metodología de aprendizaje activa basada en la indagación y la “clase inversa”. De este modo, hemos planteado, en la asignatura, una serie de seminarios abiertos y talleres conceptuales para conseguir que el estudiante se interese por esta asignatura. Así, la parte evaluativa de la asignatura se lleva a cabo de manera conjunta entre todos los participantes de la misma, es decir, docentes y alumnos juntos interactuando y marcando pautas y criterios para la misma.

Palabras clave: *Innovación docente, educación superior, metodología participativa, aprendizaje por proyectos, clase inversa.*

Introducción

Los alumnos que cursan de la asignatura suelen ser personas que están acostumbrados a una educación muy reglada y la docencia se imparte por la mañana y por la tarde y a una hora

poco recomendable (comenzamos a las 8 h y a las 15 h) por lo que muchos de ellos deciden o no venir o llegar tarde y se encuentran escasamente motivados, ya que en realidad quieren el título y no el aprendizaje que conlleva.

La asignatura se enmarca en el último año de Grado y se imparte desde el año 2013, coincidiendo con la implantación de los Grados y el Plan Bolonia en la titulación de Ingeniero Civil.

En este sentido, nos encontramos fundamentalmente con dos aspectos a trabajar:

- Los alumnos están acostumbrados en la titulación a tener la oportunidad de examinarse en una única prueba final, en nuestro caso lo vamos a cambiar por una evaluación continua.
- Tenemos problemas con la hora de comienzo de las clases porque hay gente que no tiene tiempo para comer, por ello tenemos que disponer de flexibilidad en la hora de inicio de las mismas, proponiendo algún tipo de actividad que permita el seguimiento por parte de todo el alumnado.

1. Objetivos

Esta innovación educativa pretende conseguir, fundamentalmente, una mayor motivación de los alumnos para mejorar su aprendizaje, ofreciéndoles la oportunidad de superar la asignatura mediante una evaluación continua a lo largo del cuatrimestre. Esta evaluación va a tener como núcleo central la elaboración por grupos de un trabajo “real” que van a tener que ir presentando parcialmente (con retroalimentación posterior) y de manera definitiva incluyendo una presentación oral del mismo en clase.

En este sentido tomamos de referencia varios trabajos realizados por los profesores fuera de su actividad docente y varias experiencias docentes previas (por ejemplo, Murillo, 2003; Zabala y Arnau, 2007; Santos *et al.*, 2012; Torrijo *et al.*, 2012). Con todo ello se llevó a cabo un proceso de aprendizaje donde se combinan cuatro tipos de metodologías: lección magistral participativa, aprendizaje cooperativo, aprendizaje autónomo y “*flipped classroom*” (clase inversa).

Así, nos propusimos a alcanzar los siguientes objetivos:

- “Enganchar” al alumno a la asignatura .
- Hacerles conscientes de que el aprendizaje es interno y autoconsciente.
- Fomentar el trabajo en grupo.
- Responsabilizar a los alumnos y al profesor de la necesidad de obtener retroalimentación.
- Ser conscientes de sus posibilidades como profesionales.
- Hacerlos partícipes de su propia evaluación.

Como puede verse, el conjunto de objetivos van en consonancia con llegar a conseguir un conocimiento personal del alumno dentro del marco de la asignatura, fomentando la

motivación y la responsabilidad en su propio aprendizaje, tal y como proponen Tedesco (2010) y Monroy *et al.* (2012).

2. Desarrollo de la innovación

2.1. Planteamiento

Desde el inicio del año 2013, con los objetivos (resultados de aprendizaje) en mente dispusimos un calendario de la asignatura (Teoría de Aula y Prácticas de Aula) que, con pequeñas variaciones, es el mismo que hemos llevado este último curso académico (2016-2017):

- 5 de septiembre: *Lección magistral participativa* : Presentación de la asignatura.
- 6 de septiembre: *Aprendizaje cooperativo*: Planificación de reconocimientos del terreno.
- 12 de septiembre: *Aprendizaje cooperativo*: Técnicas genéricas de prospección.
- 13 de septiembre: *Aprendizaje cooperativo*: Interpretación de datos geotécnicos en suelos y rocas, correlaciones de datos de campo y Laboratorio.
- 19 de septiembre: *Lección magistral participativa*: Caracterización de macizos rocosos, ensayos “in-situ” y de Laboratorio en rocas.
- 20 de septiembre: *Aprendizaje cooperativo y aprendizaje autónomo*: Casos prácticos de macizos rocosos.
- 26 de septiembre: *Lección magistral participativa*: Instrumentación y auscultación geotécnica.
- 27 de septiembre: *Aprendizaje autónomo*: Seminario abierto basado en Cine fórum (visionado de película-documental).
- 3 de octubre: *Aprendizaje cooperativo*: Seminario abierto basado en Cine fórum (puesta en común mediante un “roleplaying”).
- 4 de octubre: *Lección magistral participativa*: Análisis de la estabilidad. Tipos de deslizamientos.
- 10 y 11 de octubre: *Aprendizaje cooperativo y aprendizaje autónomo*: Casos prácticos de estabilidad de taludes.
- 17 de octubre: *Lección magistral participativa*: Técnicas de contención y corrección de deslizamientos.
- 18 de octubre: *Clase inversa* :Diseño y proyecto de la obra subterránea. Estudios a realizar.
- 24 de octubre: *Clase inversa* :Cálculo geotécnico-estructural del túnel. Modelos geotécnicos de comportamiento del terreno.
- 25 de octubre: *Clase inversa* :Métodos de construcción de túneles y su instrumentación y auscultación.
- 31 de octubre: *Aprendizaje autónomo*: Casos prácticos sobre túneles.

- 7 de noviembre: *Clase inversa* :Estudios de Ingeniería del Terreno a realizar en presas: Ubicación, cerradas y laderas.
- 8 de noviembre: *Clase inversa* :Estudios de prospección de materiales en presas.
- 14 de noviembre: *Aprendizaje autónomo*: Casos prácticos sobre presas.
- 15 de noviembre: *Clase inversa* :Compactación dinámica.
- 21 de noviembre: *Clase inversa* :Vibroflotación y columnas de grava.
- 22 de noviembre: *Clase inversa* :Precarga.
- 28 de noviembre: *Clase inversa* :Inyecciones y Jet Grouting.
- 29 de noviembre y 5 de diciembre: *Aprendizaje autónomo*: Casos prácticos sobre mejora del terreno.
- 12 y 13 de diciembre: *Aprendizaje cooperativo y aprendizaje autónomo*: Resumen y dudas de la asignatura.

Con esta distribución de la asignatura se pretende que el alumno sea consciente y participe de su propio aprendizaje. Además existen Prácticas de Laboratorio y una Práctica de Campo donde los alumnos son acompañados en el aprendizaje por uno o varios profesores. Todos los alumnos conocen al inicio del curso esta distribución, dejando clara cuál va a ser la metodología docente a aplicar y el profesor responsable de cada sesión.

Es evidente que la mayor parte del alumnado desconoce la terminología de aprendizaje, por ello, se les plantea de manera breve como es cada una de ella y también como va a ser la evaluación de la asignatura. En este sentido hay que remarcar que se les da la oportunidad de trabajar así o bien con el método que se había seguido hasta el año 2013 cambiándose de grupo en la asignatura.

2.2. Recursos utilizados para el desarrollo de la asignatura

Para llevar a cabo con éxito este tipo de asignatura hemos utilizado los siguientes recursos físicos como material para el alumnado:

1. *Datos necesarios para realizar el trabajo de forma autónoma y grupal*. En este sentido, al principio de curso se adjunta al alumnado abundante material disponible en PoliformaT, en forma de material escrito y vídeos que pueden servirles de base y punto de inicio para acercarse a la asignatura.
2. *Material teórico (apuntes y videos)*. Este material lo pueden utilizar para retroalimentar su aprendizaje y se comenta en clase. Este material se utiliza fundamentalmente con dos tipos de metodología de aprendizaje: aprendizaje autónomo y lección magistral participativa.
3. *Material teórico – práctico*. Lo pueden utilizar para llevar a cabo de manera óptima su trabajo grupal, para su aprendizaje cooperativo y para trabajar en Clase Inversa.

4. *Recursos bibliográficos.* A los alumnos se les facilita un amplio listado de referencias bibliográficas, tanto genéricas como específicas, que puedan consultar en los archivos de la Universidad para que trabajen de manera amplia y segura en modo Clase Inversa.

2.3. Visionado del desarrollo de la asignatura

La asignatura como puede verse en el apartado de Planteamiento tiene dos partes bien diferenciadas, una primera parte más reglada y conducida por el profesorado, con clases usando Lección Magistral Participativa, y algunas usando aprendizaje cooperativo y autónomo. Sin embargo, la segunda parte se basa casi completamente en un aprendizaje mediante Clase Inversa donde el alumno es el protagonista, llegando a impartir ellos mismos (de manera grupal) las clases para sus compañeros.

A modo de resumen se puede decir que en la primera parte son clases más teóricas, donde se les imparte unas pautas de puntos básicos de la materia que estamos trabajando, y siempre bajo el auspicio directo de un profesor. Este viene también “obligado” por la metodología elegida en la segunda parte de la asignatura y que comentamos a continuación.

La metodología de Clase Inversa en nuestro caso se basa en darles el protagonismo y la responsabilidad del aprendizaje al propio alumno (Bergmann y Sams, 2012; Sams y Bergmann, 2013). El primer día de clase se les pide que formen de manera libre nueve (9) grupos de 4-6 personas (en función del número de alumnos) y que se comunique al profesor responsable en el plazo de una semana que personas forman cada uno de ellos. Cada uno de estos grupos van a ser responsables de una de las clases de la segunda parte de la asignatura (aparecen en el apartado de Planteamiento como Clase Inversa). Este hecho implica que ellos van a tomar el “papel de profesor” y van a tener que impartir esa clase de dos horas a sus compañeros de curso. Para la preparación de la misma cuentan (siempre que lo pidan) la ayuda del profesorado de la asignatura, teniendo reuniones y realizando sesiones de apoyo y acompañamiento. Esta ayuda es a demanda, excepto la existencia de una primera reunión con el profesorado que es obligatoria, en ella se les asigna el tema a impartir para “centrarles” su desarrollo del aprendizaje. La preparación de la clase, tanto como quieren impartirla como los recursos a suministrar a “sus alumnos” es responsabilidad suya. Este hecho les crea en un primer momento varios sentimientos, pero fundamentalmente tres (3): desconcierto, miedo e incredulidad.

Visto lo anterior nos hemos dado cuenta que durante el desarrollo de la asignatura con este planteamiento existe una participación creciente de los alumnos y una implicación superior a los años anteriores, incluso superando el “miedo escénico” a hablar en público. En la *Fig. 1* mostramos un momento de una de las sesiones donde se observa como los alumnos llevan el desarrollo de la misma y se producen debates que acaban produciendo una participación muy alta por parte de los alumnos.



Figura 1. Seminario Abierto donde se observa como discurre sin el protagonismo del profesor. Se corresponde con la 20ª sesión de la asignatura. Elaboración propia.

Al principio como hemos reflejado anteriormente se utiliza un sistema metodológico basado en la denomina “lección magistral participativa”, si bien los alumnos empiezan a estar predispuestos a colaborar en la misma (*Fig. 2*) ya que llevan semanas trabando para preparar “su clase” con sus compañeros de grupo y eso les empieza a dar cierta seguridad en clase.



Figura 2. Lección magistral participativa combinada con clase inversa. Se corresponde con la 7ª sesión de la asignatura. Elaboración propia.

En este sentido y, una vez superado este “miedo”, las clases discurrían de manera grupal fomentando el aprendizaje cooperativo y haciendo que el profesor fuera un “mero asistente” (Fig. 3).



Figura 3. Sesión de aprendizaje cooperativo donde se observa como la misma discurre con el profesor como un asistente del aprendizaje. Se corresponde con la 12ª sesión de la asignatura. Elaboración propia.

2.4. Evaluación de la asignatura

La asignatura se evalúa en dos partes, dividida en los dos “bloques” reflejados anteriormente y teniendo en cuenta las prácticas de campo y Laboratorio:

- La primera parte se evalúa de manera escrita con una prueba teórico-práctica donde hay que resolver cuestiones similares a las realizadas hasta ese momento en clase. Este resultado al 40% de la nota final.
- La segunda parte de la asignatura que equivale a otro 40% de la nota final presenta tres ítems con un peso de un tercio cada uno:
 - Los alumnos presentes en la clase evalúan la misma, de forma anónima, una vez terminada la misma. Nota variable entre 0 y 10.
 - El profesor o profesores presentes en la clase evalúan la misma, de forma anónima, una vez terminada la misma. Nota variable entre 0 y 10.
 - Cada uno de los alumnos del grupo que han llevado a cabo la clase evalúan a cada uno de sus compañeros por todo el trabajo realizado, de forma anónima, una vez terminada la misma. Nota variable entre 0 y 10.

- Las Prácticas de Laboratorio equivalen a un 10% de la nota final y las evalúa el profesor responsable de las mismas en base a un trabajo escrito que realizan y entregan individualmente los alumnos.
- La Práctica de Campo equivale a un 10% de la nota final y la evalúa el profesor responsable de la misma en base a un trabajo escrito que realizan y entregan individualmente los alumnos.

3. Resultados

A la hora de valorar el resultado académico de la innovación cabe comentar que de los 457 alumnos (de 471; Tabla 1) que decidieron seguir la asignatura de manera continua durante los cuatro (4) cursos académicos realizados han aprobado todos, excepto uno (1) en el curso 2015-2016 que abandonó la asignatura. Así, las notas finales en enero de los cuatro cursos académicos reflejados se muestran en la Tabla 2, junto con los datos del último Curso anterior a esta Metodología.

El último curso con la anterior metodología fue el 2012-2013 y pueden apreciarse bastantes diferencias con respecto a los cursos posteriores. Para comenzar desciende drásticamente el número de alumnos no presentados (quizás podría implicar más motivación) y aumenta el porcentaje tanto de aprobados como de notas medias de Notables. Sin embargo, no se han incrementado de manera significativa las notas más altas (Sobresaliente y Matrícula de Honor) por lo que nos indicaría que los alumnos que ya eran excelentes siguen siéndolo independientemente de la Metodología pero consiguiendo mejores resultados el resto de alumnos o “alumnos medios” incrementándose sus calificaciones.

Tabla 1. Resultados del seguimiento de la asignatura. Elaboración propia.

	Curso 2013-2014	Curso 2013-2014	Curso 2014-2015	Curso 2015-2016	Curso 2016-2017
No presentados	32 (27,35%)	1 (1,18%)	5 (2,91%)	4 (2,96%)	4 (5,06%)
Presentados	85 (72,65%)	84 (98,82%)	167 (97,09%)	131 (97,04%)	75 (94,94%)

Tabla 2. Resultados de las calificaciones de los alumnos presentados*. Elaboración propia.

	Curso 2012-2013	Curso 2013-2014	Curso 2014-2015	Curso 2015-2016	Curso 2016-2017
Suspensos	12 (14,12%)	0 (0,00%)	0 (0,00%)	1 (0,74%)	0 (0,00%)
Aprobados	65 (76,47%)	14 (16,09%)	46 (26,29%)	42 (31,11%)	33 (44,00%)
Notables	7 (8,23%)	53 (60,92%)	119 (68,00%)	82 (60,74%)	39 (52,00%)

Sobresalientes	1 (1,18%)	14 (16,09%)	2 (1,14%)	0 (0,00%)	1 (1,33%)
Matrículas de Honor	0 (0,00%)	3 (3,45%)	0 (0,00%)	6 (4,44%)	2 (2,67%)
<i>Nota Media</i>	5,21	8,02	7,40	7,25	7,20
<i>Nota Máxima</i>	9,00	10,00	9,20	9,40	9,60
<i>Nota Mínima</i>	0,20	5,80	5,00	4,00	5,50
<i>Desviación estándar</i>	5,87	0,96	1,22	1,25	0,80

* Los porcentajes están respecto a los alumnos presentados.

Además mirando únicamente los cursos con Clase Inversa, el rasgo más notable de todos ellos es que no ha habido suspensos (uno de 457 alumnos) y que la desviación estándar obtenida ha sido baja.

Desde el punto de vista de los resultados de implicación y motivación por parte de los alumnos no se cuenta con ningún tipo de datos tabulados para poder comparar aunque estamos diseñando una manera de hacerlo para que sea lo más cuantitativo posible. Sin embargo, desde un punto de vista cualitativo, todos los profesores estamos de acuerdo en que el tanto el grado de implicación de los alumnos, como su motivación, es muy superior a lo que se conseguía históricamente en la asignatura.

4. Conclusiones

En el momento actual no hay lugar a dudas de que la metodología educativa implantada nos ha permitido avanzar en la evaluación formativa completa de los alumnos.

El hecho de dialogar sobre lo que hacen, tanto ellos como los profesores, reflexionar juntos y afrontar por su cuenta, con nuestro acompañamiento, los “obstáculos” que se les presentan día a día en la asignatura, les y nos enriquece al compartirlo con los demás.

Tal y como proponían Santos *et al.* (2012) el trabajo en equipo y la reflexión compartida del grupo de profesorado han hecho más livianas las inseguridades que genera hacer algo diferente e innovador. Se trata de establecer un compromiso de desarrollo profesional para la mejora de la calidad en la docencia universitaria. En el proceso de innovación aquí presentado, el centro de interés de nuestra propuesta se ha basado en la metodología participativa y la evaluación formativa que se ponen en marcha en las materias de una titulación universitaria.

Todo lo anterior va acompañado de un alto rendimiento académico y una disminución del denominado “fracaso escolar” en la educación superior.

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Género e igualdad en la empresa. Perspectiva de género e innovación educativa en el ámbito universitario

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Abstract

It proposes a methodological approach that treats International Law, EU and national rules on equality to make them known at all educational levels - and especially in the field of Private Law - and to achieve that the transfer and the creation of knowledge in Universities do not perpetuate an unequal system, but entrench the dignity and equality of all people as universal values and security tools for peace and social development.

Keywords: *Gender Mainstreaming; Women in Boards; Women; Equality; Gender; Corporate Social Responsibility; Methodological approach; Education.*

Resumen

Se propone un enfoque metodológico que atienda a las normas internacionales, comunitarias y nacionales en materia de igualdad para darlas a conocer en todos los niveles educativos –y en especial en el ámbito del Derecho privado- y para conseguir que la transferencia y la creación del conocimiento en las Universidades no perpetúen un sistema desigual, sino que afiancen la dignidad y la igualdad de todas las personas como valores universales y como herramientas de seguridad, paz y desarrollo social.

Palabras clave: *Incorporación de la perspectiva de género; Mujeres Administradoras; Mujeres; Igualdad; Género; Responsabilidad Social Corporativa; Enfoque metodológico; Educación.*

1. Introducción. La metodología del *Gender Mainstreaming*

"...La máxima participación de la mujer, en igualdad de condiciones con el hombre, en todos los campos, es indispensable para el desarrollo pleno y completo de un país, el bienestar del mundo y la causa de la paz".

Con estas palabras se abre el texto de la Convención de Naciones Unidas sobre la Eliminación de todas las formas de Discriminación contra la Mujer (<http://www.un.org/womenwatch/daw/cedaw/text/sconvention.htm>). El espíritu de la Convención tiene su génesis en los objetivos de Organización de las Naciones Unidas: reafirmar la fe en los derechos humanos fundamentales, en la dignidad y el valor de la persona humana y en la igualdad de los derechos de hombres y mujeres.

La Convención de Naciones Unidas, que es norma principalísima de nuestro Derecho, del máximo rango jerárquico, amplía la interpretación del concepto de los Derechos Humanos mediante el reconocimiento formal del papel desempeñado por la cultura y la tradición en la limitación del ejercicio por la mujer de sus derechos fundamentales. Dispone que los Estados Partes están obligados a coadyuvar a la modificación de los patrones socioculturales de conducta de hombres y mujeres para eliminar "los prejuicios y las prácticas consuetudinarias y de cualquier otra índole que estén basados en la idea de la inferioridad o superioridad de cualquiera de los sexos o en funciones estereotipadas de hombres y mujeres" (artículo 5). El artículo 10 c) obliga a la modificación de los libros, programas escolares y métodos de enseñanza para eliminar los conceptos estereotipados en la esfera de la educación. Por último, todas las disposiciones de la Convención que afirman la igualdad de responsabilidades de ambos sexos en la vida familiar e iguales derechos con respecto a la educación y al empleo, atacan enérgicamente los patrones culturales que definen el ámbito público como un mundo masculino y la esfera doméstica como el dominio de la mujer. Entre otros apartados este artículo 10, Parte III de la Convención, dice:

"Los Estados Partes adoptarán todas las medidas apropiadas para eliminar la discriminación contra la mujer, a fin de asegurarle la igualdad de derechos con el hombre en la esfera de la educación y en particular para asegurar, en condiciones de igualdad entre hombres y mujeres:

a) Las mismas condiciones de orientación en materia de carreras y capacitación profesional, acceso a los estudios y obtención de diplomas en las instituciones de enseñanza de todas las categorías, tanto en zonas rurales como urbanas; esta igualdad deberá asegurarse en la enseñanza preescolar, general, técnica y profesional, incluida la educación técnica superior, así como en todos los tipos de capacitación profesional;

c) La eliminación de todo concepto estereotipado de los papeles masculino y femenino en todos los niveles y en todas las formas de enseñanza, mediante el

estímulo de la educación mixta y de otros tipos de educación que contribuyan a lograr este objetivo y, en particular, mediante la modificación de los libros y programas escolares y la adaptación de los métodos en enseñanza.

f) La reducción de la tasa de abandono femenino de los estudios y la organización de programas para aquellas jóvenes y mujeres que hayan dejado los estudios prematuramente...”.

La desigualdad material entre hombres y mujeres existe y no decrece, ni a nivel mundial ni a nivel comunitario. Así lo reconocen todos los textos legales internacionales y también nacionales. A pesar de que las normas jurídicas aplicables en España y en los Estados occidentales establecen una rotunda *igualdad formal*, en la práctica *la brecha de género se mantiene e incluso asume nuevas formas entre los jóvenes*, que *perpetúan* un sistema de discriminación sin siquiera someterlo a crítica o cuestionarlo. En realidad la discriminación por razón de género es un problema grave pero que pasa *desapercibido* en la sociedad. Y pasa también desapercibido en la educación.

<<Attitudes towards equality are evolving, but today’s younger generation is not immune to gender stereotypes and disparities. Gender inequalities in education persist – in terms of study subject preferences, performance and patterns of participation. Boys, especially from disadvantaged backgrounds, drop out of school more than girls and encounter many more difficulties in reading. Women are more likely to have a higher education degree but remain overrepresented in fields of study that are linked to traditional female roles such as care-related fields and are under-represented in science, mathematics, IT, engineering and related careers. As a result, inequality in occupations is taking new forms rather than diminishing and, despite their investment in education, young women are still twice as likely as young men to be economically inactive. Women also represent the biggest untapped source of entrepreneurial potential, representing only 29 % of entrepreneurs>>.

European Commission, Strategic Engagement for Gender Equality, 2016-2019.

Los instrumentos más poderosos para conseguir una igualdad efectiva y no meramente formal entre hombres y mujeres son, por un lado, *la educación* y, por otro, *el Derecho*. Por ello, la integración de las Universidades en el Espacio Europeo de Educación Superior y los avances en materia de género y no discriminación por razón de sexo en la cultura de la sociedad global conducen necesariamente a un cambio de estrategias en todo el proceso de enseñanza-aprendizaje de todas las asignaturas de todos estudios preuniversitarios, en todos los Grados, y si cabe, con mayor fuerza en las asignaturas relacionadas con el mundo jurídico y la economía. Sin embargo, la metodología del *Gender Mainstreaming*, recomendada por los organismos internacionales y específicamente por la Unión Europea, que significa

integrar la perspectiva de la igualdad en los contenidos de todas las materias de cualquier plan de estudios, especialmente los universitarios y pre-universitarios, no se sigue en la educación española, ni tampoco en su Universidad (y, si acaso, queda en manos del “voluntarismo” y la responsabilidad individual de los docentes), bien por falta de convicción o desconocimiento de las lagunas existentes en materia de discriminación por razón de género, bien por carencia de motivación, o bien por falta de conocimiento de cómo hacerlo.

Esta propuesta docente es innovadora en cuanto a aspectos formales y también de contenido, sobre todo, en lo que se refiere a la implementación de los objetivos del *Gender Mainstreaming* en la docencia, especialmente la universitaria, como fórmula más útil y eficaz para llegar a la consecución del objetivo de la igualdad de género no meramente formal sino también real o material.

2. Aproximación a la regulación española sobre igualdad y no discriminación en el Derecho Privado

Se desconoce por una gran parte del alumnado que la igualdad entre mujeres y hombres es un *principio jurídico universal*, reconocido como tal en importantes textos internacionales como la Convención de Naciones Unidas sobre eliminación de todas las formas de discriminación de 1979 (ratificada por España en 1983). Aunque a partir de la Conferencia sobre la Mujer (Beijing, 1995) se reconoce expresamente la necesidad de su proyección práctica, los resultados no son para nada alentadores a nivel internacional.

El *Gender Mainstreaming* es la principal herramienta de los gobiernos y Estados para promover la equidad de género. Se trata de una vía educativa integral e integradora en el campo de la educación, pero no es seguida –o es hasta inconscientemente postergada- incluso en los sistemas educativos y metodológicos occidentales.

En el ámbito de la Unión Europea la igualdad es un *principio jurídico clave fundamental*. A partir del artículo 111 del Tratado de Roma hay normas comunitarias encaminadas directamente a la consecución de la igualdad de género. Basta recordar las Directivas 2002/73/CE (de reforma de la Directiva 76/207/CEE, relativa a la aplicación del principio de igualdad de trato entre hombres y mujeres en lo que se refiere al acceso al empleo, a la formación y a la promoción profesionales, y a las condiciones de trabajo); la Directiva 2004/113/CE (sobre aplicación del principio de igualdad de trato entre hombres y mujeres en el acceso a bienes y servicios y su

suministro); o la Directiva 2006/54/EC, relativa a la aplicación del principio de igualdad de oportunidades y tratamiento en el empleo de hombres y mujeres. La promoción de la igualdad de género es esencial para la Unión Europea. Se trata de un *objetivo prioritario* de la Unión Europea e incluso se asume como un indicador de su éxito en todos los niveles y de su desarrollo económico.

En su estrategia entre 2010-2015 la Comisión Europea ya priorizó como áreas clave la consecución de la independencia económica igual para hombres y mujeres, la consecución del mismo salario, la igualdad en la toma de decisiones, la dignidad y la integridad con eliminación de la violencia de género y la promoción de la igualdad de género -plasmación de la dignidad- también fuera del territorio de la Unión. Y actualmente hay que mencionar el desconocido Compromiso estratégico para la igualdad de género 2016-2019 de la Unión Europea, que establece de forma inequívoca como acción clave la de promover la igualdad de género precisamente *en todos los niveles y tipos de educación*.

Promoting gender equality in all levels and types of education, including in relation to gendered study subject choices and careers, using existing policy cooperation tools and funding instruments as appropriate, in line with the priorities set out in the “Education and Training 2020” framework (2016-2019).

Si descendemos al ámbito estrictamente nacional, en nuestro Derecho español interno también ha de tenerse en cuenta el artículo 14 de la Constitución Española de 1978, nuestra norma suprema (junto con las Convenciones y Tratados), que proclama el *derecho a la igualdad* y a la no discriminación por razón de sexo. Por su parte, el artículo 9.2 del mismo texto constitucional consagra la *obligación* de los poderes públicos de promover las condiciones para que la igualdad del individuo y de los grupos en que se integra sean reales y efectivas.

Un hito en la consecución de la igualdad material en el Derecho español es la Ley Orgánica de Igualdad 3/2007, de 22 de marzo, para la Igualdad Efectiva de Mujeres y Hombres, (publicada en Boletín Oficial del Estado de 23 de Marzo de 2007). Según el legislador, el logro de la igualdad real y efectiva en nuestra sociedad requiere no sólo del compromiso de los sujetos públicos, sino también de su promoción decidida en la órbita de las relaciones entre particulares. La regulación del acceso a bienes y servicios es objeto de atención por esta Ley de Igualdad, conjugando los principios de libertad y autonomía contractual con el fomento de la igualdad entre mujeres y hombres. También se establecen determinadas medidas de promoción de la igualdad efectiva en las empresas privadas, como las que se recogen en materia de contratación o de subvenciones públicas o en referencia a los consejos de administración.

La Ley Orgánica de Igualdad dedica un Título completo, el VII, a la “Igualdad en la Responsabilidad Social de las Empresas”. En este Título se hace referencia (artículo 73) a las acciones de responsabilidad social de las empresas en materia de igualdad. Se establece que:

Las empresas podrán asumir la realización voluntaria de acciones de responsabilidad social, consistentes en medidas económicas, comerciales, laborales, asistenciales o de otra naturaleza, destinadas a promover condiciones de igualdad entre las mujeres y los hombres en el seno de la empresa o en su entorno social. La realización de estas acciones podrá ser concertada con la representación de los trabajadores y las trabajadoras, las organizaciones de consumidores y consumidoras y usuarios y usuarias, las asociaciones cuyo fin primordial sea la defensa de la igualdad de trato entre mujeres y hombres y los Organismos de Igualdad. Se informará a los representantes de los trabajadores de las acciones que no se concierten con los mismos. A las decisiones empresariales y acuerdos colectivos relativos a medidas laborales les será de aplicación la normativa laboral.

Se incorporan, en este importante texto legal, las previsiones sobre publicidad de las acciones de responsabilidad social en materia de igualdad (artículo 74):

Las empresas podrán hacer uso publicitario de sus acciones de responsabilidad en materia de igualdad, de acuerdo con las condiciones establecidas en la legislación general de publicidad. El Instituto de la Mujer, u órganos equivalentes de las Comunidades Autónomas, estarán legitimados para ejercer la acción de cesación cuando consideren que pudiera haberse incurrido en supuestos de publicidad engañosa.

Aquí ha de tenerse en cuenta el texto del Real Decreto 850/2015, de 28 de septiembre, por el que se modifica el Real Decreto 1615/2009, de 26 de octubre, por el que se regula la concesión y utilización del distintivo «Igualdad en la Empresa», en que se reforman algunos aspectos importantes del procedimiento para introducir en él un régimen de seguimiento, control y renovación a las entidades distinguidas más ágil y eficaz. Este distintivo es una especie de “premio” para aquellas empresas que realmente implementan las políticas de igualdad y no discriminación, pero es completamente desconocido por la sociedad.

Respecto a los requisitos generales para presentar la candidatura al distintivo o prorrogar su vigencia, éstos se refuerzan al exigir que las entidades no hayan sido sancionadas por infracciones en materia de igualdad y no discriminación en el acceso a los bienes y servicios; por otra parte se adecua el límite temporal en el que las entidades no podrán presentar su candidatura por haber sido sancionadas por infracciones graves en materia de igualdad de oportunidades y no discriminación. Se considera conveniente exigir nuevos requisitos como la acreditación de la incorporación de sistemas de seguimiento y evaluación en los planes de igualdad de

las empresas que presenten su candidatura, o la presencia de mujeres en los órganos de administración de aquellas sociedades mercantiles referidas en el artículo 75 de la Ley Orgánica 3/2007, de 22 de marzo, y en consonancia con las previsiones contenidas en el nuevo artículo 540, apartado 4.c) 6.º del texto refundido de la Ley de Sociedades de Capital, aprobado por el Real Decreto Legislativo 1/2010, de 2 de julio, introducido por la Ley 31/2014, de 3 de diciembre, por la que se modifica la Ley de Sociedades de Capital para la mejora del gobierno corporativo.

En el artículo 75 de la Ley de Igualdad se incorpora, finalmente, una norma sobre la “Participación de las mujeres en los Consejos de Administración de las Sociedades Mercantiles”, mediante un texto muy complejo y de difícil interpretación:

Las sociedades obligadas a presentar cuenta de pérdidas y ganancias no abreviada procurarán incluir en su Consejo de administración un número de mujeres que permita alcanzar una presencia equilibrada de mujeres y hombres en un plazo de ocho años a partir de la entrada en vigor de esta Ley.

Lo previsto en el párrafo anterior se tendrá en cuenta para los nombramientos que se realicen a medida que venza el mandato de los consejeros designados antes de la entrada en vigor de esta Ley.

El impulso a la incorporación de las mujeres -o, en su caso, de los hombres- a los Consejos de Administración, y su necesaria composición equilibrada, se ve inmerso en un cruce de tensiones y de conflictos de intereses heterogéneos a los que el legislador no se ha atrevido a dar una respuesta clara, ni contundente ni precisa. El citado artículo 75 destaca por su deficiente técnica legislativa, y por su oscuridad en aspectos de contenido realmente importantes, pero hay que reconocerle el mérito de intentar hacer frente al problema de la infrarrepresentación de género en los órganos de administración de las empresas mercantiles privadas, aunque el objetivo haya resultado absolutamente incumplido.

Por supuesto, la Ley Orgánica de Igualdad de 2007 se refiere especialmente a la política de igualdad en la educación.

El artículo 23 establece que: “El sistema educativo incluirá entre sus fines la educación en el respeto de los derechos y libertades fundamentales y en la igualdad de derechos y oportunidades entre mujeres y hombres”.

El sistema educativo incluirá, dentro de sus principios de calidad, la eliminación de los obstáculos que dificultan la igualdad efectiva entre mujeres y hombres y el fomento de la igualdad plena entre unas y otros. El artículo 24 de la Ley Orgánica de Igualdad insiste en la garantía de una integración activa, en los objetivos y en las actuaciones educativas, del principio de igualdad de trato, evitando que, por comportamientos sexistas o por los *estereotipos sociales* asociados, se produzcan desigualdades entre mujeres y hombres.

Precisamente esta propuesta metodológica se enmarca en el apartado e) de este artículo 24, que tiende a promover “el desarrollo de proyectos y programas dirigidos

a fomentar el conocimiento y la difusión, entre las personas de la comunidad educativa, de los principios de coeducación y de igualdad efectiva entre mujeres y hombres”.

Y el artículo 25 de la Ley Orgánica de Igualdad atiende a la igualdad en el ámbito de la educación superior, en que se ha de fomentar “la enseñanza y la investigación sobre el significado y alcance de la igualdad entre mujeres y hombres”.

3. Conclusiones

El objetivo más importante de esta propuesta es suscitar la reflexión y la crítica sobre una problemática que, a pesar de las circunstancias de crisis económica que atravesamos, no puede seguir siendo ignorada. Aunque sí existe reconocida una igualdad formal en los textos legales, no existe una igualdad material –real- entre hombres y mujeres. Ello se observa claramente desde la perspectiva práctica en todos los ámbitos de la empresa, desde los trabajadores hasta los directivos y altos cargos. Todas las estadísticas españolas muestran inequívocamente y de forma constante que la igualdad no se ha alcanzado en las empresas, sobre todo en los cargos de dirección o de mayor importancia económica o de poder. La tónica a nivel mundial es la misma.

Se mantiene la brecha salarial y la diferencia de condiciones laborales o sociales. No hay todavía en España, ni en casi ningún Ordenamiento (salvo en los países nórdicos en que las normas de igualdad material se introdujeron de forma obligatoria -y no como opción- para todas las empresas, con un gran éxito práctico a pesar de las fuertes reticencias iniciales) un porcentaje significativo igualitario de mujeres directivas o en puestos de mando de las empresas.

Entiendo que es esencial crear modelos de mujeres administradoras y minorías en la administración y en los puestos directivos de las empresas, también para que las mujeres y las minorías de futuras generaciones puedan identificarse y desarrollarse conforme a modelos de mujeres y minorías en los Consejos de Administración y puestos de poder en las empresas. Es esencial modificar la actitud de los discentes sobre el papel de las mujeres en la empresa y en los negocios. Sostengo que es capital que todos los discentes puedan apreciar la importancia del Derecho privado para la consecución de los cambios sociales necesarios.

Por mi parte le doy gran relevancia a los artículos legales referidos a la educación para la igualdad de mujeres y hombres, su integración en la política de educación y la igualdad en el ámbito de la educación superior. Hoy sigue siendo una quimera pretender conseguir un cambio profundo en la cultura social sin un cambio educacional, y por ello me parece importantísimo el trabajo con los niños y con los jóvenes, en los círculos de la familia y también en las escuelas y los institutos, y por supuesto en las Universidades, para convencer de que las mujeres y los pertenecientes a grupos minoritarios sí pueden realizar cualquier

trabajo, y también, por ejemplo, el de directivo u otro en igualdad de condiciones en las empresas privadas. Considero que esto será muy beneficioso en España, como lo fueron los *Mentoring Programmes* llevados a cabo en Estados Unidos, y sostengo que un desarrollo legal adecuado de las normas jurídicas que ya existen, que propicie la integración de la igualdad en la formación sería, a largo plazo, muy beneficioso para el logro mantenido del equilibrio y la igualdad material, que ya no precisaría de medidas de acción positiva.

De ahí que la metodología aquí propuesta -educativa y divulgativa en la juventud pre-universitaria y universitaria- mediante la filosofía holística del *Gender Mainstreaming* tenga la máxima importancia, desde mi punto de vista.

Y más en concreto, se propone que en toda la docencia de las asignaturas jurídico-mercantiles y de empresa, se aluda o se aborde, de forma directa y principal, a la Ley Orgánica de Igualdad española, que es el principal foco normativo de nuestro Ordenamiento Jurídico, junto a la Constitución, y se haga referencia a la existencia de las normas internacionales referidas, al menos resumidamente para que los discentes puedan visualizar la problemática social de la brecha de género y para proporcionarles *una visión crítica de la situación real y legal*. De nada sirve que haya textos legales tan importantes si en la juventud preuniversitaria y universitaria siguen siendo desconocidos por completo.

Particularmente, desde el punto de vista del docente de asignaturas de empresa y de Derecho mercantil se debe mostrar a los discentes en todo caso:

- Cómo los juristas partimos de la atenta observación de la realidad social, que es la brecha de género en la empresa y la inexistencia de mujeres -o minorías- en los órganos de mando de las empresas en todo el mundo, y de forma acusadísima en España, y la falta de conciencia social de que esto suponga un problema.
- Qué dicen nuestras leyes para acabar con ese "techo de cristal" para las mujeres y para acabar con la posible discriminación de cualquier persona perteneciente a una minoría o de cualquier género.
- Un marco de reflexión crítica sobre la cuestión de la ausencia de mujeres y minorías en los órganos de poder de las empresas, que pasa desapercibida en la sociedad y en la que se reflejan los valores de la cultura que tenemos y de la sociedad a la que aspiramos.
- Y al hilo de estas importantes cuestiones debe intentarse que los alumnos perciban que el Derecho, en general, y en concreto el Derecho de empresa, es algo útil, cercano, muy interesante y que sirve realmente para mejorar nuestra vida diaria y nuestro futuro.
- La regulación -al menos básica- sobre igualdad material de las personas y su repercusión directa en todas y cada una de las instituciones del Derecho privado (empresa, sociedades, seguros, publicidad, etc.).

El sentido de todo ello es propiciar, mediante este impulso metodológico (en especial en la docencia del Derecho privado, de empresa y económico), un paso adelante en la sociedad,

para concienciar de un problema de desigualdad material que, de otro modo, seguirá pasando desapercibido para todos (docentes y discentes), perpetuándose modelos estereotipados.

Sostengo que en la metodología docente de las materias jurídico-privadas han de abordarse estas cuestiones y que debe analizarse la forma de implementar las medidas metodológicas en cada caso, en cada asignatura (y especialmente en las jurídico-sociales) para dar aplicación a las normas jurídicas constitucionales y para conseguir que la transferencia y la creación del conocimiento en las Universidades españolas no perpetúen un sistema desigual, sino que afiancen la dignidad y la igualdad de todas las personas como valores universales y como herramientas de seguridad, paz y desarrollo social.

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Viaje por el Derecho de la Empresa a través del mundo de las Artes

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Abstract

I propose a journey never taken: learning Business Law through the Art world. Far from being separated, Arts and Laws are linked, because both are cultural manifestations. Our trip suggests a completely innovative and experiential approach to the study of the Business Law from the artworks. It pursues a holistic, different, meaningful and long-lasting learning through the Architecture, Sculpture, Painting, Music and Dance, Literature and Films.

Keywords: Law, Arts, Business, significant learning, learning by experiencing, true long lasting learning, Architecture, Sculpture, Painting, Music and Dance, Literature, Films.

Resumen

Se propone un viaje que nunca se ha emprendido: El aprendizaje del Derecho de la empresa a través del mundo artístico. Lejos de estar separados, el Arte y el Derecho están unidos, porque ambos son manifestaciones culturales. Nuestro viaje sugiere una forma vivencial y completamente innovadora de abordar el estudio del Derecho de la empresa a partir de obras del Arte. Se persigue un aprendizaje holístico, diferente, significativo y duradero a través de la Arquitectura, la Escultura, la Pintura, la Música y la Danza, la Literatura y el Cine.

Palabras clave: Derecho, Artes, empresa, aprendizaje significativo, aprendizaje vivencial, aprendizaje duradero, Arquitectura, Escultura, Pintura, Música y Danza, Literatura y Cine.

Introducción

Ahora cuando me dispongo a repasar este pequeño escrito me doy cuenta de que, siendo sincera, mi objetivo principal ha sido disfrutar escribiéndolo. Otro objetivo real es que resulte ameno para usted, lector. Y finalmente quiero comenzar a reflejar aquí lo que espero abordar con mucha más profundidad y atención en el futuro y que ahora, por razones de tiempo y espacio no se puede alargar: una metodología “revolucionaria” para los juristas y para las ciencias sociales, en especial para los mercantilistas o los docentes relacionados con el Derecho de la empresa, pero en la que confío, pues propiciará una formación holística y más crítica y duradera.

Un grupo de músicos debe realizar un encargo: crear una partitura musical para un himno. Finalizada la obra, el gestor, corrupto y desleal les ofrece una comisión. Los comisionados contestan “No, ¿por quién nos toma? Como vamos a pedirle el 20 por ciento de sus honorarios. El 20 por ciento es para usted, el 90 por ciento para nosotros”. (Les Luthiers, 2017)

Si usted se dispusiera a estudiar en este momento la temática de la retribución de los administradores o los gestores en las empresas, o debiera explicar la lealtad en la gestión de los negocios y la responsabilidad que se genera por las conductas desleales a través del ejercicio de complejas acciones de responsabilidad civil el panorama a la vista sería arduo. Sin duda será difícil captar la atención durante el largo rato que dicha explicación conllevará. Sin embargo, con un texto satírico literario como el reflejado, obra de los recién nombrados Premio Príncipe de Asturias de la Comunicación, sin duda la atención se captará mucho mejor y, lo que es más importante, se entenderá de un golpe de qué estamos hablando y el trasfondo que hay tras las conductas desleales en el mundo de las empresas. Además se suscitará la curiosidad para saber qué hay que hacer para perseguir esas conductas y la pregunta de cuáles son los resultados prácticos cuando se acude a los tribunales fuera de los sonados y frecuentes casos del mundo mediático. Analizar entonces aquellas normas se hará mucho más atractivo.

Este trabajo quiere resaltar la unión entre el Arte y el Derecho (Niño, 2011), pero desde una perspectiva muy diferente a la tradicional, que únicamente atiende al Derecho del Arte y rompe cualquier otra vía de comunicación entre Arte y Derecho.

El Derecho del Arte es un sector del Derecho que regula los aspectos legales relacionados con las obras de arte: su subasta, movimientos transfronterizos de las obras, imitaciones, derechos de autor... Sus protagonistas son los propios artistas, los adquirentes de obras de arte, los coleccionistas, museos, galeristas y las casas de subastas.

Mi propuesta, en cambio, va por un camino diametralmente opuesto. No es el Derecho del Arte sino *el Derecho a través del Arte*, y tiene como protagonistas a los discentes, a todos los que se acerquen al mundo jurídico económico o empresarial, bien desde el ámbito de los Grados o bien desde la formación anterior –Bachilleratos- o posterior –Doctorado, Másteres

o especialización profesional- para adquirir conocimientos vivos y críticos a partir de las experiencias artísticas. Se formula una propuesta integradora de aprendizaje especialmente interesante para los que compartan la pasión por el arte.

Si buscamos en toda la doctrina existente un estudio sobre la relación Arte-Derecho fuera de este marco del Derecho del Arte apenas encontraremos alguna referencia aislada (Nina, 2010) y casi siempre referida al ámbito filosófico (Gallego Morell, 1993). Carnelutti, para quien el Arte, como el Derecho, sirve para ordenar el mundo, en 1948, realizó un trabajo titulado *Arte del Derecho*, en el que considera, por ejemplo, un artista al legislador (“pintor” del Derecho). Salvo esta aportación, sobre la utilización de las Artes como *recursos* para el aprendizaje del Derecho no hay estudios específicos, quizá porque se han visto los dos mundos –el jurídico y el artístico- totalmente distantes (normas que atan frente a libertad creativa), excepto en el caso del recurso del cine. Y mucho menos hay estudio alguno, que yo haya podido localizar, sobre el Derecho de la Empresa y las Bellas Artes.

El arte (del latín *ars, artis*, y este del griego *τέχνη téchnē*), desde el punto de vista que ahora me interesa (segunda acepción del término), es la manifestación de la actividad humana mediante la cual se interpreta lo real o se plasma lo imaginado con recursos plásticos, lingüísticos o sonoros (Real Academia Española de la Lengua, 2014). Si bien el concepto fundamental de Arte no varía con el paso del tiempo (Muñoz Martínez, 2006), sí cambian sus formas y contenidos, y siempre, de alguna forma, reflejan, desde mi punto de vista, la realidad social donde ha surgido la creación o la realidad imaginada como forma de evasión o de superación de esa realidad. Por tanto, de un modo u otro, el Derecho sí está en el Arte. En todas y cada una de las obras de arte. Pero no en ellas mismas como objeto (sería oportuna entonces la pregunta ¿de quién es el cuadro? ¿Quién compuso la obra? ¿Cómo puede transmitirse?) sino que el Derecho está, en mi opinión, *dentro* de cada obra de arte, en su espíritu. Y transmiten mensajes que van mucho más allá de la literalidad, que pueden ser utilizados, real o metafóricamente, para explicar la actualidad jurídica o los objetivos a los que deben tender las normas.

Lo que me propongo es mostrarle a usted, lector, que quizá no es jurista, o a usted, conocedor del Derecho de la empresa y los negocios, que sí es posible acceder al conocimiento de las instituciones del Derecho mercantil de una forma amena y significativa a través de las Artes. Manejaré en este pequeño estudio las siete Bellas Artes, en el concepto acuñado por Batteaux en el siglo XV (De Sá Tavares, 2017): la Arquitectura, la Escultura, la Pintura, la Música y la Danza, la Literatura (que engloba al teatro) y el Cine.

2. Comencemos nuestro itinerario

2.1. La arquitectura

Hay innumerables escenarios arquitectónicos relevantes para el Derecho de la empresa que podríamos visitar, todos ellos fascinantes, como los barrios gremiales medievales donde surgió el medieval y primer Derecho de la empresa, hasta los grandes edificios de las multinacionales, rascacielos gigantes (tantas veces con pies –jurídicos- de plomo), los barrios del centro de cualquier ciudad occidental (plagados de publicidad y marcas, también objeto del Derecho empresarial), o la visita virtual (que propongo en todos mis cursos) a nuestro Tribunal Supremo (del Siglo XIX, solemne y lleno de símbolos sobre la supremacía de la Ley) y al moderno Tribunal Constitucional (surgido con nuestra Constitución Española de 1978).

Sin embargo propongo un ejemplo arquitectónico especial, cuya imagen puede conducirnos a hablar durante horas de los nuevos valores a los que atiende, a los que no atiende, y a los que debe atender el nuevo Derecho de la empresa. La protección de los consumidores, de los usuarios, la protección del medio ambiente. La necesaria responsabilidad de las empresas contaminantes o que causan daño a las personas o a los colectivos. La necesidad de que el Derecho mercantil atienda a los más débiles o desprotegidos frente a las estructuras empresariales deshumanizadas. La influencia de la industrialización y de la producción en serie y en masa en nuestra materia. La importancia del transporte, de los seguros de responsabilidad civil... Se trata de toda una ciudad: la ciudad de Springfield.



Figura 1. La ciudad de Springfield de Los Simpson

El 12 de abril de 1991, en una presentación en el programa de la Sociedad Estadounidense de Editores de Periódicos (emitido por C-SPAN), Matt Groening dijo que el subtexto de *Los Simpson* es que: “Quienes están en el poder no siempre tienen en la mente vuestros mejores intereses”. *Los Simpson* se basa en la desconfianza hacia el poder que se encuentra alejado

de la gente común y corriente (Cantor, 2009) y, desde mi punto de vista, se basa también en la separación, tan frecuente, entre los intereses de los ciudadanos y los intereses protegidos por las leyes.

2.2. La escultura

Una parte clave del Derecho empresarial es el bloque de los títulos valores, como el cheque, el pagaré o la letra de cambio. Partiremos de la escultura para acercarnos a estas instituciones, que nacieron para facilitar el crédito en la edad Media. ¿Sabía usted que en España, en Medina del Campo, existe un monumento dedicado especialmente a la Letra de Cambio? Es este:



Figura 2. Monumento a la primera Letra de Cambio en Medina del Campo

La razón de la existencia de este monumento es que en Medina del Campo se cree que se firmó la primera Letra de Cambio, girada el 2 de julio de 1553 por Ginaldo Giovanni Battista Storxxi sobre Besançon precisamente como consecuencia del inmenso apogeo de las Ferias Internacionales de esta localidad (Del Sol Hernández, 2015).

Con aquellas *litteras* o cartas de cambio, y dado que prestar dinero estaba totalmente prohibido por el Derecho eclesiástico de la época, se aseguraban liquidez y crédito en el ámbito internacional. La institución de la Letra de Cambio se mantiene hasta hoy con un régimen que siempre ha conservado sus tintes de homogeneidad internacional y su carácter de base para todos y cada uno de los títulos valores. A partir del estudio de las antiguas letras y del análisis de su regulación actual podremos comprender el papel de los firmantes (el librador, el librado, el avalista...) y veremos las excusas que se pueden oponer al pago de la letra y las características del procedimiento de reclamación del importe de la letra a los que la hayan firmado. Observaremos cómo los operadores económicos de aquel pasado, y de siempre, acuden a medios ingeniosos y prácticos cuando las normas jurídicas prohíben o frustran las expectativas en los negocios y en la vida económica. Además insistiremos en las características permanentes en la historia y visibles si cabe con más fuerza hoy, del Derecho

de la Empresa: riguroso (compromiso por la firma), ágil (juicios rápidos, con pocos motivos de oposición), basado en la confianza, universal (régimen mundial porque los comerciantes exigen y han exigido siempre un mercado sin barreras) y basado en la protección de la apariencia y de la seguridad del tráfico. Que una institución mercantil (recuérdese que hablamos de la letra de cambio, no de la Justicia o el Derecho -bien representados escultóricamente desde la Antigüedad- sino de un simple trozo de papel) goce de un monumento propio nos explica mucho de la importancia de estos títulos.

2.3. La pintura



Figura 3. Washington cruzando el Delaware en la noche de Navidad de 1776 Fuente: Emanuel Leutze, 1851. Museo Metropolitano de Arte, Nueva York

El Congreso Continental no adoptó oficialmente la bandera que aparece en el cuadro hasta el 14 de junio de 1777 pero, según la tradición, Betsy Ross había terminado una bandera con este diseño a fines de mayo o principios de junio de 1776 a pedido de George Washington y otros dos miembros del Congreso. Leutze, que era abolicionista apasionado, incluyó en su cuadro a un afroamericano, el tercer tripulante contando desde la proa. Este cuadro de Washington cruzando el Delaware es totalmente significativo para comprender el Derecho de sociedades y empresas mundial. ¿Sabía usted que Delaware es un pequeño Estado de EEUU, pero allí están domiciliadas casi todas las sociedades americanas y muchísimas internacionales? ¿Y sabía usted que el actual foco creador del Derecho mercantil de sociedades está allí y que de allí vienen los vientos de nuestras reformas en Derecho de Sociedades? Veamos un ejemplo. Sus normas mercantiles, extraordinariamente liberales y flexibles, han dado lugar a la configuración de una figura, la *Business Judgment Rule*, como una presunción de actuación correcta de los administradores de las empresas en la adopción de decisiones empresariales, y atribuye a los demandantes del daño y los perjuicios sufridos por una mala gestión el deber de desvirtuar esa presunción o “puerto seguro” para los

administradores. Esta normativa se ha acogido en toda Europa como normativa legal. Y también en nuestra Ley de Sociedades de Capital (226 Ley de Sociedades de Capital). Rompe con nuestra legislación de sociedades, que tenía hasta ahora normas extremadamente duras y exigentes para los administradores desleales o incumplidores. En el fondo late en la reforma el reconocimiento y la protección de un espacio de inmunidad de los administradores en la toma de decisiones por operaciones o negocios desafortunados. Esta normativa, que es hoy Derecho positivo, nos debe introducir a la explicación de las nuevas instituciones jurídicas societarias y sus también novedosos valores inspiradores, como, por ejemplo, la potenciación del papel de los jueces, que serán finalmente quienes calibrarán la conducta de los gestores de las empresas. Insistiremos también en la internacionalidad de las instituciones mercantiles y atenderemos, desde una visión crítica, a los riesgos que entraña la importación de elementos foráneos a nuestra cultura jurídica en el río revuelto de las crisis económicas y de valores.

2.4. La música y danza

El recurso a la música es definitivo en una clase. Sencillamente resultará inolvidable para los alumnos, sobre todo de Derecho, que no están acostumbrados a nada similar. La música puede servir como recurso “de fondo” cuando se realiza una práctica o un comentario individual. Sin embargo aquí se propone usar la letra y la música de una canción como ilustrativa de un tema o de alguna institución.

Hay muchísimas canciones que hablan del dinero: por citar algún ejemplo de las canciones conocidas podemos citar de Listas.20minutos.es, 2017) *Money Money Money* de Abba, *Price Tag* de Jessie J., *Money* de Pink Floyd, *Material Girl* de Madonna, *Money for Nothing* de Dire Straits, *Money (That's what I want)*, *Don't Stop Spending All Your Money On Me*, de Black Eyed Peas, *Not All About The Money* de Timati & La La Land Feat... Muchas otras se refieren a las empresas, a la alienación en el trabajo, a la naturaleza, al medio ambiente y a su destrucción por la falta de respeto a nuestro planeta por parte de todos (no puedo dejar de mencionar *Earth Song* y *Heal the World* de Michael Jackson, 1995 y 1991 respectivamente y la bellísima *Colores en el viento*, banda sonora de *Pocahontas*, 1995, que grita contra la ausencia de responsabilidad social de todos y la apropiación irrespetuosa de la naturaleza), a la ausencia de valores en la sociedad y en las empresas, canciones con tintes sociales y otras que usan estas temáticas del Derecho de la empresa tangencialmente en un contexto de otros temas...

Sin embargo no he tenido duda para esta pequeña presentación. Aporto aquí *Superwoman* (Alicia Keys, 2009), como un pequeño homenaje a todas las personas, y en especial a todas las mujeres que, en todos los campos de su existencia, pueden volar y puede construir un mundo mejor, también en el Derecho de las empresas, en el que la discriminación en los Consejos de Administración (como se refleja en el vídeo) es tan brutal que hasta la Unión Europea tiene como línea principal de acción su erradicación. En su día dirigí un Proyecto Internacional I+D+I (2007-2012) sobre esta temática, tan importante. Muchos años después

no se ha avanzado en la Responsabilidad Social Empresarial ni en materia de género. Me parece muy importante que los discentes de la disciplina conozcan, críticamente, las líneas que marca el Derecho, lejos de la realidad social y económica, en esta problemática.



Figura 4. Alicia Keys. Superwoman Fuente: <https://www.youtube.com/watch?v=-AphKUK8twg>

2.5. La literatura

Cuando comencé a escribir este pequeño resumen estaba decidida a centrar mi referencia en algún clásico: uno entre los grandes gigantes literatos españoles, cualquiera de los siempre sorprendentes textos literarios de la antigüedad clásica -con su permanente búsqueda de la verdad, de la lealtad, de lo cierto, de la idea de Justicia-, de la literatura más moderna, sin olvidar las novelas optimistas y confiadas en el Derecho, como la importantísima aportación de clásicos como Julio Verne, o la más decepcionada y negra visión de la colonización y la generación de un Derecho injusto y discriminante de Joseph Conrad (pensemos en la desoladora *El corazón de las tinieblas*, 1899), sin olvidar la inmensidad de la literatura contemporánea (tentada estuve de centrarme en *La catedral del Mar* de Ildefonso Falcones, por su inigualable tratamiento del incipiente Derecho mercantil y la inmensa influencia del Derecho español en el Derecho de la navegación).

Sin embargo me he decantado finalmente por una obra centrada en Japón, que puede transmitirnos la visión más clara de la globalización de los mercados, de la uniformación de las normas y de las formas de las transacciones en el Derecho de las empresas a nivel mundial. Se trata de *Estupor y temblores*, de Amelie Nothomb (2006), en la que, de forma en parte autobiográfica, la escritora relata su estancia laboral en Tokio trabajando para la gran compañía Yumimoto, empresa en la que sufre la alienación y la mayor discriminación posible por su origen europeo y por su condición de mujer. He aquí algunos fragmentos (Hondall, 2013) no del todo significativos porque la obra sobrevuela el mundo de la empresa en todas sus páginas y debe reflexionarse sobre ella en su conjunto:

"El ventanal, al fondo del vestíbulo, me aspiró como lo habría hecho la ventanilla toda de un avión. Lejos, muy lejos, se veía una ciudad tan lejos que dudaba haberla pisado jamás".

"Me pidió que lo siguiera por innumerables e inmensas salas, en las que me presentó a multitud de personas, cuyos nombres yo iba olvidando a medida que él los iba pronunciando".

"Al igual que los ceros, los empleados de Yumimoto sólo adquirirían algún valor cuando se situaban detrás de otras cifras. Todos menos yo, que ni siquiera alcanzaba la categoría de cero".

¿Y fuera de la empresa, qué les esperaba a aquellos contables de cerebro lavado por los números? La cerveza obligatoria con colegas tan trepanados como ellos, horas de metro abarrotado, una esposa que ya duerme, el sueño que te aspira como el desagüe de un lavabo que se vacía, las escasas vacaciones en las que nadie sabe qué hacer: nada que merezca el nombre de vida".

"Aquella constatación me recordó la frase de André Maurois: "No hables demasiado mal de ti mismo: podrían creerte". (Amelie Nothomb, 2006)

En la obra se muestra, con un inmenso sentido del humor, que el globo es ya una villa y que las inquietudes del Derecho mercantil son las mismas, y con respuestas globales y muy similares, en todas partes, a los mismos problemas de enormes empresas deshumanizadas o deshumanizantes, de jerarquías inamovibles, de discriminación maquillada por razón de género o raza...

2.6. El cine

En cuanto a Derecho mercantil y cine sí contamos con numerosas y valiosas contribuciones, algunas muy relevantes para poner en relación el Derecho de la Empresa y el cine. Son muchos los especialistas que se han dado cuenta de la posibilidad de aprovechar todo el potencial del cine para explicar contenidos propios de nuestra disciplina. Las nuevas series de abogados, los clásicos como *Perdición (Double indemnity, 1944*, ideal para estudiar el mundo de los seguros), *Lloyds's of London (1936*, estupenda para analizar la génesis del mercado del seguro marítimo), *Gilda (1946*, perfecta para el estudio de los cárteles), la maravillosa *¡Qué bello es vivir! (It's a wonderful life, 1946*, absolutamente recomendable – en su día dirigí yo un curso sobre Derecho de la empresa y cine, fuente de momentos mágicos, y esta fue mi película escogida como principal- por su reflejo del mundo de las pequeñas sociedades mercantiles, la responsabilidad de los administradores, las entidades de crédito, los valores de la confianza y la apariencia en el mundo mercantil, etc.), o más actuales como *El dilema (The insider, 1999*, sobre el mundo de los secretos de la empresa), *La red social (The Social Network, 2010)*, *Margin Call (2011*, sobre las crisis financieras con vasos comunicantes en la sociedad globalizada), y muchas más, son perfectas para ambientar situaciones, problemas de la práctica viva y fomentar un estudio crítico y un aprendizaje duradero del Derecho.

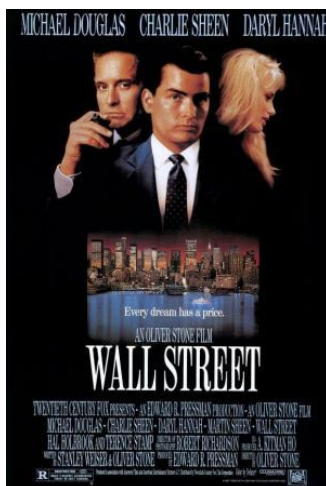


Figura 5. Wall Street (1987)

Entre tantas he escogido como botón de muestra *Wall Street*, de Oliver Stone (1987), que *Wall Street* refleja con dureza y transparencia el mundo frío de los mercados mobiliarios, base de nuestro sistema capitalista. Ante expresiones como las que se escuchan en la película ("La información es lo más valioso del mundo"; "si quieres un amigo, cómprate un perro"; "la ambición es buena, es necesaria y funciona"; "lo que importa es el dinero, el resto es pura conversación"; "el dinero ni se gana ni se pierde, pasa de unas manos a otras como por arte de magia"; "lo malo del dinero es que te obliga a hacer cosas que no quieres"; "sal y produce algo en vez de hacer el dinero comprando y vendiendo gente"), se lleva a los alumnos a plantearse de forma crítica la conveniencia o no de regulación imperativa –obligatoria– en el mundo de los mercados de valores, especialmente cuando se trata del uso y abuso de información privilegiada. *Wall Street* permite el acercamiento a varios conceptos jurídicos complejos de una forma amena y realista. Por ejemplo, podrá apreciarse qué es información privilegiada, qué consecuencias puede tener el uso y el abuso de la misma, qué es el *insider trading*, qué es la toma de control de una sociedad por otra, qué es una opa, cómo puede un gran accionista o un analista de inversiones manipular el mercado de capitales, qué pueden hacer los trabajadores, los pequeños accionistas, la prensa, la inspección, qué papel juega la ética en los negocios, el tratamiento del Derecho privado y del Derecho público sobre el mundo de las finanzas y la especulación financiera, etc.

3. Conclusiones

Comparto que el arte es un mágico misterio y a la vez un maravilloso aspecto de la condición del ser humano, el “lugar” donde se expresa lo inmaterial de la realidad, la esencia de ésta (Muñoz Martínez, 2006). He tratado de mostrar que se puede utilizar exitosamente el arte como instrumento de comunicación y de transmisión de ideas culturales y jurídicas para la docencia de un curso completo de cualquier asignatura de Derecho empresarial.

Confío en que usted haya pasado un rato agradable leyendo este pequeño trabajo sobre una propuesta metodológica totalmente innovadora para el aprendizaje duradero del Derecho de la Empresa, y que quizá haya reflexionado sobre alguno de los fascinantes problemas de esta disciplina. En cualquier caso, muchas gracias por su atención.

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Gamificación a través de Kahoot como innovación docente en el Grado de Logopedia

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Abstract

The subject of Neurology had shown little interest in changes in educational method. Kahoot, a gamification tool, was established as a new pedagogical method in the part of Neurology of the subject Biological Foundations of Language in the first course of the Degree of Speech-Therapy. This new game-based learning increased student interest and importance of Neurology in future Speech-Therapists. In order to achieve the acquisition of theoretical knowledge, Information and Communication Technologies were implemented. The degree of satisfaction of the students and the teaching staff was high; this success invites to perform a complete change of the teaching methods of the subject of Neurology, both in the Degree of Speech-Therapy and in other Degrees where the subject is also taught.

Keywords: : *innovation, speech-therapy, game-based learning, Kahoot..*

Resumen

Hasta ahora, la docencia de la asignatura de Neurología había mostrado escaso interés en cambios del método docente. Mediante la herramienta de gamificación de Kahoot se ha establecido un método pedagógico novedoso en la parte de Neurología de la asignatura Fundamentos Biológicos del Lenguaje de Neurología del primer curso del Grado de Logopedia que ha permitido incrementar el interés del alumnado por la asignatura, así como ha facilitado la adquisición del conocimiento teórico a través de la utilización de las Tecnologías de la Información y la Comunicación. El grado de satisfacción del alumnado y del profesorado ha sido alto, dato que invita a incidir en el cambio de los métodos docentes de la asignatura de neurología, tanto en el Grado de Logopedia como en otros Grados donde se imparte la asignatura..

Palabras clave: *innovación, logopedia, gamificación, Kahoot.*

Introducción

La asignatura de Fundamentos Biológicos del Lenguaje es una asignatura de Carácter Básico del Grado en Logopedia correspondiendo a 6 ECTS. Se cursa en el primer cuatrimestre del primer curso, la asignatura es impartida de forma conjunta por las Áreas de Fisiología y Medicina. En concreto, la parte de Medicina depende de los profesores adscritos al área de Neurología impartiendo el conocimiento teórico en forma de clases magistrales. Creemos que este sistema pedagógico aleja a los alumnos del primer curso que acaban de llegar al ámbito universitario sin conseguir captar su interés por unas enfermedades importantes en su futuro profesional (Eurolo, 2004), sobre todo, en relación con el cambio pedagógico que propone el Espacio Europeo de Educación Superior (Cruz 2007, de Miguel 2006).

Las tecnologías educativas innovadoras se han desarrollado con el fin de obtener una mayor participación de los alumnos en la clase, así como facilitar la adquisición habilidades para el aprendizaje del alumnado (Naeve, 2013). Estas tecnologías se pueden acompañar de plataformas on-line, algunas de ellas con la ventaja de ser gratuitas, que incrementan la facilidad para captar la atención e interés de los alumnos, puesto que pertenecen a una generación que se ha desarrollado paralelamente a internet y otras habilidades informáticas (Ames, 1992).

Los juegos y elementos similares a los juegos han comenzado a invadir el mundo real. La gamificación (derivado del inglés, game-based learning), se define como el uso de mecánicas y dinámicas del juego con el fin de crear marcos para promover los comportamientos deseados. La gamificación ha encontrado su camino en diferentes ámbitos como: marketing, política o salud, con predicciones augurando que se convertirá en una multiindustria de millones de euros (Schell, 2010)

La intuición sugiere que la gamificación puede ser capaz de motivar a los estudiantes a aprender mejor y a preocuparse más por el estudio. Con el fin de implementar la gamificación, hay que evaluarla por sus beneficios y desventajas, explorar las implementaciones actuales y posibilidades, así como comprender mejor la lógica teórica detrás de la gamificación. Esto nos permitirá crear unas intervenciones más eficaces en la innovación docente (Lee, 2011). La gamificación educativa propone el uso del juego como un sistema de reglas, experiencias de los jugadores y roles que consigue además de transmitir conocimiento, ayudar a formar el comportamiento de los estudiantes (Squire, 2005).. De este modo, la gamificación incide en tres áreas principales en las que la gamificación puede servir como una intervención:

- Cognitiva: Los juegos guían a los jugadores a través del proceso de dominio y los mantienen comprometidos con tareas difíciles (Koster, 2004).
- Emocional: Los juegos invocan una gama de emociones poderosas: curiosidad, frustración o alegría; y proporcionan muchas experiencias emocionales positivas, como el optimismo y el orgullo. También ayudan a los jugadores a combatir sus experiencias

emocionales negativas e incluso a transformarlas en positivas. (Lazarro, 2004; McGonigal, 2011).

- Social: Los juegos permiten probar nuevas identidades y roles, con toma de decisiones desde otros puntos de vista. Los jugadores también adoptan roles que son ficticios, explorando nuevos lados de sí mismos en el espacio seguro del juego que nunca desarrollarían sin gamificación (Gee, 2008).

Kahoot, es una plataforma de aprendizaje basada en el juego, que permite a los educadores y estudiantes integrar, crear, colaborar y compartir conocimientos. Kahoot es una herramienta de gamificación gratuita que es utilizada por alumnos a lo largo de todo el mundo debido a su diseño atractivo y por su facilidad de manejo, tanto para el profesor como para el alumno. Por su simplicidad en el manejo se Kahoot es una excelente herramienta de gamificación. comunicaciones comenzará siempre en la página 2 dejando la primera página para los metadatos. Tendrán una extensión mínima de 5 páginas y máxima de 15.

1. Objetivos del Proyecto

Se propone innovar el método docente con los siguientes objetivos:

- Incrementar la inquietud por el conocimiento, la motivación y el grado de satisfacción del alumnado en el estudio de la asignatura.
- Implementar la gamificación como tecnología educativa innovadora, con el consiguiente incremento de diferentes aspectos en el aprendizaje universitario como son la motivación, el esfuerzo, la fidelización y la cooperación.
- Utilización positiva de los dispositivos móviles dentro de las Tecnologías de la Información y la Comunicación, con la finalidad de la adquisición de una competencia digital imprescindible en una sociedad cada vez más tecnológica. títulos tendrán un máximo de tres niveles numerados con el sistema decimal.

2. Descripción del proyecto

El trabajo comenzó a organizarse en los dos primeros meses del curso. Se escogieron dos clases del final del curso cuyo tema versaba sobre las infecciones del sistema nervioso y demencias que se impartieron los días 14 y 28 de noviembre de 2016, respectivamente), constando cada una de las clases de dos horas. Previamente ya se habían impartido varias clases teóricas dedicadas a la parte de la Neurología de la asignatura.

Ya desde de la primera clase impartida por el profesor implicado en el Proyecto de Innovación a principios del mes de noviembre, se fue comunicando a los alumnos el futuro cambio en la metodología docente. De este modo, se comunicó al alumnado el cronograma del proyecto de innovación.

Básicamente, el proyecto de innovación consistió en impartir dos clases de la parte de Neurología de la asignatura de Fundamentos Biológicos del Lenguaje con un novedoso método pedagógico basado en la gamificación y en el uso de dispositivos móviles

Para la gamificación se escogió la herramienta gratuita Kahoot que se puede conseguir online y se trabaja de forma “streaming” y, por lo tanto, no es necesario descargar ningún contenido ni instalar aplicación alguna. Tiene la ventaja que se utiliza en cualquier dispositivo móvil, pudiéndose utilizar en teléfono móvil, tableta u ordenador portátil. Se consideró ventajosa la facilidad del manejo Kahoot, siendo suficiente unos breves minutos de explicación acompañado de una mínima práctica para reconocer su sencillo manejo.

De manera sencilla, las clases con gamificación con la herramienta Kahoot se llevó a cabo de la siguiente manera:

- La semana previa a las clases, a los alumnos se les indicó que conociesen la presentación de las clases teórica a impartir accesibles en el Aula Virtual de la Universidad de Oviedo. Indicándoles también que debían traer un dispositivo móvil los días de las clases con Kahoot.
- El día de la clase expositiva, durante la primera media hora de la clase, los alumnos plantearon dudas o aclaraciones sobre los conceptos teóricos estudiados previamente.
- Durante la hora siguiente se utilizará Kahoot en cada uno de los dispositivos móviles de los alumnos tras una explicación sobre su funcionamiento.
- Se plantearon 15 preguntas con 4 respuestas múltiples siendo sólo una de ellas correcta en cada una de las clases, versando las preguntas sobre el tema indicado previamente (figura 1).



Figura 1. Pantalla del ordenador principal del aula compartida por alumnos y profesor.

- Los alumnos deben responder en un tiempo determinado, que será regulado por el profesor en función de la dificultad de la pregunta (figura 2). Transcurrido el tiempo, en el ordenador del aula aparecerán los resultados en conjunto y en el dispositivo móvil de cada alumno sus propios resultados.

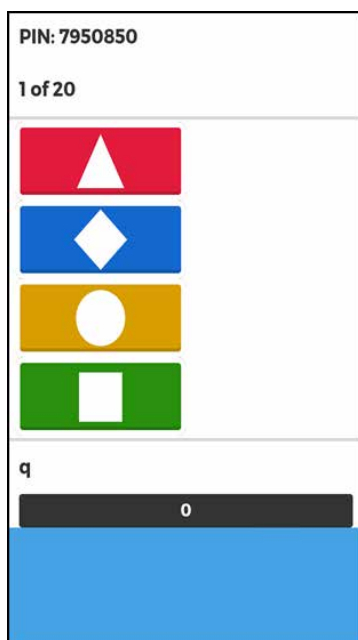


Figura 2. Pantalla que cada alumno veía en su dispositivo móvil con las posibles respuestas.

- Por último, en la última media hora de la clase, se hará una aproximación a los contenidos de la clase con el fin de aclarar y afianzar conceptos en función de los resultados de las preguntas.
- El profesor realizó un trabajo previo teniendo que definir cada una de las preguntas (figura 3), cuatro respuestas posibles con sólo una correcta, un tiempo máximo de contestación: así como, una foto o vídeo que pueda ayudar a entender el concepto de la pregunta.

Dadas las peculiaridades del Proyecto de Innovación no fue necesario incrementar ni modificar los recursos utilizados habitualmente en la asignatura:

- La página web de la asignatura.
- Proyector y ordenador de aula.
- Cada alumno debía aportar su propio dispositivo móvil, sobre esta parte no surgió ningún problema puesto que todos los alumnos aportaron su dispositivo móvil por lo que no hubo necesidad de utilizar ningún recurso informático de la Universidad.

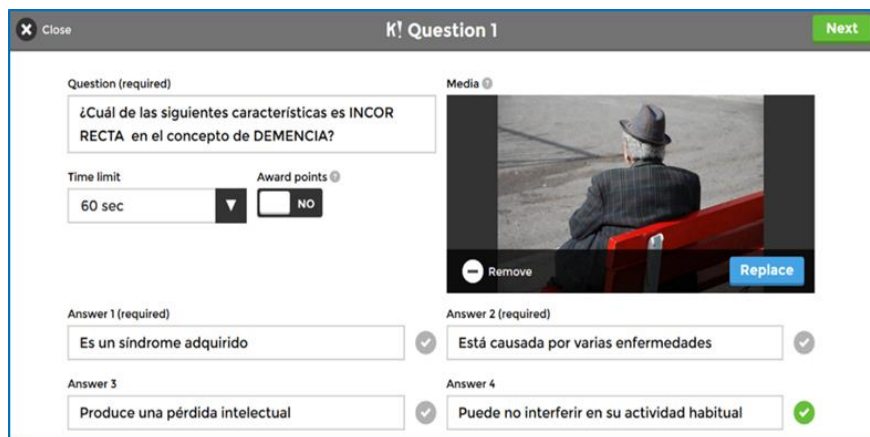


Figura 3. Diseño de la pregunta realizada por el profesor previa a la clase.

3. Indicadores propuestos para evaluación

3.1 Evaluación de grado de satisfacción del alumno:

Con el fin de conocer la satisfacción del alumnado con el Proyecto de Innovación Docente, se realizó una encuesta que consistía en 10 preguntas con cinco tipos de respuestas en una escala Likert con 5 posibles niveles de acuerdo: Muy en desacuerdo, En desacuerdo, No estoy seguro, De acuerdo, y Muy de acuerdo. Como marco temporal para responder a la encuesta se estableció una semana desde el día 9 de diciembre al 16 de diciembre, aunque se amplió una semana más hasta el 23 de diciembre de 2016 con el fin de alcanzar el máximo número de respuestas.

Los rangos establecidos de puntuación global fueron (con una puntuación posible desde cero a 50 puntos):

- 0-10 puntos: muy bajo.
- 11-20 puntos: Bajo.
- 21-30 puntos: Aceptable.
- 31-40 puntos: Bueno.
- 41-50 puntos: Muy bueno.

3.2 Evaluación con Kahoot

Media de las puntuaciones de los alumnos obtenidas en las preguntas realizadas a través de Kahoot

- 0-30 % de acierto en las respuestas: Bajo.
- 31-70 % de acierto en las respuestas: Aceptable.
- 71-100% de acierto en las respuestas: Bueno.

Este fue el indicador propuesto de más difícil análisis probablemente debido a la inexperiencia del profesorado. El poco tiempo entre preguntas que establece la aplicación, así como la dificultad para establecer una media en la respuesta de todos los alumnos impidió establecer una medida realmente objetiva de este indicador.

3.3 Evaluación de la asistencia a clase:

El baremo establecido fue:

- Asistencia en clase innovación menor con respecto a clase expositiva: Malo.
- Asistencia en clase innovación igual con respecto a clase expositiva: Aceptable.
- Asistencia en clase innovación mayor con respecto a clase expositiva: Bueno.

3.4 Comparativa entre las calificaciones del curso anterior (15-16) y actual (16-17):

El baremo establecido consistió:

- Mejores calificaciones en el curso anterior: Malo.
- Iguales calificaciones: Aceptable.
- Mejores calificaciones en el curso actual: Bueno.

4. Evaluación de los indicadores propuestos

4.1 Grado de satisfacción del alumno:

Las respuestas para las diferentes preguntas de la encuesta fueron las siguientes (expresadas en números de respuestas y % sobre el total de las respuestas)

1. Tengo mucho interés por las últimas tendencias tecnológicas: 20 respuestas (83,33 %)
2. Me gusta utilizar el teléfono móvil en clase: 15 respuestas (62,50 %)
3. Prefiero las clases con tecnología informática: 12 respuestas (50,00 %)
4. He adquirido más conocimiento que una clase expositiva clásica. 15 respuestas (62,50 %)
5. Estas clases mejoran la motivación más que una clase expositiva clásica: 22 respuestas (91,67 %)

6. Estas clases mejoran la cooperación entre alumnos más que una clase expositiva clásica: 17 respuestas (70,83 %)

7. Con este tipo de clases apetece acudir más a clase más que una clase expositiva clásica: 18 respuestas (75,00 %)

8. Los resultados obtenidos en esta clase son buenos: 17 respuestas (70,83 %).

9. Prefiero una clase con método innovador más que una clase expositiva clásica: 16 respuestas (66,67 %)

10. Valoración GLOBAL BUENA de las clases con tecnología innovadora asignatura: 20 respuestas (83,33 %)

La puntuación global fue:

- 0-10 puntos muy bajo: 0
- 11-20 puntos Bajo: 0.
- 21-30 puntos Aceptable: 3 (12,5 %)
- 31-40 puntos Bueno: 8 (33,3 %)
- 41-50 puntos Muy bueno: 13 (54,2 %)

Con estos datos se puede afirmar que, bajo el punto de vista de los alumnos, la experiencia ha sido muy buena.

4.2 Evaluación con Kahoot:

Las preguntas realizadas a través de Kahoot fue siempre superior al 31 % por lo que el indicador se considera aceptable.

4.3 Asistencia a clase:

Se puede establecer que la asistencia a clase es similar entre las clases expositivas (a los que acudieron 27 y 21 alumnos en las dos clases siguientes a las clases de metodología docente innovadora) con respecto a las propias clases con aplicación de metodología docente innovadora (asistencia de 23 alumnos el primer día y 25 alumnos el segundo día). El total de alumnos matriculados de la asignatura es 33 alumnos.

Según el baremo propuesto, el indicador es: aceptable.

4.4 Calificaciones de Asignatura (parte Neurología)

En la comparativa entre las calificaciones en la convocatoria de enero del curso anterior (15-16) y actual (16-17), según el baremo propuesto, el indicador es: bueno.

5. Objetivos alcanzados

- Hemos iniciado una experiencia con metodología docente innovadora.
- Iniciar el conocimiento por parte del profesorado de las diferentes herramientas para mejorar el método docente, siendo la gamificación, uno de ellos.
- Aumentar el interés por parte de los alumnos de una asignatura compleja en el primer cuatrimestre del primer curso del Grado de Logopedia.
- Diferenciar por parte del alumnado de los conceptos teóricos básicos y fundamentales en la asignatura.
- La aplicación del uso de los dispositivos móviles en la adquisición del conocimiento.

6. Experiencia adquirida

Con este proyecto el profesorado:

- Ha adquirido un interés por el cambio en la metodología docente clásica, apreciando la posibilidad clara y real de mejorar la clase magistral o, al menos, combinarla con otros métodos docentes.
- Se ha establecido un primer contacto enriquecedor con el método de gamificación, completamente desconocido hasta ahora, ampliando las posibilidades de métodos para transmitir el conocimiento.
- Establecer una relación con el alumnado mucho menos rígida y más cercana con la posibilidad de la interacción profesor-alumno más personal.
- La utilización de recursos informáticos aplicados al aprendizaje.
- Acercamiento a realizar cambios mayores en la metodología docente en la asignatura de Neurología, tanto en el grado de Logopedia en otros Grados donde se imparte la asignatura.
- Esbozar la posibilidad de prolongación de la aplicación del proyecto de innovación en los cursos siguientes.

7. Conclusiones

La puesta en marcha del Proyecto de Innovación ha producido una gran acogida en el alumnado, presentado un desconocido interés por la asignatura, así como por los conceptos fundamentales de la asignatura.

El Proyecto de Innovación reafirma la idea del profesorado en continuar con la línea de trabajo con el fin de mejorar en el método docente de la asignatura para la optimización de la transmisión del conocimiento.

Esta nueva motivación pedagógica del profesorado, invita a poner en marcha otros métodos de innovación pedagógica, así como a iniciar la implementación de este Proyecto de Innovación Docente en otros grados.

8. Aplicaciones futuras

Este cambio de método docente puede ser el inicio de cambios mayores en la metodología docente en el Área de Neurología en la asignatura de FBL. Además, se podrá aplicar en contextos pedagógicos diferentes puesto que la asignatura de Neurología también se imparte en otros Grados, como el Grado de Medicina, pero también en los Grado de Odontología y Fisioterapia, donde la asignatura de Neurología se imparte como asignatura compartida, siempre y cuando se adapte a las peculiaridades específicas de cada Grado.

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Uso de un Electronic Voting System: una radiografía del aula universitaria en tiempo real

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Abstract

Some of the characteristics of degrees' curricula have led the methodologies used in the development of lessons to undergo a revision by the faculty. As a consequence of this, there has been a widespread use of Information and Communication Technologies (ICTs) with the aim of alleviating some of the deficiencies detected in the implementation of the aforementioned degrees, to bring teachers closer to new generations ("digital natives"), as well as to make these subjects more attractive.

In this line, a group of professors from the Universitat Politècnica de València as well as the Universitat de València, within the framework of the Project "EstadísTIC@ y MatemàTIC@s: elaboración de materiales interactivos para favorecer su aprendizaje y evaluación en los estudios de grado", has chosen to use an "Electronic Voting System" (EVS), the Clickers.

In the present work an analysis is done regarding the results of using Clickers in a subject inside the Double Degree Program (DDP) in Tourism-ADE, as well as in another subject from the Degree in Fundamentals of Architecture.

The results point to a satisfactory reception and evaluation by the students, as well as an improvement in the assimilation of the contents imparted in the subject.

Palabras clave: *ICTs, Clickers, Electronic Voting System, teaching innovation, academic performance.*

Resumen

Algunas de las características de los planes de estudio de Grado han provocado que las metodologías utilizadas en el desarrollo de las clases hayan sufrido una revisión por parte del profesorado. Como consecuencia de la misma, se ha producido un uso generalizado de las Tecnologías de la información y la comunicación (TICs). Con ello se ha pretendido paliar algunas de las deficiencias detectadas en la implantación de los grados, acercar al profesorado

a las nuevas generaciones (“nativos digitales”), así como hacer a éstas más atractivas las asignaturas.

En esta línea un grupo de profesores, de la Universitat Politècnica de València y de la Universitat de València, en el marco del Proyecto “EstadísTIC@ y MatemàTIC@s: elaboración de materiales interactivos para favorecer su aprendizaje y evaluación en los estudios de grado”, hemos apostado por utilizar un “electronic voting system” (EVS), los Clickers.

El trabajo que se presenta analiza el resultado de su uso en una asignatura del Programa de Doble Titulación (PDT) de Turismo-ADE y en otra del Grado en Fundamentos de la Arquitectura.

Los resultados apuntan a una satisfactoria acogida y valoración por parte del alumnado, así como una mejoría en la asimilación de los contenidos de la asignatura.

Palabras clave: *TIC’s, Clickers, Electronic Voting System, innovación docente, rendimiento académico.*

Introducción

La implantación de los grados a partir del curso 2010-2011 en las Universidades españolas, ha supuesto una revisión de la metodología utilizada en el proceso enseñanza-aprendizaje, pues el papel de los dos agentes principales implicados en dicho proceso ha sufrido un cambio importante. En efecto, el profesor ha pasado de ser la fuente del saber que hacía partícipe al alumnado de sus conocimientos, a ser principalmente una guía del estudiante, que se ha convertido en el principal actor de su proceso de aprendizaje (Cabero Almenara y Marín Díaz, 2012).

Sin embargo, algunos de los estudios realizados con la finalidad de analizar los primeros resultados muestran una disminución del rendimiento académico en los nuevos planes de estudio (Palací et al, 2014; López-Rodríguez, M.I. et al, 2016)

Esta y otras deficiencias detectadas, así como la incorporación en las aulas de las denominadas generaciones “nativo digitales” han provocado que el uso de las Tecnologías de la información y la comunicación (TIC’s) se haya incrementado progresivamente en el desarrollo de las clases. Estudios previos demuestran los buenos resultados que se obtienen mediante su uso (Aguado et al, 2014; Bezanilla et al, 2014; Calvo Bernardino et al, 2013; Esteban et al, 2009)

Entre las múltiples TIC’s utilizadas cabe mencionar los Clickers, un electronic voting system (EVS), que permite obtener en tiempo real un feedback de la audiencia. Así, un grupo de profesores, de la Universitat Politècnica de València y de la Universitat de València, en el marco del Proyecto de la Universitat de València “*EstadísTIC@ y MatemàTIC@s: elaboración de materiales interactivos para favorecer su aprendizaje y evaluación en los estudios de grado*”, han apostado por su uso, obteniendo muy buenos resultados (Caballer-

Tarazona, M. y C. Pardo-García, 2014; Barac, M. y Pardo-García, C. 2015) tanto en estudios de grado como en estudios de máster (López, M.I. et al, 2015; López, M.I y Barac, M., 2016). Cabe citar, a modo de ejemplo, que este EVS permite (Derek, 2009):

- Aumentar la atención y participación del alumnado
- Tener un registro de la asistencia en clase.
- Tener una percepción, tras el desarrollo de la clase, de cuáles son los puntos fuertes y débiles de los contenidos trabajados que merecen especial atención.

En este trabajo el objetivo planteado es doble: por una parte estudiar la percepción que el alumnado tiene de esta herramienta y por otra analizar, mediante métodos estadísticos, los resultados de su uso. Para el primer caso se hará uso de las impresiones de una muestra de alumnos del Grado en Fundamentos de la Arquitectura, ofertado por la Universitat Politècnica de València, y para el segundo de una muestra de estudiantes del Programa de Doble Titulación (PDT) de Turismo-ADE, ofertado por la Universitat de València.

1. Metodología

La información utilizada para la elaboración del trabajo planteado se ha obtenido mediante el uso de un muestreo casual (Latorre et al, 2003) entre los estudiantes de los grados anteriormente citados. En cuanto a la metodología considerada, ésta corresponde a técnicas descriptivas que permitirán no sólo tener una visión general de la situación en ambas asignaturas sino, además, analizar la representatividad de algunas medidas de tendencia central así como la variabilidad y evolución de la misma en los casos pertinentes.

Como es sabido una disminución de la variabilidad supondrá una mayor representatividad de la media, de manera que si, como es el caso, se quisieran comparar las dispersiones de diferentes muestras se hará uso del coeficiente de variación de Pearson.

Con la finalidad de no exceder en demasía la dimensión del trabajo, se proponen como futuras líneas de investigación el análisis de la significatividad de las diferencias detectadas a nivel descriptivo. Para ello se haría uso del Análisis de la Varianza (ANOVA), que requiere de la comprobación del cumplimiento de las hipótesis de partida: normalidad y homocedasticidad. Las herramientas estadísticas usadas para llevar a cabo dicha comprobación serían el test de Kolmogorov-Smirnov y el test de Levene, respectivamente. Por último, si se detectaran diferencias significativas, se utilizaría el test de Scheffé, que permitiría identificar entre qué poblaciones las medias son significativamente diferentes.

2. Resultados en la asignatura Introducción a la Inferencia Estadística del Doble Grado Turismo-ADE

Cabe resaltar que los datos con los que se trabaja corresponden a la primera promoción de esta doble titulación, que presentó un rasgo diferenciador respecto a las que la sucedieron. En esta primera promoción la vía de acceso del alumnado fue doble, ya que a los estudiantes de nuevo ingreso en las titulaciones de ADE y Turismo se les ofertó, en el curso 2014-15, la posibilidad de acceder al doble grado de Turismo-ADE. Aunque el criterio de selección de los aspirantes fue su nota de acceso, no hay que olvidar que el perfil del alumnado de Turismo mostraba claras disparidades respecto al de ADE. Entre dichas diferencias, la que más pesó sin duda en la impartición y asimilación de las asignaturas de carácter cuantitativo, fue los estudios preuniversitarios realizados, pues mientras que los estudiantes con vía de acceso ADE provenían mayoritariamente de un bachillerato de sociales, los de vía acceso Turismo habían cursado este tipo de bachillerato o bachillerato de humanidades o bien provenían de ciclos formativos.

Como consecuencia de la heterogeneidad detectada, en términos cuantitativos, el equipo docente de la asignatura “Introducción a la Inferencia Estadística” decidió incluir, en el desarrollo de las clases, el uso de los Clickers, con la finalidad de detectar los posibles puntos débiles y tomar las acciones correctoras pertinentes. El uso de esta herramienta se concretó, finalmente, en la realización de tres sondeos, programados una vez que se habían impartido una serie de temas que conformaban, respectivamente, los bloques de: “Teorema Central del límite y Distribuciones derivadas de la Normal”, “Estimación por punto y por intervalo” y “Contrastación paramétrica y no paramétrica” .

La Tabla 1 recoge el porcentaje de aciertos en cada sesión y la tabla 2 algunas de las medidas de reducción más relevantes.

Tabla 1. Porcentaje de aciertos según sesión. Fuente: Elaboración propia

Cuestión	Primera sesión	Segunda sesión	Tercera sesión
1	15,38%	69,57%	83,33%
2	92%	96,15%	54,55%
3	63,16%	92,31%	86,67%
4	0%	40%	57,14%
5	7,69%	0%	78,26%
6		42,86%	63,64%
7		92%	63,16%
8		85,19%	44%
9		64%	50%
10		92%	77,78%
11			92%
12			45%

Tabla 2. Medidas de reducción según sesión. Fuente: Elaboración Propia

Parámetros	Primera sesión	Segunda sesión	Tercera sesión
Media	35,65%	67%	66%
Desviación típica	35,77%	29,81%	16,06%
C. de variación de Pearson	1,003	0,44	0,24
Mínimo	0%	0%	44%
Máximo	92%	96%	92%

A partir de la observación de las mismas se deduce que:

- El porcentaje medio de aciertos creció notablemente entre la 1ª y la segunda sesión, al pasar del 35,65% al 67% y disminuyó ligeramente entre la 2ª sesión y la 3ª (del 67% se pasó al 66%). Pero ese decrecimiento mínimo se compensa si se tiene en cuenta el valor de los coeficientes de variación de Pearson que muestran una disminución progresiva, lo que implica un crecimiento en la representatividad de la media y una homogeneización

del nivel de conocimientos de los alumnos. Lo indicado se constata gráficamente en las figuras 1 y 2.

- En cuanto al porcentaje mínimo de aciertos, aunque se mantiene en el 0% en las dos primeras sesiones, esto es, hubo estudiantes que no acertaron ninguna de las cuestiones planteadas, en la última de las sesiones el estudiante que menos aciertos obtuvo se situó en un 44% de respuestas acertadas.

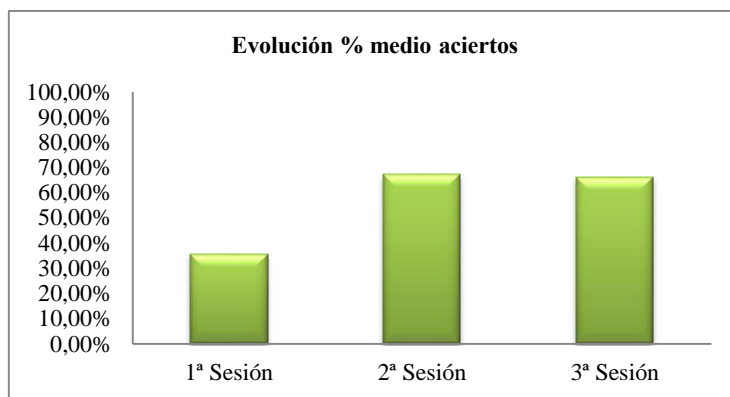


Figura 1. Evolución del % medio de aciertos en la asignatura “Introducción a la Inferencia Estadística”

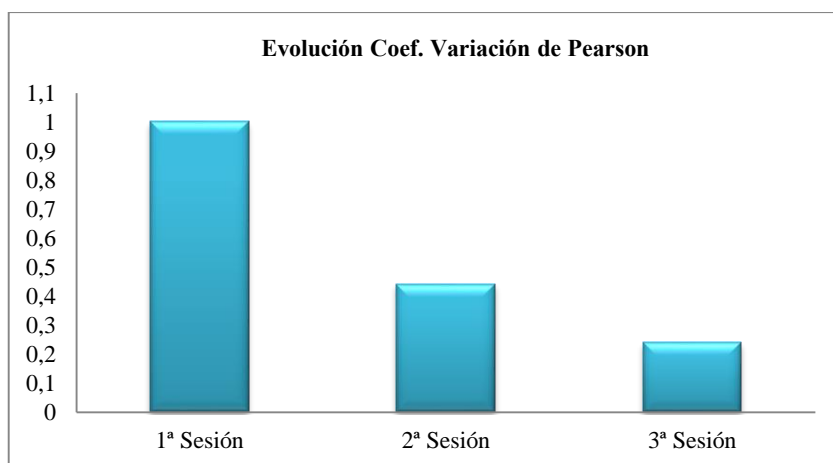


Figura 2. Evolución del coef.de variación de Pearson en la asignatura “Introducción a la Inferencia Estadística”

- Por otra parte, una vez detectadas las cuestiones con menor porcentaje de aciertos en las diferentes sesiones se tomaron las medidas oportunas para su correcta asimilación, mediante la realización de ejercicios complementarios, debate en clase, etc.

Todo parece indicar que el uso de los clickers repercutió en una mejora del rendimiento académico de los estudiantes, ya que la tasa de presentados, en primera convocatoria, fue del 100%, de los que aprobaron el 79% (el 68% de ellos con una nota superior a 7).

Por último, la metodología utilizada dinamizó la clase y contó con una muy buena acogida por parte del alumnado que otorgó, en las encuestas de evaluación llevadas a cabo por la Unidad de Calidad de la Universitat de València una puntuación en el apartado “Metodología” de 4,83 (sobre 5).

3. Resultados en la asignatura Matemáticas 2 del Grado en Fundamentos de la Arquitectura

En el caso de la asignatura Matemáticas 2 es difícil cuantificar las posibles mejoras en el rendimiento académico de los alumnos que son debidas al uso de los clickers, porque las diferencias existentes entre los distintos grupos pueden deberse a múltiples factores. Uno de los más importantes es que los alumnos no se matriculan aleatoriamente en cada grupo, sino que siguen un orden de matriculación según su expediente y, puesto que conocen de antemano quiénes serán sus profesores en cada asignatura, hay grupos más demandados que, inevitablemente, se saturan antes y con mejores alumnos. Otro factor importante es el horario, o que sea un grupo de mañana o de tarde. También es determinante en el rendimiento el profesor que imparte la asignatura en cada grupo. En este caso se utilizaron los clickers en los tres grupos impartidos por una misma profesora, de los ocho en que se divide la asignatura.

Por todo esto, lo que hemos hecho ha sido sondear con una encuesta on-line la opinión de los alumnos de esos tres grupos. Los resultados de este sondeo se muestran en la Fig.3. Del total de alumnos que asistieron a las clases en las que se utilizaron los clickers han contestado la encuesta el 70%. Los resultados han sido espectaculares. Nos parece obvio que la clase es más participativa y amena, pero aún así, que el 93% de los encuestados responda con el valor más alto a esa pregunta indica hasta que punto los estudiantes están satisfechos con la experiencia. La percepción que tienen los estudiantes de cómo ha mejorado su rendimiento académico con el uso de los Clickers es también sorprendente y esperanzadora. Con sólo tres sesiones realizadas, el 59% cree que le han ayudado “mucho” o “bastante” a preparar los exámenes y el 47% que ha contribuido “mucho” o “bastante” a mejorar su nota en la asignatura. En la misma línea están las respuestas al aprovechamiento de las clases y a la comprensión de los complejos conceptos de la materia.

Todo esto se refleja en la nota que ponen respecto a la satisfacción general con el uso de los clickers: el 93% más de un 8. Algunos alumnos han añadido interesantes comentarios que refuerzan estas ideas:

- *Clases más amenas*
- *Deben seguir aprovechándolos, es una gran idea.*

- *En mi opinión lo que mas favorecía es la participación en clase y así prestar más atención.*
- *Es interesante el uso de los clickers porque te ejerce de una manera práctica y visual los ejercicios realizados en el curso. Es una sencilla y rápida manera de aclarar conceptos.*
- *Es más divertido usar los clickers y se participa más en clase, por lo que creo que es mejor usarlos, ya que motiva al alumno a asistir a las clases.*
- *Es una manera interactiva de aprender y de aprender.*
- *Fomentó el dinamismo y la atención durante las clases. Resultó una herramienta muy interesante.*
- *Productivo y divertido a la vez que innovador.*
- *Me parece que los clickers son muy buenos para dejar las ideas claras, además hace muy participativa la clase y es más dinámica, te motiva a prestar atención y estudiar mucho más los temas, en lo personal me encantó esta iniciativa de la profesora y la vi muy oportuna en las clases en la que los utilizamos.*

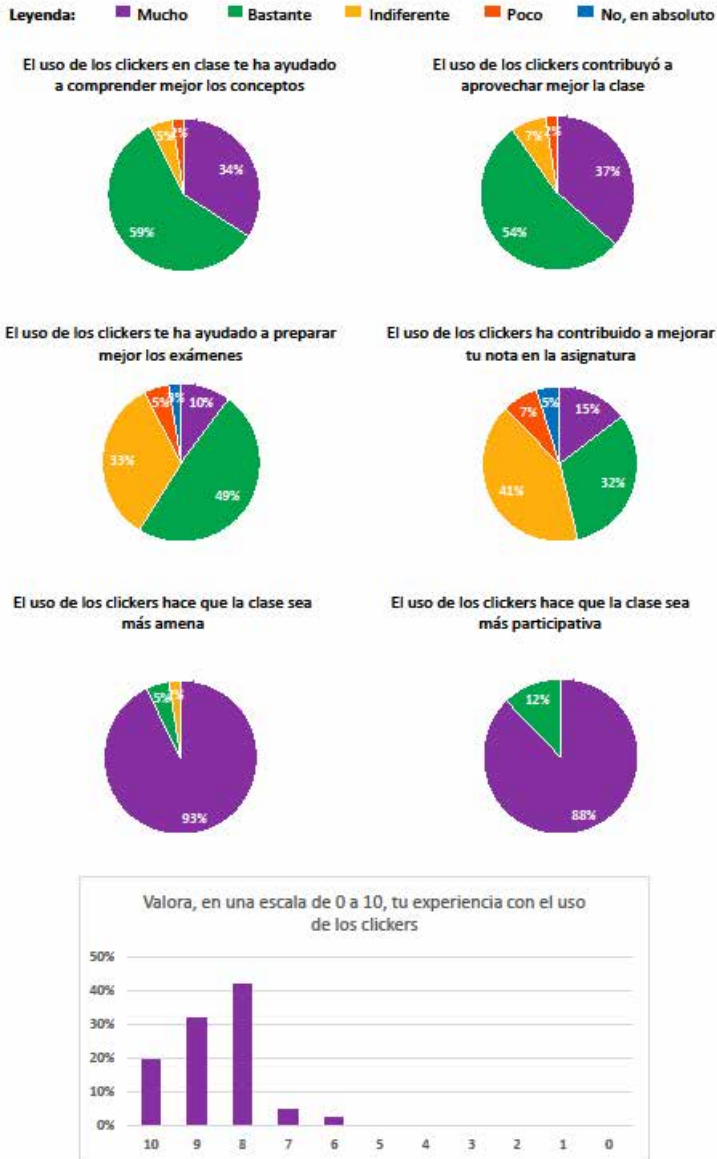


Figura 3. Resultados de la encuesta sobre el uso de los clickers en Matemáticas 2

Resulta obvio que les obliga a estar más atentos, a preguntar para aclarar conceptos y fomenta la competitividad entre ellos, puesto que conocen inmediatamente sus resultados y la comparación con el resto de sus compañeros.

4. Conclusiones

Los resultados obtenidos nos muestran muchos aspectos positivos del uso de los clickers en las dos asignaturas estudiadas, entre los que cabe destacar:

- Se consiguió dinamizar la clase e involucrar a los estudiantes en su propio proceso de aprendizaje.
- En cada una de las sesiones se detectaron puntos débiles y se tomaron medidas para reforzar los contenidos que no se hubieran asimilado correctamente.
- Contribuye a mejorar el rendimiento y los resultados finales de los alumnos.
- El alumnado acoge muy positivamente la incorporación de este tipo de EVS y otorga una valoración muy alta cuando se le pregunta sobre su utilización.
- Para el profesor es una herramienta extremadamente sencilla y fácil de utilizar. El software es gratuito y rápido de instalar y las presentaciones son con Power Point. Para una materia como las matemáticas, dónde casi todas las cuestiones involucran fórmulas y gráficos, esta facilidad de realización de los cuestionarios es muy importante, entre otras cosas porque permite utilizar el material previo del profesor ahorrando así una gran cantidad de trabajo.
- Para el alumno, al margen de la bondad del propio método didáctico, introduce un elemento físico nuevo en el aula, el “clicker”, que siempre resulta atractivo y ameno de utilizar. Este hecho ya le predispone positivamente con lo que ayuda a mejorar su actitud en clase y fomenta, indudablemente, la participación y la interacción profesor-alumno

Todas estas consideraciones hacen de los clickers una herramienta extremadamente útil en el aula.

5. Agradecimientos

Expresamos nuestro agradecimiento al Servei de Formació Permanent i Innovació Educativa así como a los Vicerectorats d'Estudis de Grau i Política Lingüística i de Polítiques de Formació i Qualitat Educativa de la Universitat de València por la concesión del proyecto de innovación educativa UV- SFPIE_GER16-418142 que ha financiado parcialmente esta comunicación.

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CON LAS MANOS. Experiencia de innovación docente en la UPV (Valencia, Spain) para conocer la tierra como material para el desarrollo de las capacidades creativas y constructivas

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Abstract

This text presents a project for educational innovation and improvement in the field of architectural restoration carried out at the School of Architecture of Universitat Politècnica de València (UPV, Spain). The project was carried out in the 2016-2017 academic year.

The earthen architecture heritage is a major part of the local culture both because of its remote origins and the varied technology adapted to natural and cultural surroundings. In addition, given its salubriousness and its cultural relationship with the habitat, earthen architecture is currently an interesting line in the construction of new architecture as earth is the most sustainable material, providing energy saving throughout the entire construction process. However, this material is barely studied at university, and newly qualified architects have very little training in this field.

The main aim of this project was to bring earthen architecture closer to students in practical terms through active learning methods. Students should be able to touch the earthen material “with their hands” (Fig. 1), building following traditional techniques and experimenting with creations so that they can learn about this material as part of a constructive tradition that should be known, valued, and respected. In addition to being a valid tool and a current material for contemporary designs.

Keywords: *Innovation Project, learning by doing, experimentation, earthen architecture.*

Resumen

El trabajo presentado se ha desarrollado en la Escuela de Arquitectura de la Universitat Politècnica de València (UPV, Spain) en el marco de un Proyecto de innovación y mejora educativa que se ha llevado a cabo en el ámbito de la restauración arquitectónica.

El patrimonio de la arquitectura de tierra constituye una parte fundamental de nuestra cultura. Además, este patrimonio constituye en la actualidad una interesante línea de aprendizaje para la construcción de la nueva arquitectura contemporánea, ya que se trata de un material sostenible desde el punto de vista del propio material, del ahorro energético en todo el proceso constructivo, de su salubridad y su relación cultural con el lugar. Sin embargo, en las escuelas de arquitectura casi no se trabaja con este material y los arquitectos recién titulados carecen en muchas ocasiones de formación en estos temas.

El objetivo del proyecto ha sido acercar los estudiantes a la arquitectura de tierra, desde un punto de vista práctico y a través de metodologías de aprendizaje activas. Se trata de que los estudiantes toquen “con las manos” el material tierra, construyan con él según las técnicas tradicionales y que empiecen a experimentar de forma creativa para que entiendan este material no sólo como parte de una tradición constructiva que se debe conocer, valorar y respetar, si no como una herramienta válida y actual para el proyecto contemporáneo.

***Palabras clave:** proyecto de innovación, aprendizaje activo, experimentar, arquitectura de tierra.*

Introducción

Con este proyecto de innovación y mejora educativa se pretende de forma experimental introducir la tierra como material de construcción en tres asignaturas de la escuela de arquitectura (Restauración arquitectónica, asignatura obligatoria de 5º curso; Composición, asignatura obligatoria de 4º curso y Restauración de la arquitectura histórica no monumental, asignatura optativa del curso de Master Universitario en Arquitectura) a través de unas actividades conjuntas y por separado de los estudiantes que participan en ellas. Las actividades se han propuesto con una metodología de “learning by doing” (Rama et al., 1998) de forma que los estudiantes aprendan sobre el material trabajando y experimentando con él.

1. Objetivos generales del proyecto

El proyecto pretende que los estudiantes involucrados puedan en primer lugar tener un aprendizaje más real y directo en relación a la arquitectura de tierra, entendiendo su importancia como patrimonio local, así como las posibilidades que puede aportar para el diseño de una nueva arquitectura más sostenible (AA.VV., 2014). El objetivo principal por lo tanto es el aprendizaje de la tierra como material de construcción y su aplicación a través de sus infinitas posibilidades creativas (CRAterre et al., 2005).

Los objetivos generales del proyecto, son fundamentalmente:

- Acercarse al material tierra: los estudiantes podrán conocer las características y propiedades generales de la tierra como material de construcción y ser capaces de

identificar diferentes tipos de tierra a través de la observación y manipulación del material. Experimentar con diferentes métodos de campo sencillos las distintas propiedades (plasticidad, humedad, moldeabilidad...) de la tierra.

- Comprensión de las técnicas tradicionales: a través de la ejecución de las técnicas tradicionales de arquitectura de tierra (adobe, tapia, pared de mano, entramado) se tratará de entender cómo se empleaban las herramientas, las fases de ejecución, secado y puesta en obra. A través de esta experimentación los estudiantes aprenderán a entender y valorar las técnicas constructivas y los edificios tradicionales construidos con ellas de forma que entiendan la importancia de su conservación y restauración.
- Experimentar de forma creativa con el material tierra: a partir del conocimiento de la tierra como material y de las técnicas constructivas tradicionales, el estudiante podrá empezar a experimentar con sus propias manos de forma creativa para poder encontrar formas de expresión e innovación que podrá aplicar a su estudio o proyecto (trabajo práctico de cada una de las asignaturas que participan en la experiencia).

2. Actividades realizadas

Para conseguir los objetivos generales anteriormente planteados se ha realizado una actividad específica (de un día completo de duración) en el marco de las tres asignaturas que han participado en el proyecto y común a las tres para que los estudiantes pudieran trabajar conjuntamente.

En esta actividad no han participado todos los estudiantes de las diversas asignaturas sino que se ha tratado de un grupo experimental de voluntarios (90 estudiantes aproximadamente) que han aceptado desde el principio del curso participar en esta actividad experimental. La jornada de trabajo se ha realizado en los terrenos de la UPV, en el solar 8H que el equipo tiene concedido para actividades formativas.

El aprendizaje específico obtenido durante esta jornada se ha trasladado al programa de las asignaturas a través de la incorporación de lo aprendido a los ejercicios prácticos desarrollados en cada una de ellas. Para ello se ha ofrecido a los estudiantes la posibilidad de participar en esta actividad experimental y los voluntarios que han decidido participar, han elegido un caso de estudio para el trabajo práctico relacionado con el tema de la arquitectura de tierra.

Así pues, durante esta jornada específica los alumnos han realizado varios talleres relacionados con el conocimiento de la tierra como material y algunas técnicas constructivas de tierra (construcción con tapia, adobe y enlucidos de tierra). Para la organización de la jornada, se dividió a los alumnos en 4 grupos que iban rotando hasta completar los cuatro talleres propuestos.

2.1. Taller de conocimiento de la tierra como material

Este taller es quizá el más teórico aunque a la vez también experiencial-sensorial. Se trata de que los alumnos conozcan la tierra: tipos de tierra, sus propiedades básicas, estados, etc. Para ello se realizaron con los alumnos algunos ejercicios sensoriales con distintos tipos de tierra para que pudieran aprender a diferenciarlas, con algunos experimentos sencillos de campo que sirven para obtener datos sobre las características de la misma y se realizaron también algunas experiencias para comprobar la resistencia que alcanzaban unas pequeñas probetas, elaboradas según diversos factores: grado de humedad, grado de compactación...



Figura 1. Imágenes de la realización del taller. Fuente: autores.

2.2. Taller de construcción con tapia

En este taller los alumnos aprenden los fundamentos básicos de la construcción tradicional de los muros de tapia, con el empleo de un encofrado (tapial) que reproduce a escala un encofrado tradicional tipo. Así pues, los alumnos deben ejecutar todo el proceso de construcción del muro, desde el montaje del encofrado, la preparación de la mezcla de tierra y el posterior apisonado, hasta el desencofrado.



Figura 2. Taller de construcción con tapia. Fuente: autores.

2.3. Taller de elaboración de adobes

La construcción con adobes es otra variante de construcción con tierra presente en la arquitectura tradicional. En este taller los alumnos elaboran varios adobes, ejecutados de forma experimental con distintas dosificación y distintos estabilizantes (cal, paja, grava...) añadidos en la mezcla.

2.4. Taller de revestimientos de tierra

Este taller se dedica específicamente a los revestimientos (enlucidos) de tierra. En él los alumnos aprenden a realizar diversos tipos de revestimientos con distintas granulometrías, aprendiendo a controlar la cantidad de agua añadida a la masa para que esta sea suficientemente moldeable y se facilite su puesta en obra pero sin exederse, ya que una cantidad demasiado elevada de agua provocaría retracciones durante el secado que se materializarían como fisuras en el enlucido final.



Figura 3. Taller de elaboración de adobes. Fuente: autores.



Figura 4. Taller de enlucidos de tierra. Fuente: autores.

3. Resultados preliminares

Tras finalizar las fases de preparación y ejecución de las actividades de innovación docente del proyecto, es necesaria la evaluación de las mismas (Arends, 2007). La evaluación de los resultados (positivos y/o mejorables) del proyecto se va a analizar a través de la realización de encuestas a los estudiantes (se han realizado la encuesta tanto a los voluntarios que han participado en el proyecto –grupo experimental– como a los que no han participado –grupo control–) y posteriormente se realizará el análisis de las mismas para poder extraer conclusiones sobre el grado de aceptación de esta experiencia en los alumnos y el grado de mejora que ha supuesto para la formación de los mismos.

Para la elaboración y realización de las encuestas se ha trabajado con google formularios, por la facilidad de uso y gestión de los datos obtenidos. Además, al poder general encuestas virtuales, ha sido mucho más sencillo obtener el feedback necesario de los alumnos, obteniendo un total de 153 respuestas de estudiantes (82 respuestas de estudiantes que han participado en el proyecto y 71 respuesta de estudiantes que no han participado).

Esta encuesta se ha centrado en dos cuestiones fundamentales, dividiéndose por tanto en dos bloques de preguntas: uno relacionado con la experiencia personal de cada estudiante con el taller (la experiencia obtenida en caso de haber participado o por qué no se ha participado en caso de no haberlo hecho), y un segundo bloque centrado en cuestiones relativas a la arquitectura de tierra, para poder comparar los resultados en esta materia y la verdadera mejora que puede suponer este tipo de inmersión directa en el material, de los alumnos que han participado en el taller con los de los que no han participado.

4. Conclusiones

Con este proyecto de innovación y mejora educativa se ha podido acercar la arquitectura de tierra a los estudiantes de arquitectura de una forma directa y experimental. El interés de conocer la arquitectura de tierra como parte del patrimonio arquitectónico vernáculo de nuestro territorio reside en que la protección, conservación y restauración de este patrimonio se fundamentan en el conocimiento, respeto y valoración del mismo.

Por otra parte, la arquitectura de tierra constituye en la actualidad una interesante línea para la construcción de la nueva arquitectura en cuanto se trata de un material más sostenible desde un punto de vista del propio material, del ahorro energético en todo el proceso constructivo, por su salubridad y por su relación cultural con el lugar en el cual vivimos (AA.VV.2014).

La importancia de este tipo de iniciativas de aprendizaje basadas en metodologías activas (Moore et al. 2002) es cada vez más evidente ya que también lo es la demanda de estas actividades por parte de los estudiantes universitarios, quienes generalmente están acostumbrados a un aprendizaje basado en las clases magistrales, en las que son simplemente espectadores, y que acogen con gran entusiasmo estas nuevas experiencias de aprendizaje en las que ellos son los protagonistas de su propio aprendizaje (Bautista Martínez, 2012). Por otro lado, la experiencia directa con el material ha otorgado a los estudiantes un grado de conocimiento del material superior al que se habría conseguido con una clase de aula con una metodología más tradicional. Así pues, es importante destacar la importancia de este tipo de acciones innovadoras, con metodologías de aprendizaje basadas en la experiencia directa y la participación activa, en el “learning by doing”, por las que cada vez más está apostando la enseñanza universitaria.

5. Agradecimientos

Este texto es parte del Proyecto de innovación y mejora educativa (PIME) “*CON LAS MANOS. La tierra como material para el desarrollo de las capacidades creativas y constructivas*” (cod. A06, 2016-2017, professor responsable: Camilla Mileto), financiado por el Vicerrectorado de Estudios, Calidad y Acreditación de la Universitat Politècnica de València.

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Material audiovisual en inglés de las prácticas de laboratorio de la asignatura "Ingeniería Térmica"

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Abstract

Videos in English allow the students to become familiar with the vocabulary and the expressions used in the field of study. The objective of this work is to make a video in English by the students of the bilingual Double Degree (Civil Engineering and Mining and Energy Resources) of the University of Oviedo. The content of the video consists on the realization of a laboratory practice of the subject "Thermal Engineering" titled: "Experimental study of a vapor-compression refrigeration cycle". Students have access to extensive didactic material: presentations in ppt, practice guides, links to catalogs and bibliography. Students were organized to distribute the tasks to be carried out. The degree of involvement of the students has been very high, expressing their enthusiasm throughout the process. The result of a satisfaction questionnaire has been close to 100%.

Keywords: video, recording, audiovisual, English, refrigeration, heat pump, laboratory, engineering.

Resumen

Los videos en inglés permiten al estudiante familiarizarse con los términos y las expresiones usadas en el campo de estudio. El objetivo de este trabajo consiste en la elaboración de un vídeo en inglés, por parte de los alumnos que cursan estudios en el Doble Grado bilingüe (Ingeniería Civil y de los Recursos Mineros y Energéticos) de la Universidad de Oviedo. El contenido del vídeo consiste en la realización de una práctica de laboratorio de la asignatura "Ingeniería Térmica" titulada: "Experimental study of a vapor-compression refrigeration cycle". Los alumnos tienen acceso a un amplio material didáctico: presentaciones en ppt, guiones de prácticas, links a catálogos y bibliografía. Los estudiantes se organizaron para repartirse las tareas a realizar. El grado de implicación de los alumnos ha sido muy alto, manifestando su entusiasmo

durante todo el proceso. El resultado de un cuestionario de satisfacción ha sido cercano al 100%.

Palabras clave: *video, grabación, audiovisual, inglés, refrigeración, bomba de calor, laboratorio, ingeniería.*

Introducción

La asignatura "Ingeniería Térmica" se imparte en el Doble Grado (en Ingeniería Civil y en Ingeniería de los Recursos Mineros y Energéticos) de la Universidad de Oviedo. Esta asignatura pertenece al módulo Común a la titulación de Graduado en Ingeniería de los Recursos Mineros y Energéticos, dentro de la materia Energía y Medio Ambiente. Su carácter es Obligatorio, ya que en ella se presentan conceptos y competencias imprescindibles para la formación de un graduado en ingeniería, tanto para el estudio de asignaturas posteriores, como para su ejercicio profesional como ingeniero. Esta asignatura es de carácter tecnológico, aunque con una base en la termodinámica y en la física.

La asignatura aporta al alumno una forma de enfrentarse a los problemas que se le plantearán en la práctica profesional como ingeniero basada en la realización de balances de masa y energía, así como en el conocimiento de los fundamentos de los procesos térmicos y de transferencia de calor. En este sentido, la asignatura resulta indispensable para la producción de graduados con una sólida base teórica y experimental, cuyas experiencias analíticas, de diseño y de laboratorio resulten atractivos para la industria. Los conocimientos adquiridos son fundamentales en materias tales como plantas de producción de potencia, automoción, calor y frío, ingeniería medioambiental, fuentes alternativas de energía, etc.

El principal objetivo de este trabajo consiste en la elaboración de videos con audio en inglés, por parte de los alumnos grupo bilingüe de la asignatura "Ingeniería Térmica", sobre las prácticas de laboratorio de dicha asignatura.

En la actualidad los procesos de enseñanza-aprendizaje universitarios se complementan con el empleo de nuevas herramientas como imágenes, juegos y videos (Hernández, 2014). En particular, los recursos audiovisuales permiten integrar las Tecnologías de la Información y la Comunicación (TICs) en el proceso de aprendizaje (Zorrilla, 2014) (Waldegg, 2002), así como proporcionar nuevos contenidos a los alumnos, mediante la generación de películas didácticas que ayuden a comprender tanto los fundamentos teóricos como prácticos de las experiencias de laboratorio de la asignatura. Por otro lado, la elaboración de audios en inglés permite al alumno familiarizarse con la terminología y la forma de expresarse en este idioma, lo cual es fundamental para el futuro profesional de un estudiante de ingeniería. Este proyecto también fomenta el uso de bibliografía en inglés por parte de los alumnos. Es una manera de que tanto el alumnado como el profesorado de la asignatura mejoren su nivel de inglés y servirán de ejemplo y estímulo para los alumnos de cursos posteriores. Por otro lado, este tipo de experiencias didácticas es extrapolable a múltiples asignaturas de carreras técnicas y científicas (Ezquerro, 2010) (Grau, 2010). El concepto de mini-vídeo docente resulta muy

útil en la docencia actual, ya que permite hacer accesible este concepto al mayor número de personal docente posible (Letón, 2010). El contenido del presente trabajo pretende dar un paso más, involucrando al alumnado en la elaboración del material didáctico y en inglés, con lo que los resultados de aprendizaje se incrementan sustancialmente.

1. Descripción de la práctica de laboratorio

Dado que el número de alumnos del grupo bilingüe es muy reducido, se planteó la grabación de una única práctica de laboratorio de las tres que se realizan en la asignatura. En este caso se eligió la práctica titulada: “Ciclo Frigorífico de Compresión Mecánica de Vapor”. Consiste en la realización y estudio experimental dicho ciclo, así como la estimación de las potencias y de los coeficientes de operación funcionando como máquina frigorífica (MF) y como bomba de calor (BC).

1.1. Fundamento teórico

Las máquina térmica ideal inversa (Moran, 2010) funciona entre dos focos a distintas temperaturas, de manera que mediante un proceso cíclico absorbe calor (Q_E) del foco frío (el de menor temperatura) y cede calor (Q_C) al foco caliente (el de mayor temperatura), para lo cual consume energía mecánica (W) como muestra esquemáticamente la figura 1.

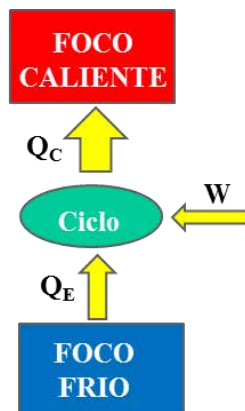


Figura 1. Esquema básico de una máquina térmica inversa

Este tipo de máquina térmica se denomina máquina frigorífica si el objetivo es extraer calor del foco frío, y bomba de calor cuando lo que se aprovecha es el calor cedido al foco caliente. La máquina frigorífica más ampliamente utilizada en la actualidad es la llamada máquina frigorífica de compresión mecánica de vapor, cuyo ciclo básico se denomina ciclo Rankine inverso por su similitud al ciclo de potencia con turbina de vapor (Cengel, 2002). Es muy habitual la representación del ciclo en un diagrama presión-entalpía, el cual se presenta en la figura 2.

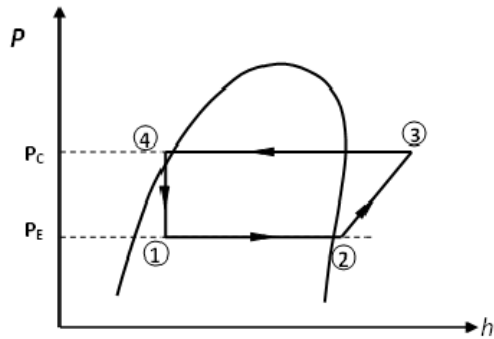


Figura 2. Diagrama P-h de un ciclo Rankine inverso

Los procesos que tienen lugar en un ciclo inverso de Rankine básico son los siguientes:

Proceso 1-2. Evaporación (efecto frigorífico): Se realiza en el equipo denominado evaporador, el cual es un intercambiador de calor en que un refrigerante absorbe calor del foco frío mediante un proceso idealmente isobárico. Dicho refrigerante sale del evaporador en forma de vapor saturado o ligeramente sobrecalentado.

Proceso 2-3. Compresión de vapor: Se comprime el vapor hasta la presión de condensación (P_C). Este proceso, prácticamente adiabático, pero no isentrópico. Da nombre a esta tecnología frigorífica y consume potencia mecánica para mover el compresor mediante un motor eléctrico.

Proceso 3-4: Enfriamiento y condensación: Se produce una cesión de calor al foco caliente mediante un proceso idealmente isobárico en el intercambiador e calor llamado condensador.

Proceso 4-1: Laminación isentrópica: En la válvula se produce una reducción de la presión hasta alcanzar la presión más baja (P_E) y completando el ciclo.

1.2. Descripción del equipo

En el laboratorio del área de Máquinas y Motores Térmicos de la Escuela Politécnica de Mieres (Universidad de Oviedo) se dispone de un equipo didáctico que consiste en una pequeña máquina frigorífica de compresión mecánica de vapor, la cual utiliza refrigerante R-134a y cuyos elementos principales son:

- Evaporador en forma de serpentín sumergido en baño de agua dentro de un recipiente a modo de calorímetro, el cual hace la función de foco frío.
- Condensador idéntico al evaporador pero en este caso, el calorímetro hace la función de foco caliente.
- Compresor alternativo bicilíndrico y de potencia variable entre 100 y 150 W.
- Válvula de expansión termostática.

En la figura 3 se presenta la vista frontal del equipo que lleva instalados unos manómetros para la medida de las presiones del condensador y del evaporador, así como unos visores que permiten la observación de las diferentes fases del refrigerante. En la figura 4 (Izda.) se observa la colocación de unos termómetros analógicos para la medida de la temperatura del refrigerante a la entrada y la salida del evaporador. De la misma manera se pueden medir las temperaturas del R134a a la entrada y la salida del condensador. Se dispone de más termómetros para la medida de la temperatura del agua en el interior de los calorímetros. En la figura 4 (Dcha.) se puede apreciar el refrigerante en fase vapor a la salida del evaporador. También se dispone de un barómetro para medir la presión atmosférica, la cual es necesaria para obtener presiones absolutas, que son las que se deben usar.

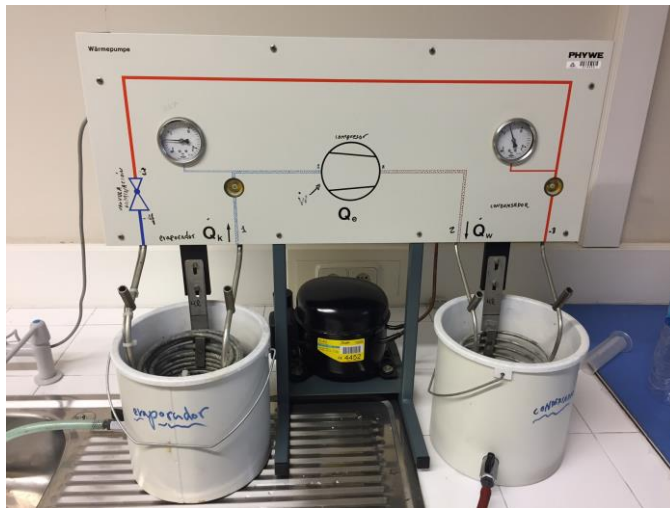


Figura 3. Vista frontal del equipo

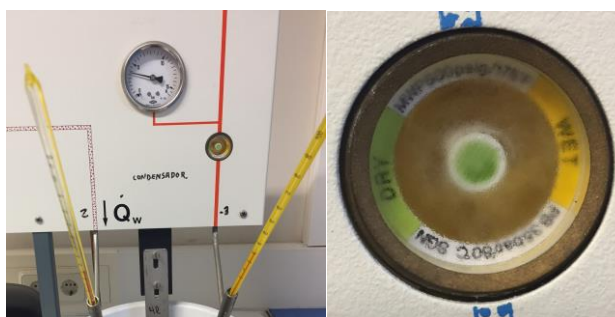


Fig. 4 (Izda.) Detalle zona del condensador. (Dcha.) Visor situado a la salida del evaporador

1.3. Procedimiento experimental

1. Comprobación que el nivel del agua de los calorímetros coincide con la marca que corresponde a 4 litros, rellenando en caso necesario.
2. Medición de las temperaturas iniciales del agua de los calorímetros.
3. Se acciona la alimentación eléctrica y transcurridos unos 5 minutos, para que la máquina alcance su funcionamiento normal, se realiza la medición de las temperaturas del refrigerante a la entrada y a la salida de los dos serpentines. Simultáneamente, se registrarán las presiones de los dos manómetros. Se podrá observar que el calorímetro del evaporador se enfría, mientras que el del condensador se calienta, así como las fases del refrigerante por medio de los visores.
4. Transcurridos 15 minutos desde el inicio, se miden y anotan nuevamente las temperaturas del agua en los dos calorímetros.
5. Se desconecta el equipo y se realizan los cálculos que indicados en el siguiente apartado.

1.4 Cálculos

Con los valores obtenidos de temperaturas y presiones del refrigerante a la entrada y salida del evaporador y del condensador, se pueden precisar los 4 estados correspondientes, bien mediante el uso de unas tablas de propiedades del R134a o directamente sobre un diagrama P-h de dicho refrigerante (como el mostrado de forma cualitativa en la figura 2). Téngase en cuenta que las presiones medidas por los manómetros son relativas y ha de sumarse la presión atmosférica del laboratorio para obtener las presiones absolutas.

Suponiendo que los calorímetros son adiabáticos, es decir, no intercambian energía con el ambiente, se tendría como valor medio de la potencia frigorífica (\dot{Q}_E) en kW:

$$|\dot{Q}_E| = \frac{|Q_E|}{t} = \frac{m_w c_p (T_i - T_f)}{t} \quad (1)$$

Siendo:

t : tiempo total transcurrido en segundos; T_i y T_f : temperaturas inicial y final del agua del calorímetro del evaporador respectivamente; m_w : masa de agua de cada calorímetro (4 kg); c_p : calor específico del agua (4.18 kJ/kg-K).

Análogamente se calculará la potencia térmica media cedida al agua del calorímetro del condensador (\dot{Q}_C).

Aplicando el Primer Principio de la termodinámica al ciclo, se puede deducir la potencia consumida por el compresor mediante la ecuación:

$$|\dot{W}| = \dot{Q}_C - |\dot{Q}_E| \quad (2)$$

El valor obtenido no será exacto, ya que se han despreciado los intercambios de calor con el ambiente, además de otras simplificaciones y errores de medida. Sin embargo, en esta práctica se pretende que el estudiante comprenda el funcionamiento de la máquina y sea consciente de los órdenes de magnitud de las variables, por lo que la precisión de los valores numéricos obtenidos no es muy importante.

Finalmente, se estiman los coeficientes de operación medios de la máquina funcionando como máquina frigorífica (MF) y como bomba de calor (BC) mediante las expresiones:

$$COP_{MF} = \frac{|\dot{Q}_E|}{|\dot{W}|} \quad (3)$$

$$COP_{BC} = \frac{|\dot{Q}_C|}{|\dot{W}|} \quad (4)$$

2. Descripción del material didáctico

El material didáctico al cual tendrán acceso los alumnos mediante el Campus Virtual de la Universidad de Oviedo se compone de:

- Presentaciones en Power Point (en inglés), donde se explican los conceptos teóricos que debe conocer el alumnado para la comprensión de la práctica a realizar, así como las tecnologías utilizadas.
- Guion detallado de la práctica (en inglés).
- Links a catálogos de los aparatos a utilizar.
- Bibliografía en inglés y español.

El material de apoyo ya se ha elaborado con anterioridad por parte del profesorado de la asignatura y se encuentra disponible desde el primer momento en el Campus Virtual. Este material docente se utilizará en las clases expositivas y los estudiantes deberán usarlo vía Web para fomentar el trabajo autónomo de los mismos.

La generación de las películas de video en inglés se realizará en paralelo con el desarrollo de las prácticas de laboratorio de la asignatura, permitiendo al alumno involucrarse y aprender a manejar las herramientas utilizadas (cámara de video digital, micrófonos, pantallas para controlar la luz y sus reflejos, filtro para eliminar el ruido ambiental y software para tratamiento de video y audio).

Se creará un foro para los alumnos en el que podrán compartir información, opinar y plantear dudas a los profesores. De esta manera se fomentará su trabajo en equipo, aumentará su grado de participación y la coordinación con el profesorado.

3. Proceso de producción de la película de video

1. Seminario introductorio.

En este seminario, el profesorado explica en el aula de teoría en qué consiste la práctica, así como los materiales y el proceso de grabación. En este caso, como se trata de un grupo reducido de 5 alumnos, sólo se realizará un video sobre la práctica de laboratorio explicada en el epígrafe 1. La duración del video será de aproximadamente 12 minutos, para fomentar

la capacidad de síntesis, y se divide en cinco partes. Cada alumno se encargará de una de esas partes:

- 1) Concepto de Máquina Frigorífica y Bomba de Calor
 - 2) Explicación del ciclo de Rankine inverso
 - 3) Descripción del equipo de laboratorio
 - 4) Realización experimental de la práctica
 - 5) Cálculo de Potencias y coeficientes de operación
2. Preparación del texto en inglés

Cada estudiante deberá preparar la parte que le corresponde, haciendo uso del material didáctico del que disponible en el Campus Virtual y el foro creado a tal efecto.

3. Reuniones del alumnado

Los estudiantes se reunirán las veces que sea necesario para poner en común sus dudas y hacer ensayos de su parte del video. Tendrán a su disposición el laboratorio donde se ubica la práctica, siempre bajo la supervisión de al menos uno de los profesores de la asignatura.

4. Reuniones generales

Se realizarán dos reuniones generales, a la que asistirán todos los involucrados. Una a mitad del cuatrimestre y otra una semana antes de la grabación definitiva. En estas reuniones se aclararán las dudas que tengan el alumnado, tanto de conceptos como de ejecución del video, así como de pronunciación y explicaciones en inglés.

5. Grabación del video y de las pistas de audio

El alumnado, supervisado por el profesorado de la asignatura, realiza la práctica y la grabación en video. Para ello se cuenta con la ayuda del Servicio de Audiovisuales de la Universidad de Oviedo. El audio se grabó con un micrófono que llevaba cada alumno. Por otro lado, la propia cámara graba también el sonido, pero de peor calidad. Por este motivo, al empezar cada toma, el alumno decía su nombre, unas palabras clave y el número de la repetición. Por ejemplo: Pedro, toma de datos, 2 (segunda vez que se graba esa toma). Este sistema facilita la sincronización de imagen y audio en el posterior montaje final. En la figura 5 se muestra un momento de la grabación.

6. Montaje final del video

Mediante un software de realización de videos se procede al montaje definitivo, realizado en colaboración con el Servicio de Audiovisuales. Fueron necesarios cuatro borradores sucesivos en formato .wmv (de aproximadamente 120 MB) hasta conseguir el montaje adecuado y definitivo, grabado con mayor calidad en formato .mp4 (de 2,7 GB y 11,5 minutos).

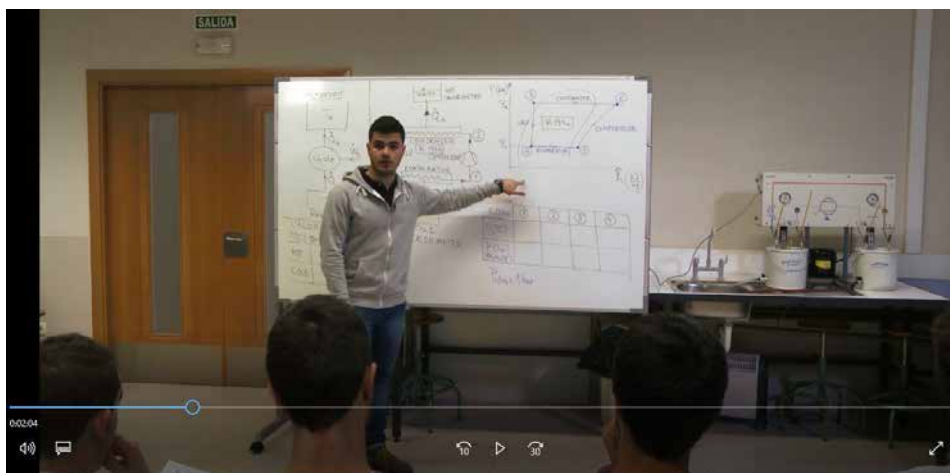


Fig. 5 Captura de la grabación en video

4. Grado de satisfacción y trabajos futuros

Desde el primer momento los alumnos acogieron con gran interés la propuesta de los profesores de elaborar un video en inglés recogiendo los contenidos de una práctica de laboratorio. Durante todas las fases del proceso de preparación y grabación el grado de implicación de los alumnos ha sido muy alto, manifestando su entusiasmo en todo momento, incluso cuando se tuvieron que enfrentar a alguna dificultad como la pronunciación de determinados términos en inglés o vencer la “vergüenza” a la hora de ponerse delante de una cámara y hablar en inglés. El resultado de un cuestionario de satisfacción de los alumnos ha sido prácticamente del 100%. En dicho cuestionario valoraron del 1 al 5 diversos aspectos como: he mejorado mi actitud a la hora de hablar en inglés en público, veo la utilidad realizar un trabajo en equipo, me ha parecido interesante el proceso seguido para la grabación del vídeo, percibo que he aprendido más del tema de refrigeración que si lo hubiera estudiado de forma convencional, etc.

Por parte de los profesores se plantea la posibilidad de ampliación y mejora de este proyecto. En próximos cursos se utilizarán los videos ya realizados para visionarlos con los nuevos alumnos y analizarlos para buscar deficiencias y elementos de mejora. Se estudiará la posibilidad de añadir subtítulos en inglés y/o español. Los videos estarán disponibles en el Campus Virtual para todos los alumnos y se pretende ir aumentando el número de prácticas grabadas con otros equipos disponibles en el laboratorio. También se tiene intención de trasladar esta idea a otras asignaturas del departamento de energía al que pertenecen los profesores que han participado en este proyecto.

5. Conclusiones

Se ha elaborado un video con audio en inglés, sobre la práctica de laboratorio "Ciclo Frigorífico de Compresión Mecánica de Vapor", realizado por los alumnos del grupo bilingüe de la asignatura "Ingeniería Térmica" del Doble Grado en Ingeniería Civil y de los Recursos Mineros y Energéticos. En dicho video se explica la teoría básica y el desarrollo experimental, así como la estimación de las potencias y de los coeficientes de operación del ciclo funcionando como máquina frigorífica y como bomba de calor.

En este trabajo se expone la metodología empleada y los medios necesarios para la elaboración del video. Esta metodología puede ser aplicada en asignaturas similares de carácter científico-técnico. También se proponen sugerencias de mejora y ampliación del número de vídeos, con el fin de crear un repositorio que sirva de base para futuros cursos.

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La importancia de las prácticas experimentales en la enseñanza de la ciencia

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Abstract

We have an Spanish education system that needs major changes in teaching technology, engineering and mathematics. It is of the utmost importance that our young people become aware of the importance of careers in scientific fields. It is also necessary that children should have the possibility of having educational experiences in these fields. In this article we want to contrast the theoretical knowledge with the practical one. In this case on "chocolate" or another scientific concept that our students receive with a "new perspectives" that will surely bring them the perception of the feelings that give us the senses. We call it experimenting, performing laboratory practices. Also very spectacular experiments on "dry ice" and "liquid nitrogen" with elementary students are added to confront them with the theory of the changes of state of matter. Finally, as one primary teacher said at the end of one of the sessions "You can be sure that the result of an experiment is more important than a thousand theories."

Keywords: *Tale, fruits, .practical, theoretical, science, students.*

Resumen

Tenemos un sistema educativo español que necesita cambios importantes en la enseñanza de la tecnología, la ingeniería y las matemáticas. Es primordial que nuestros jóvenes sean conscientes de la importancia de las carreras relacionadas con los ámbitos de la ciencia. Y es necesario que ya desde los primeros niveles de la educación, los niños deberían tener la posibilidad de tener experiencias educativas interesantes en dichos campos. En este artículo se quiere contrastar el conocimiento meramente teórico con el práctico. En este caso sobre "el chocolate" u otro concepto científico que reciben nuestros estudiantes con una "nueva" percepción y entendimiento que seguro les aportará la percepción de las sensaciones que nos dan los sentidos. Lo que llamamos experimentar, realizar prácticas de laboratorio. También se añaden experimentos muy espectaculares realizados con alumnado de

Primaria sobre el “hielo seco” y el “nitrógeno líquido” para confrontarlos con la teoría de los cambios de estado de la materia. Finalmente, como dijo un maestro de primaria al terminar una de las sesiones “Se puede asegurar que vale más el resultado de un experimento que mil teorías”.

Palabras clave: *Cuento, frutas, prácticas, teoría, ciencia, alumnado.*

1. Introducción

Recientemente apareció un artículo en la prensa nacional donde, con razón, se hablaba de la falta de gente preparada para dar a nuestra industria el valor añadido que necesita para competir en el extranjero. Según el Hays Journal la distancia entre las necesidades de talento en las empresas y el nivel de sus profesionales fue, en el 2016, del 14% en Europa pero se ampliaba al 30% en España. Se hacía hincapié en que tenemos un sistema educativo que necesita cambios importantes en la enseñanza de la tecnología, la ingeniería y las matemáticas. Se asegura que es primordial que los jóvenes sean conscientes de la importancia de las carreras relacionadas con los ámbitos de la ciencia expuestos anteriormente. Y, muy importante, es necesario que ya desde los niveles iniciales de la educación, los niños y niñas deberían tener la posibilidad de tener experiencias educativas interesantes en dichos campos. Podemos subrayar, en este punto, lo de experiencias.

Estas experiencias deben hacer mella en nuestros jóvenes estudiantes de Primaria y Secundaria ESO, (para más información, MECD y XTEC). Pero, actualmente, demasiados conceptos científicos se explican solo de forma teórica lo que conlleva que la mayoría de estudiantes no ha tenido un contacto directo con la parte experimental de dichos conceptos, de física, de química, de biología, de matemáticas, de tecnología, etc.

En este artículo se quiere contrastar el conocimiento meramente teórico, en este caso sobre "un alimento determinado" u otro concepto científico, que reciben nuestros estudiantes con una “nueva” percepción de las sensaciones (Ackerman, 1991) que nos dan los sentidos, lo que llamamos "conocimiento experimental".

La experimentación que se ha trasladado a las aulas se basa en un cuento sobre el chocolate (Coe, 2007; Beckett, 2008). En el que se muestra de qué está hecho, sus propiedades físicas y químicas, dónde se cultiva, su importancia económica y otros parámetros de la historia antigua y actual de dicho alimento, todo ello sin que el alumnado que trabaja sobre ello no llegue siquiera a probarlo ya que no lo conocen. ¿Qué ocurrirá cuando los niños del cuento, al final de tanto estudio, prueben un poco de chocolate? Todos sus sentidos se pondrán en marcha, el tacto y el gusto disfrutarán de su textura, se despertará la percepción visual al verlo sólido en pastilla o líquido y caliente en una taza, ¿quién no lo ha experimentado?

Siguiendo en este contexto, se mostrarán algunos ejemplos de ciertos alimentos que no son de nuestra zona geográfica por lo que no es fácil obtenerlos. Pero, por otra parte, son muy importantes y apreciados en otros lugares de la Tierra. Con dichos alimentos, si el profesorado lo cree oportuno, el alumnado de distintos niveles educativos puede realizar o

copiar esta experiencia. Así, trabajando en grupos, semejante a como aparece en nuestro cuento introductorio se podrá comparar aquellos conocimientos meramente teóricos y que, generalmente, el alumnado extrae de Internet con saborear realmente dicho alimento.

Los autores ya han realizado dicho trabajo con alumnado de Secundaria que han estudiado el Litchi y el Physalis (Fleming, S.; Bacon, 2004).

Finalmente, se añaden experimentos muy espectaculares realizados con alumnado de los últimos cursos de Primaria sobre el “hielo seco” y el “nitrógeno líquido”. A pesar de las explicaciones teóricas que el profesorado pueda dar sobre el cambio de estado, cuando aquellos niños lo palpan, reaccionan de forma inimaginable, los niños adoran tener las manos sucias (aplicado a los experimentos, Moore. 2003). Se puede asegurar que “vale más el resultado de un experimento que mil teorías”.

2. Los maestros y la ciencia

Este cuento surgió a finales del siglo pasado en un encuentro en Rio de Janeiro con el Dr. Leopoldo de Meis (1938-2014), un gran bioquímico brasileño preocupado por proporcionar conocimientos sobre ciencias a los maestros de primaria de su país (web Universidad Federal Río de Janeiro). Decía el Dr. de Meis que si aumentamos el interés por las ciencias de los maestros también aumentará el de sus alumnos. Podemos añadir que una de las formas es que participen de estos experimentos, para ello se debe prepararlos con cursos experimentales dirigidos al profesorado (Fernández-Novell, 2004).

2.1. Cuento

En este apartado se presentará el cuento en sus partes, la introducción, el desarrollo y el desenlace.

2.1.1. Introducción

¿Es posible que en algún lugar de nuestro planeta hayan niños que no sepan qué es el chocolate? Imaginemos una zona de nuestro planeta sin internet, ni televisión, ni electricidad, se podría pensar, no existe pero seguro que con un poco de imaginación nos podríamos ir a la casa de la montaña donde no llega ni internet ni el teléfono o aquella isla desierta o... Pues sí que existen zonas de este tipo, en la selva Amazónica, en ciertas regiones de Australia, en otras zonas del Himalaya donde todavía no tienen electricidad.

Imaginemos, que al igual que en España se celebra, por ejemplo, la Olimpiada de Química y que los ganadores, luego van a representarnos en la Olimpiada Internacional, también en una de estas regiones del planeta sin electricidad AMATRALIA (nombre inventado de AMAZonia y ausTRALIA), viven diferentes tribus que quieren dirimir entre ellas y dar un premio a los mejores estudiantes "sobre un tema de ciencia".

Una de ellas, la tribu de los Mixers, cuyo jefe es Ayamatec (los nombres de los jefes deben empezar por la primera letra del alfabeto) quiere que sea la ganadora y para ello ha

solicitado los servicios de un profesor, pero no cualquiera, debe ser de Europa, en su tribu ya saben que los maestros que vienen de tan lejos lo saben todo.

Imaginemos que es uno de nosotros y que se llama Maestro, la cantidad prometida por Ayamatec es muy apetecible aunque las condiciones también son importantes:

- Las clases deberán hacerse en inglés ya que la prueba final será en dicho idioma, el lector puede imaginarse una zona de Australia o que las tribus del Amazonas que participan todavía no han sido "colonizadas" y descienden de ingleses.
- La cantidad a percibir dependerá de la situación en la que quede la tribu de los Mixers entre las cuatro de la región, si ganan será lo acordado al 100% o el 75% si son segundos, el 50% si son terceros y solo el 25% si terminan últimos.

Maestro se desplaza hasta la zona con unos cuantos libros (Cambridge dictionary; Mans, 2013) y su tableta dentro del zurrón mientras que lleva el móvil en el bolsillo. Al entrar en el poblado se encuentra unos niños y niñas como los de cualquier otra parte de nuestro globo, como los del barrio con muchas ganas de aprender, de jugar y de hacer chiquillerías o trastadas. "Parece un buen trabajo" dice Maestro para sí mismo.

Ayamatec en persona, seguido de su séquito, ha salido a recibirle a la entrada del pueblo y después conduce a Maestro, ahora ya es Mr M, así le ha llamado el jefe de la tribu y éste será su nombre para todos los Mixters, hasta una choza donde están esperándole los mejores alumnos de la tribu que, los ancianos han seleccionado para ganar la prueba. Oldetec, el anciano mayor, le va presentando, uno a uno, diciéndole porqué han sido escogidos. Por la cara que ponen todos parecen tan asustados como el propio Mr. M.

A continuación Ayamatec le conduce a otra choza colindante con la anterior, pintada de colores rojos y verdes. Sale a recibirles Zamatec, el chamán de la tribu (los nombres de los chamanes debe empezar por la última letra del alfabeto) quien le comunica la información más importante del día, sobre qué versará la prueba.

Zamatec dirigiéndose directamente a Mr. M. le dice que "la prueba se realizará dentro de dos Lunas Llenas, más o menos un mes y medio, en un altiplano equidistante de las cuatro tribus participantes y versará sobre el chocolate algo que no sabemos que es". Luego de forma desafiante pero muy ceremoniosa también, no en vano Ayamatec estaba presente, le pregunta "¿Sabe Mr. M. qué es el chocolate?"

Maestro responde de forma inmediata " Claro, el chocolate se obtiene del cacao..."

"Expléndid" le contesta Ayamatec en un inglés básico. Se dirige a su tribu sonrío y con ello hace que toda la tribu vitoree a Mr. M. y quede claro que gracias a él, a Ayamatec, la tribu ganará a las otras tres.

Después le enseñan su choza, sin televisión ni radio ni electricidad y nuestro atrevido profesor se pregunta ¿Qué hacen cuando no hay luz, cuando se ha puesto el Sol?. Pronto lo descubrirá, la noche está al caer.

2.1.2. Desarrollo

Mr. M. refleja todo este impresionante día y el trabajo de los siguientes, en su diario.

Primer día en la aldea de Amatralia:

"Han sido muy amables conmigo. Después de las presentaciones y rituales la comida a base de verduras y algo de pescado, del río local, como plato especial para celebrar mi llegada ha sido frugal. Luego por la tarde he ido a la "escuela", una choza con una especie de bancos para sentarse y unas cajas con libros. Tengo una colaboradora, Evatec, la hija mayor de Ayamatec, a quien he pedido dos bancos más para mí y mis libros, cada banco está asignado a un alumno. Según me ha comentado Evatec, en la escuela se sigue un horario muy estricto, mañana lo comprobaré. A las seis de la tarde ya oscurece, se cena, como hoy. Después me he ido a mi choza a oscuras, suerte que Evatec me ha proporcionado una especie de vela para poder leer y escribir este diario que ha durado casi una hora. Luego la noche ha caído sobre nosotros, todo el poblado duerme y no habrá movimiento hasta que mañana salga el Sol"

Segundo día y primero de trabajo real:

"La escuela empieza a las 9 de la mañana después del desayuno de los estudiantes. Todos, los 9 chicos, se han puesto en pie cuando he entrado, ¡Qué emoción! Después de repetir los nombres, Youtec, el más joven con 8 años; Mytec, el mayor con 14 años; el más difícil de recordar es Hydrargirtec, ya los iré recordando. Los he repartido en grupos de trabajo de 3, nunca han hecho grupos de trabajo. Les he dicho que para ganar tenía que ser en equipo y he repartido el primer trabajo: Grupo 1: Estudio de los compuestos: Teobromina y lecitina. Grupo 2: La Historia del chocolate. Grupo 3: ¿Qué son los cristales polifórmicos? Les he proporcionado los libros (como año Internet) para hacer los trabajos a cada grupo. Cuando el Sol está en lo más alto suena la campana y se detiene el estudio para comer y, más o menos, una hora después se continúa, a las cinco suena otra vez la campana y cesa la actividad en la escuela. Entonces unos niños juegan a una especie de basket, otros luchan entre sí y las niñas, de las que no tengo ninguna en el grupo que deberá competir, ayudan a sus madres y abuelas a preparar la cena. Tengo suerte y Evatec me ha proporcionado más de diez velas para poder escribir este diario, hasta mañana"

Podríamos seguir leyendo día a día el diario de Maestro pero nos ceñiremos a 2-3 días.

Décimo día:

"Como he visto que ya han trabajado suficientemente los primeros temas, hoy les he dado los siguientes según: Grupo 1: ¿Qué comemos cuando comemos chocolate?. Grupo 2: El comercio del cacao y del chocolate. Países productores de cacao y países consumidores de cacao. Grupo 3: Obtención del licor de cacao, la manteca de cacao y el polvo de cacao. Les he dejado los mismos libros (Internet ¿dónde estás?) a cada grupo. La rutina sigue

igual. Hacia días que no veía a Evatec y hoy he podido hablar un poco con ella, es muy guapa, espero que ni ella ni Ayamatec entiendan el castellano, si no..."

Vigésimo octavo día:

"Hoy les he proporcionado los tres últimos trabajos, la cita se acerca. Así: Grupo 1: ¿Qué es el Marketing y su relación con el chocolate. Grupo 2: El chocolate, materia sólida, líquida o gaseosa. Grupo 3: El cacao, un regalo de los dioses. Con estos 3 temas ya se ha terminado todo lo que los jóvenes pueden hacer con los libros que he traído.

Trigésimo sexto día:

"Hoy ha sido el último día de clase, mis nueve valientes, no en vano la tribu les llama los "Nueve Magníficos" saben que mañana deberán ir a l'altiplanície de los Godtecs a demostrar todo lo que han aprendido. Seguro que tratarán de hacerlo lo mejor que sepan. También será mi exámen. Hoy he besado a Evatec y no me ha rechazado, quiero pensar que no ha sido solo para darme ánimos. Me voy a dormir, mañana es el gran día"

2.1.3. Desenlace

Son las cinco de la mañana del día crucial y como ocurre con algunos estudiantes, Youtec ha vomitado toda la noche pero ha sido de los primeros en llegar al punto de reunión, la escuela. Se han dado ánimos unos a otros y junto a Maestro, Ayamatec, Zamatec y Evatec han emprendido la caminata, de más de 1 hora, hacia Godtecs.

Después de los rituales de cada tribu ha empezado la competición en una gran choza cuadrada donde los jóvenes de cada tribu han ocupado una pared distinta.

Después de una larga espera, han salido los jóvenes de la tribu de los Trees y casi detrás de ellos han salido los de la tribu de los Wooders. Han sido recibidos por sus respectivas tribus con gritos de soporte. Finalmente, ha sonado una campana y han salido los Mixers y los Lioners, se han repetido los gritos y aullidos de soporte.

Después de comer y beber, poca cosa ya que los jóvenes están esperando los resultados, aparece el grupo de ancianos, dos de cada tribu, para dar el resultado.

La tribu que sabe más de chocolate es MIXERS, sí, sí, los Mixers, nosotros.

Todos se abrazan, los jóvenes Wooders se acercan a felicitarlos y uno, parece el líder, pregunta "¿Sabíais de qué dioses el chocolate era su bebida?, nosotros no".

Inmediatamente responde Hydrargirtec "De los aztecas". Gracias respondieron todos.

Cuando los jóvenes Lioners se acercan a felicitarlos también les hicieron una pregunta "¿Sabíais si el chocolate es conductor de la electricidad?, nosotros no".

Responde Mytec "No, no lo es". Gracias respondieron todos.

Finalmente, cuando fueron a felicitarles los Trees hicieron la siguiente pregunta "¿Cuál es el país que produce más cacao?, nosotros no lo sabemos".

Ahora contesta Youtec "En Costa de Ivory". Gracias vuelven a contestar y todos juntos, los jóvenes de las cuatro tribus se juntan para hablar, discutir y, ahora sí, comer y beber.

Al caer el Sol, regresan a sus respectivas tribus, Mr. M. es recibido como un héroe, todo la tribu le aclama y cuando se acerca Evatec a entregarle un regalo y darle un beso en la mejilla, Maestro se ruboriza tanto que toda la tribu se ríe.

Pero aquí no termina la historia, Mr. M. tiene preparada una sorpresa a sus alumnos y a toda la tribu, les reúne a todos en el centro de la tribu, todas las chozas están en círculo y dejan el centro para las grandes ocasiones, como esta.

Trae una caja de madera que ha llegado esta misma mañana. La abre y de dentro saca algo nuevo, CHOCOLATE, unas pastillas de chocolate "Simón Coll", reparte una porción a cada uno. Les enseña como comerlo y a continuación pregunta a sus "niños" ¿Qué gusto tiene?, ¿En qué estado se encuentra y qué sucede en la boca? y ... Los nueve jóvenes reconocen, mediante sus sentidos, todo aquello que han estudiado. Todo es una fiesta.



Figura 1. Cholate que se comercializa en Australia

Evatec le pregunta "¿Qué más hay en la caja?". Maestro, mucho más tranquilo y sin sonrojarse la invita a ir a su lado y ser su ayudante para realizar unos EXPERIMENTOS con chocolate (Mans, 2008).

De dentro de la caja saca más chocolate, una botella de agua con gas, un hornillo de gas, un poco de azúcar y, algo desconocido para todos ellos, un par de pilas de 4,5 V y una bombilla unida por unos hilos a las pilas.

Con ello realiza, delante de toda la tribu y con cierto recelo de Zamatec, los cuatro experimentos todos ellos relacionados con lo que los "Nueve Magníficos" han estudiado solo de forma teórica:

- 1.- Flotación del chocolate en agua con gas.
- 2.- Salpicaduras al hervir.

3.- Reacciones de Maillard y diferencias con la caramelización.

4.- El chocolate no conduce la electricidad.

3. Experimentando el cuento

Siguiendo en este contexto, ¿se puede repetir la experiencia del cuento sobre el chocolate en nuestras aulas? Sobre el chocolate seguro que no, todos los niños y niñas de primaria y los mayores de la ESO de nuestro país, seguro que saben lo qué es, es más, lo toman casi a diario en sus diferentes presentaciones comerciales.

Pero por suerte, tenemos bastantes ejemplos de alimentos que no son frecuentes en nuestras tiendas y de difícil obtención en nuestra zona geográfica. Estos alimentos son muy apreciados e importantes en la alimentación de otras zonas de nuestro planeta, la Tierra.

Con algunos de estos alimentos, si el profesorado lo cree oportuno, el alumnado de distintos niveles educativos puede realizar o copiar esta misma experiencia y profundizar en la importancia de la experimentación para entender la ciencia.

Esta experiencia ya se ha realizado, los autores han trabajado con su alumnado de Secundaria que ha estudiado a fondo el Litchi y la Physalis. Aquí se expone la segunda que quizás es menos conocida y que puede ser más popular con otros nombres como, Aguaymanto, Uchuva o Alquequenje.

El alumnado, organizado en grupos (Dennick, 1998; Fernández 2014) ya que en esta actividad se considera el aprendizaje de las ciencias como un proceso de socialización (Driver, 2000), estudió los temas siguientes relacionados con dicha fruta:

- Descripción de la planta y el fruto
- Historia de su cultivo
- Características nutricionales
- Propiedades

Algunos temas llevaron a respuestas del tipo:

- Physalis, uvilla, alquequenje, aguaymanto, tomate silvestre o tomatillo (Physalis peruviana L.), es el fruto de la uchuva. Un arbusto familia de las solanáceas que comparte características similares con las patatas, el tomate y el tabaco.



Figura 2. Imagen de la Physalis

- Es una fruta baja en calorías, adecuada en tratamientos para adelgazar. También para mejorar la glucemia en la diabetes y disminuir el colesterol.

Tabla 1. Composición de la fruta del Physalis

Composición del Physalis (por 100 g comestible)	
•	Calorías – 49
•	Proteínas – 1'50 g
•	Grasa – 0'5 g
•	Fibra – 0'4 g
•	Hidratos de carbono – 11 mg
•	Calcio – 9 mg
•	Niacina – 0'8 mg
•	Tiamina – 0'10 mg
•	Fósforo – 21 mg
•	Hierro – 1'70 mg
•	Riboflavina – 0'17 mg
•	Agua – 85 g
Nota: 200 g de Physalis cubren el 100% de las necesidades diarias vitamina A y el 75% de vitamina C	

Este enfoque de la enseñanza de las ciencias basado en las prácticas guarda estrecha relación con las competencias científicas que dicho alumnado debe alcanzar (Franco, 2015). Además, esta actividad pone de relieve la capacidad del alumnado en buscar y gestionar la información obtenida, un aspecto fundamental (Blanco, 2015) de las competencias científicas y que refuerza la enseñanza basada en la investigación.

Los distintos grupos de alumnado hicieron unas presentaciones muy aceptables, explicaron su historia, cultivo, importancia económica en los países productores, sus aplicaciones en medicina, incluso sabían que gusto tenía aquella fruta que nunca habían probado. Mostraron una muy buena capacidad para dar a conocer sus investigaciones.

El mismo día de las presentaciones, el professor compró un par de kilos de aguaymanto, nombre por el que fue reconocida dicha fruta en la tienda de frutas tropicales, y que fue repartida entre el alumnado al acabar las presentaciones. Como en el cuento del chocolate, nuestro alumnado reconoció el gusto "dulce y un poco ácido" que indican los libros e Internet. Compararon los conocimientos teóricos con saborear realmente dicho alimento.

4. Hielo seco y nitrógeno líquido

Siguiendo con el objetivo principal de este artículo que es poner de relieve la importancia de la experimentación en la enseñanza de las ciencias en cualquier nivel, incluso en el universitario, a continuación se exponen experimentos realizados con niños de 10 años.

Una de las aportaciones más esperada por los maestros de primaria es, sin duda, realizar experiencias sobre los cambios de estado. Además de experimentar con agua en los tres estados, sólida o hielo, líquida del grifo y gas en la humedad, el alumnado aprende el porqué de los cambios de estado al "darles o quitarles calor" según ellos mismos.

También el nombre que recibe cada cambio de estado: de sólido a líquido "Fusión, dicen"; de líquido a gas "Ebullición, y ¿qué es la evaporación? algunos preguntan", etc.

Después de esta parte bien conocida por todos, viene la experimentación con el "Hielo seco o nieve carbónica o dióxido de carbono sólido". Algunos alumnos ya lo conocen pero no saben o no pueden explicar que ocurre cuando un trozo de CO_2 sólido se introduce en agua. "El agua hierve" dicen unos, "Salen burbujas" dicen otras y como se aprecia en la figura 3, todos están emocionados en poder tocar el experimento. Al concluir el experimento entienden que las burbujas no son de la ebullición del agua sino del propio sólido que pasa directamente a gas, la "Sublimación".



Figura 3. Dos momentos de la experimentación con nieve carbónica

Algo parecido sucede cuando ven la acción del nitrógeno líquido sobre un globo hinchado. Lo "ven" porque ellos no pueden tocar o acercarse al lugar donde tenemos el N_2 líquido.



Figura 4. Dos momentos de la experimentación con N₂ líquido

Algunos preguntan "¿Cómo puede hacer esto si el nitrógeno está en lo que respiramos? nos helaríamos por dentro" La explicación de los cambios de estado puede ayudar a hacerles entender aquello que ven y que experimentan.

Al mismo tiempo, como se observa en las figuras 3 y 4, la expectación de estos jóvenes es mayor a medida que avanza la parte experimental. A pesar de cualquier excelente explicación teórica sobre el cambio de estado, cuando aquellos niños lo ven, lo entienden y reaccionan de forma inimaginable (Fernández, 2013).

5. Conclusiones

- Como decía el Dr. de Meis "Si aumentamos el interés por las ciencias de los maestros también aumentará el de sus alumnos". Y con ello seguro que también aumentaría el interés por la ciencia en nuestra sociedad.
- Gracias al hilo conductor de un cuento se consigue la atención del alumnado y su participación en esta aventura pedagógica.
- El alumnado ha sabido trabajar en equipo (Competencia científica), en grupo donde uno de ellos ha ejercido de líder sin imponer su criterio.
- El alumnado ha sabido buscar, gestionar y procesar toda la información obtenida (Competencia científica), aspecto fundamental
- El alumnado ha sabido mostrar una buena capacidad para comunicar y discutir, en las presentaciones grupales, los resultados y conclusiones de sus investigaciones (Competencia científica).
- Además, se ha observado, en el alumnado participante, un aumento en las preguntas de ciencias realizadas, en definitiva, en su interés por la ciencia,

- Este tipo de actividad es exportable a todos los niveles de enseñanza. Aquí se ha presentado lo realizado en Primaria y Secundaria pero, es evidente, que incluso en el nivel universitario sirve esta aproximación pedagógica.
- Finalmente, como dijo un maestro de primaria al terminar una de las sesiones "Se puede asegurar que vale más el resultado de un experimento que mil teorías", el propio profesorado debe enfatizar la importancia de la educación experimental en la enseñanza de las ciencias.

Todo ello refuerza nuestro enfoque pedagógico sobre la necesidad de enseñar ciencia basada en la investigación que realice el propio alumnado.

6. Agradecimientos

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The transmission of knowledge

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Abstract

Recently, authors have visited and collaborated with some schools in Kenya and South Africa as well as Brazil, Mexico, India and Nepal before. The way, children and young people learn, was compared and evaluated and, how teachers teach was analyzed in anywhere in this World. Great theories about education have been developed but, how do children actually learn? What differences are there in the way of learning among our children here, in any town or city in Spain, of those in South Africa or Kenya or in one of the countries mentioned above? This article will show the three most used educational forms or models in the countries visited by the authors, the conventional school, the village or tribe and the Masai people. It will be compared with the characteristics of that "models" to primary education in Spain. Finally, we will point out the similarities and differences that may exist between these models of children's education.

Keywords: *Knowledge, Spain, Kenya, primary, students, teachers.*

Resumen

Después de visitar y colaborar con algunos centros escolares en Kenya y Sudáfrica así como de Brasil, México, India y Nepal, se quiere comparar la forma de aprender que tienen los niños y por ende la forma de enseñar de los maestros en cualquier parte de nuestro planeta. Se han desarrollado grandes teorías sobre la educación pero ¿cómo aprenden realmente los niños? ¿qué diferencias hay en la forma de aprender entre nuestros pequeños aquí, en cualquier pueblo o ciudad española, de aquellos que se encuentran en Sudáfrica o Kenya u otro de los países antes mencionados? En este artículo se mostrarán las tres formas más utilizadas en los países visitados por los autores, la escuela convencional, el poblado o tribu y el pueblo de los Masai. Las características de cada "método" se compararán con la educación primaria en España u otro país occidental. Finalmente, se señalarán las semejanzas y diferencias entre estos modelos de educación de los niños.

Palabras clave: *Enseñanza, España, Kenya, primaria, alumnos, profesorado*

1. Introducción

En este siglo XXI los gobiernos dedican una gran parte de su esfuerzo a la investigación y transferencia del conocimiento a la sociedad. Por ello, en el mundo occidental, hay una revolución sobre cómo innovar en la enseñanza primaria, en cómo se deben utilizar los recursos informáticos de “última generación” para que estos sean lo más adecuados a lo que esperamos que aprendan nuestros niños.

Sin ánimo de entrar en polémicas, a nuestro entender estériles, y después de viajar y visitar, los dos últimos años, algunos centros escolares en Kenya y Sudáfrica así como previamente de Brasil, México, India y Nepal, se puede comparar y valorar la forma que tienen los niños y jóvenes de cualquier parte por aprender y por ende la forma de enseñar de los maestros, también, en cualquier parte de nuestro planeta. Se han desarrollado grandes teorías sobre la educación (Klafki, 1990; Esteban, 2016; Cubero, 2017 para profundizar) pero ¿cómo aprenden realmente los niños? ¿qué diferencias hay en la forma de aprender entre nuestros pequeños aquí, en cualquier pueblo o ciudad española, de aquellos que se encuentran en Sudáfrica o Kenya u otro de los países antes mencionados?

En las comunidades donde no hay internet, móviles, ordenadores, ..., o electricidad, los niños aprenden cantando, recitando una y otra vez lo que deben aprender. Salen fuera de la escuela para aprender de su entorno. Son felices incluso desplazándose dos o más horas desde su casa a la escuela y volver de noche, sin luz, etc. Todos ellos son realmente el futuro de estas zonas. En las pocas escuelas que hay en dichas zonas, las clases tienen alumnos de distintas edades. ¿Qué sucedería en las escuelas de España si algún niño ha de repetir curso? ¿Cómo va a ir con alumnos más pequeños?, preguntan los padres. Pero parece que en otros lugares esto no es problema si lo que se quiere es que todos aprendan.

Las familias están muy preocupadas por la educación de sus hijos y el grado de su aprendizaje por lo que el profesorado está, socialmente, mucho más valorado que en nuestro país.. No como aquí que cuando un profesor suspende o reprocha la falta de ganas y de trabajo de algún alumno/a también debe discutir y convencer a los familiares.

Hemos de ser capaces de identificar las necesidades reales de nuestro alumnado, de nuestros niños y niñas de primaria, para que, en el currículo de dicho nivel educativo, se puedan desarrollar los objetivos finales propuestos: que sean buenos ciudadanos (Ministerio de Educación, Cultura y Deporte, web; Egidio Gálve, 1995). Quizás para ello hemos de tener una visión transgresora de la enseñanza y volver la vista hacia aquellos niños y maestros "sin..."

En este artículo se mostrarán las tres formas de enseñanzamás utilizadas en dichos países: la escuela convencional, el poblado o tribu y otras culturas como el pueblo Masai. No se hará una comparación académica de los modelos y/o currículos educativos de estos países con el nuestro sinó que se señalarán aquellos puntos en que las semejanzas y diferencias puedan ser de interés para los docentes.

2. La educación, otra prioridad

La educación siempre nos ha parecido de gran importancia, por esto nos hemos dedicado a ella como profesores. Europa es una zona donde la educación es primordial. Pero ¿qué sucede en aquellos países en que la pobreza es endémica? Hemos observado que no solo en nuestro entorno la educación es una prioridad, también lo es para estos países.

Pero allí, los niños tienen otras prioridades imprescindibles en su vida diaria como son las de mantenerse vivos, evitar enfermedades infecciosas producidas por beber agua en mal estado y comer cada día, entre otras. Estas prioridades no contemplan los móviles o la televisión que sí tienen los niños que se encuentran en los países occidentales.

Podemos poner dos ejemplos: Una noticia del periódico African Independent de Agosto del 2016. "*African Success Stories: Volume 38: The Gambia: YahYa Kandeh, supports youth and community health. He is passionate about education and community health services. His aim: safe drinking water*". Cuya traducción podría ser: Historias africanas de éxito: Volumen 38: Gambia: YahYa Kandeh, da su apoyo y fondos para mejorar la salud de la juventud y de la comunidad. Le apasiona todo lo relacionado con la educación y los servicios de salud comunitaria. Su objetivo: el agua potable para todos.

Otro ejemplo es el estudio de algunos términos y disciplinas a tratar en el proyecto "*RIGOGO Projects (Pty) Ltd*":

Los términos son: Promover la igualdad de oportunidades. Desarrollo del potencial humano e invertir en el desarrollo humano. Dar apoyo a la capacidad de las comunidades de manejar sus propios negocios y generar un desarrollo económico sostenible. Encontrar un rol activo del desarrollo de nuestra cultura, economía, política y ciencia.

Formalizar la formación de una fundación de conocimiento a medio plazo que permitirá estudiar y trabajar sobre las siguientes disciplinas:

- Provisión de agua (Estaciones de bombeo y purificación)
- Construcción de carreteras (canales y tuberías de desagüe en las tormentas)
- Sanidad (Plantas de tratamiento de las aguas negras)
- Proyectos estructurales (Puentes, escuelas, hospitales)

Es importante destacar, en este punto que, a pesar de todo, se están llevando a cabo algunas soluciones como la propuesta por el Profesor Mitra, que nació en Calcuta el 1952.

Éste realizó en el año 1999 el experimento "El agujero en la pared" o "*Hole in the Wall*" en inglés. Así, colocó en Kalkaji, un barrio deprimido de Nueva Delhi, un ordenador personal y permitió que los chicos del vecindario experimentaran con él sin darles indicación alguna.

El resultado fue sorprendente: muy pronto aprendieron el funcionamiento básico del ordenador, se organizaron de forma espontánea y compartieron sus conocimientos. Los que avanzaban más rápido enseñaban al resto. Con ello consiguió que los chicos de los barrios más pobres pudieran aprender, explorar juntos y tuvieran ideas, algunas de ellas extraordinarias.

Finalmente se ha de reconocer que, a pesar de todos los inconvenientes, algunos de estos niños asisten a la escuela, llegan a ella o a su casa después de largas caminatas de hasta 2 horas en la semioscuridad en la madrugada. ¿Qué hacen en la escuela?, ¿Qué aprenden? y ¿Cómo lo aprenden? Las respuestas se relacionarán con la educación en nuestro país.

3. Modelos de educación en Kenya

Hay un famoso proverbio africano que dice “Para educar a un niño hace falta toda la tribu”. O, dicho de otra forma, el ser humano necesita de los demás para crecer y realizarse plenamente: ***no hay progreso si no es de todos y para todos.***

El sistema educativo en Kenya (web The Guardian) está dividido en primaria, ocho años de estudio; secundaria, otros cuatro años y, finalmente, educación superior, otros cuatro años más que engloba la Universidad y las escuelas profesionales. Si nos ceñimos a la educación primaria en este país, los ocho años de ésta están divididos en tres ciclos o niveles según: los tres primeros años pertenecen al ciclo o nivel bajo; dos años más en el ciclo medio y tres años más para superar el ciclo superior. Una primera aproximación a la realidad educativa en Kenya se puede obtener de (Valentin, 2014)

A continuación se exponen los tres modelos:

- Enseñanza en una escuela
- Enseñanza en un poblado/familia sin escuela
- Enseñanza en otras culturas

Los autores han convivido con las tres opciones, que se expondrán a continuación, durante su estancia en Kenya y en las escuelas visitadas en Brasil, México, Nepal, India y Sudáfrica. Se mencionarán las semejanzas y diferencias con los modelos educativos en los países occidentales.

3.1. Enseñanza en una Escuela convencional

Este modelo sigue el que conocemos en España, una escuela con distintas aulas y con maestros que imparten sus conocimientos. Así, la Escuela con aulas, como la entendemos en la actualidad, también ha sido observada por los autores en Río de Janeiro (Brasil) o en Playa del Carmen (México), Nueva Delhi (India) y Johannesburg (Sudáfrica).

Se pueden destacar, para una posterior discusión, algunos aspectos peculiares como la asistencia, la heterogeneidad en la clase, la lengua vehicular, todo ello para mejorar la dinámica de la clase. La Figura 1 muestra la escuela Rainbow 4Kids donde estuvieron los autores, se puede visitar sus páginas web (rainbow4kids; rainbowconnection).



Figura 1. Dos fotografías de la visita a la escuela Rainbow situada a las afueras de Mombasa, a la izquierda los autores junto a los directores del centro.

Cuando fuimos a la Escuela “Rainbow4Kids”, cerca de Mombasa, Kenya, el recibimiento por parte del director y la jefa de estudios fue muy cordial. Después de presentarnos al profesorado fuimos invitados a entrar en distintas clases. En ellas, fuimos recibidos con unos cánticos que, realmente, nos abrumaron por el sentimiento que conllevaban. Luego, en unas determinadas clases que se hacen en inglés y que previamente ya se había acordado con el profesorado y la dirección de la escuela, se hizo una pequeña colaboración sobre la enseñanza y aprendizaje de las ciencias.

3.1.1. Asistencia y heterogeneidad en la clase

Según los directores, uno administrativo y otra académica, la asistencia suele ser bastante regular. Recuerdan que ha mejorado mucho desde hace unos años, a pesar de ello, cada día hay algún chico que tiene que ir a trabajar con su familia o alguna chica que debe quedarse en casa para hacer las labores pertinentes o cuidar de algún familiar, generalmente algunos hermanos menores. Para muchos alumnos la escuela es el lugar donde, además de aprender, reciben un desayuno equilibrado que la mayoría no tiene en casa, subrayando la función social de la escuela. Algunos de los alumnos llegan a la escuela o a su casa después de largas caminatas de hasta 2 horas en la semioscuridad de la madrugada o de la noche.

Se pudo observar que el alumnado estaba dividido por niveles, en cada clase habían niños y niñas que tenían el mismo nivel educativo, sin importar la edad. Así en una misma clase podían convivir y aprender chicos de 10 años con otros jóvenes de hasta 14 años. El profesorado nos decía que los niños y niñas van cambiando de clase conforme van avanzando en sus estudios. Las clases son mixtas con más niños que niñas, según nos confirmó el profesorado “Es más fácil que se quede una niña al cuidado de la casa o familiar que no un niño”.

La lengua vehicular es la nativa, el Swahili (Kenya en swahili es Jamhuri Ya). Los más pequeños solo hacen clase en dicho idioma que es el más hablado en la comunidad y su

lengua materna. Posteriormente se va introduciendo el inglés y, en los últimos cursos toda la enseñanza es en inglés, incluso los libros utilizados y los exámenes realizados son en dicho idioma. Los autores lo pudieron comprobar en las asignaturas de ciencias naturales, de física y de química.

3.1.2. La dinámica de la clase

En la clase hay una pizarra con tiza y los alumnos están sentados por parejas en unos bancos de madera (con el nombre de la entidad o persona que los ha patronizado). Es bueno recordar que en clase no tienen Internet, vídeo, pizarras táctiles ni nada que se le parezca, únicamente la pizarra, la tiza, el profesorado y unos libros que se van distribuyendo de un año al siguiente y poco papel para escribir con lápices.

El panorama no parece alentador pero, en la clase de nivel intermedio nos hicieron una excelente representación de las profesiones. En un inglés muy aceptable cada niño o niña de la clase nos explicaba con canciones, incluso hubo un par de raps, con bailes, con mímica y teatro aquello a lo que querían dedicarse de mayores. Fue una mañana excelente ya que luego, los más pequeños, de cinco o seis años, nos cantaron una canción que utilizan para dormir y luego otra para auyentar a los leones, todo ello en Swahili. En este nivel infantil, la clase està dividida en distintas zonas, siguiendo el método Montessori (Maria Montessori web), donde los niños y niñas realizan actividades en grupo que favorecen la colaboración espontánea entre ellos. Una zona es la de los números, otra la de las letras, otra la de los animales de la zona y la última la de los coches, barcas, carretas, en definitiva del movimiento.

3.1.3. Relación con el entorno

Es muy importante la relación que tiene la escuela, el profesorado y los alumnos con el entorno. Por ello, visitan a los cultivos de alimentos y en clase se trata la prevención de mordedura de animales como serpientes, roedores y otros.

Una vez al año, toda la escuela visita el museo de los monos, situado a pocos kilómetros de la escuela. En él, unos monitores muy experimentados, explican, a todos los alumnos, la evolución de la fauna y flora del lugar. Las definiciones e ilustraciones utilizadas son distintas para los diferentes niveles educativos.

Dentro de la flora cabe destacar el alcanfor, el bambú y un enorme Boabab, árbol de enormes proporciones que llama la atención de todos los niños. De la fauna sobresalen los animales de la sabana, elefante, rinoceronte, cebrá, jirafa y león junto a abundantes especies de pájaros y serpientes. Los monos son los más vistos y perseguidos, explicados y, finalmente, entendidos. La figura 2 muestra dos instantáneas en dicho lugar.



Figura 2. Dos fotografías del Museo de los monos. A la izquierda uno de ellos en su hábitat natural y a la derecha los autores en una sala de dicho museo.

Dentro de la relación de la escuela con el entorno, la directora nos invitó a pasear por los alrededores de la escuela, chozas de familias del alumnado. En este y otros paseos pudimos observar que todo el mundo, padres, madres, familiares incluso aquellos niños que no habían ido a la escuela, saludaban de forma efusiva a la directora que nos acompañaba.

Otro ejemplo de escuela convencional pero diferente es la Escuela Mbuyisa Makhubu, escuela de primaria situada en el barrio de Soweto en Johannesburg en Sudáfrica. La escuela, debido a los problemas raciales está protegida por una valla lo suficientemente alta. Pero con respecto a la asistencia, heterogeneidad del alumnado, dinámica de clase y relación con el entorno la solución educativa es similar a la escuela de Kenya.

En los distintos tipos de escuelas que se ha visitado, todo el alumnado va con uniforme, de color rojo en el caso de la escuela "Rainbow4Kids" y azul en la escuela Mbuyisa Makhubu.

3.2. Enseñanza en un poblado/familia sin escuela

En Kenya, en la zona de Manaus, selva Amazónica de Brasil, y en la del Yucatán, en México, existen poblados formados por una gran familia o clan donde no hay una escuela. Aquí los niños y niñas aprenden del día a día, de todos los quehaceres para que el grupo o familia siga viviendo. Como todos los niños, los del poblado son muy despiertos a la hora de aprender y lo hacen directamente de su entorno y familia.

Se ha visitado un poblado situado cerca de Mombasa, concretamente en la zona de la Reserva Nacional "Shimba Hills" En la figura 3 se muestran fotografías de las labores para obtener grano y después la harina para hacer pan.



Figura 3. Dos fotografías de la separación del grano y su molienda

Como se puede observar, los pequeños siempre están alrededor para ir aprendiendo lo que se debe hacer. En la fotografía de la izquierda, una madre está obteniendo el grano mientras que en la de la derecha es la abuela de la familia la que enseña como obtener la harina para hacer el pan o para cocinar.

Se preguntó ¿Cuándo vienen los médicos al poblado, de dónde vienen y por qué motivos? La respuesta del “jefe” de familia fue “Los médicos de la capital nunca vienen al poblado, nosotros tenemos nuestro propio xamán, nuestro “médico”, que se encarga de sanar a aquellos que lo necesitan. Éste nos enseñó la choza de los enfermos, aquel día no había nadie. Explicó que el camino a dicha choza es especial, está marcado en el suelo con tiza y según como lo ande el enfermo indica que tipo de enfermedad tiene. Para su sanación utilizan unas medicinas obtenidas de las plantas de la zona. El xamán hace una especie de tisana con ellas que guarda dentro de unos frascos hechos con calabazas situados en la choza “hospital”. Este conocimiento también debe pasar de generación en generación.

3.3. Enseñanza en otras culturas

La tercera forma mayoritaria de enseñanza en Kenia se realiza en algunas tribus, que administran su propia enseñanza por medio de una escuela en cada poblado de la tribu, como ocurre con el Pueblo Masai que, en Kenia se encuentra en la zona delimitada por la Reserva Nacional de Masai Mara dentro del Parque Nacional del Serengueti que mayoritariamente .

Este tipo de enseñanza, intermedio de los dos anteriores, instruye, a los más jóvenes, a partir de la vida de la propia tribu, mientras que los mayores deben asistir a clase en la escuela dirigida y organizada por el propio pueblo Masai.

A pesar de ello, la asistencia no es nada constante ya que una de las formas de subsistencia de los Masai es el pastoreo que los jóvenes ya realizan a temprana edad. Los maestros que imparten las enseñanzas a estos jóvenes son también Masai pertenecientes a la tribu.

Este tipo de escuelas, que se encuentran siempre fuera del propio poblado, también se ha observado en algunas tribus de la zona de Manaus en la selva amazónica de Brasil.

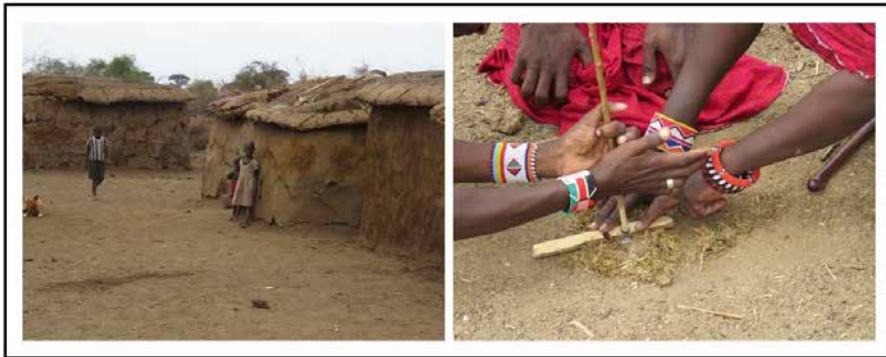


Figura 4. A la izquierda parte de las chozas de la tribu que rodean la plaza central, lugar de reunión y a la derecha 3 Masai enseñando como obtener fuego.

4. Discusión y conclusiones

Después de poner en contexto como funciona la enseñanza en estas zonas alejadas de nuestro mundo de internet, es menester discutir y comparar aquellas “necesidades de aprendizaje” que se presentan en cualquier sociedad. También se debe poner de relieve las semejanzas y diferencias entre sus “modelos” de enseñanza junto a la actitud del alumnado y profesorado en sus aulas con relación al nuestro. La educación siempre ha sido de gran importancia para todos por ello, aquí se presentan aquellos puntos que, para los autores y solo para ellos, tienen un valor relevante y merecen ser observados y discutidos.

Distintas edades en una misma clase.

Se ha comprobado que en las llamadas escuelas convencionales la presencia de alumnos de distinta edad en la misma clase se asume con normalidad así como la educación mixta con chicos y chicas, estas en menor cantidad, en la misma clase. Puede concluirse que le dan más importancia al aprendizaje que a la edad.

Cuantos problemas pueden representar para una escuela en nuestro país, para su dirección y profesorado si algún niño o niña debe repetir y no pueden pasar a la siguiente clase por una enfermedad que les ha mantenido medio curso sin ir a la escuela por ejemplo. Generalmente, familiares y otros miembros de nuestra sociedad querrán que continúen con sus amigos en el curso superior. Pero si hacemos memoria, en España en los años 60 también había estudiantes de distintas edades en la misma clase, ahora en las escuelas rurales ocurre algo parecido. Desde los años 80 ya no se ha visto con buenos ojos tener niños de diferente edad en la clase pero si que dentro de ella se hace un tratamiento a la diversidad. No es una diversidad de edad pero si de saber. ¿Qué piensan los propios niños

cuando ven que los demás avanzan y saben más? Quizás también nos lo deberíamos preguntar nosotros.

El entorno y la familia o la tribu primeros baluartes de la enseñanza.

En nuestro sistema educativo y, en casi todos, la forma más sencilla de aprender para los más pequeños pasa por trabajar en relación con su entorno. Se podría pensar que, en estos países del tercer mundo, es lo que tienen, la selva y los animales los tienen allí mismo y deben preocuparse por protegerse de ellos. Cierto, pero también es cierto que nuestros maestros y maestras enseñan, desde las fiestas más tradicionales, su historia, su parte festiva y sus comidas, hasta las visitas a jardines botánicos y al zoológico. Se debe añadir que las visitas a los museos de la zona es una actividad educativa que todo el profesorado, sea en donde sea, utiliza para que sus niños y niñas aprendan y abran sus mentes a los nuevos conocimientos.

A todos los niños les gusta aprender.

Aquellas personas que se dedican a la enseñanza o que han tenido hijos saben que esta afirmación es válida en cualquier situación. Recuerdan cuando los pequeños empiezan a leer y lo van repitiendo todo, esto ocurre en todo el mundo. Incluso en escenarios bélicos o de migración masiva de personas, como las que aparecen en las noticias a diario, se puede observar que un niño o una niña de 6-10 años quiere ir a la escuela, quiere aprender, hacer experimentos, leer libros, etc.

¿Cómo motivar a los jóvenes hacia el estudio?

Se ha constatado que en estas zonas más deprimidas económicamente la motivación por el estudio existe pero ésta debe luchar contra otras prioridades “más importantes” como trabajar ayudando a la familia cuando sea menester. El tener un desayuno seguro puede ser un aliciente y el disponer de cuentos dedicados a enseñar también (Nazareth, 2009; Fernández, 2012). Pero no ocurre con frecuencia, en países occidentales como el nuestro.

¿Cómo se puede interesar a nuestros niños en la lectura, por ejemplo, o en las ciencias, con el descenso de vocaciones científicas que padece Europa? Se podría volver a los tiempos en que se decía: "La letra con sangre entra". Pero ni en las escuelas convencionales ni en los poblados o en las tribus que los autores han visitado se sigue dicha premisa, no se contempla. Pero cuando recordamos la canción de cuna, en swahili, con que nos festejaron aquellos niños nos viene a la memoria como aprendimos las letras del abecedario y las tablas de multiplicar, cantándolas una y otra vez.

Tanto en estas culturas como en la nuestra, sí que se muestra la importancia de la enseñanza ya desde temprana edad. Es importante resaltar en este punto, que en las escuelas de Kenya y Sudáfrica visitadas se utiliza el método Montessori en las clases de los más pequeños como se utiliza en muchas escuelas de la cultura occidental.

Es cierto que nuestros niños y jóvenes estudiantes, desde primaria hasta la secundaria, tienen muchos “inputs externos” como los móviles, las tabletas, la televisión, Internet, etc. Algunos cada vez leen menos, juegan menos en grupo o se divierten menos explicando sus

aventuras del todo inventadas. En cambio los niños y niñas de Kenya, Brasil o Sudáfrica se divierten jugando, cantando y aprendiendo. Quizás para que nuestros niños y profesorado se diviertan deberían tener una visión transgresora de la enseñanza y volver la vista hacia la enseñanza de aquellos niños y maestros "sin..." que se ha analizado.

Reconocimiento a los maestros y maestras.

La principal diferencia, comprobada personalmente por los autores, entre la posición social de los maestros en Kenya y Sud África, por ejemplo, y en nuestro país ha sido el gran respeto que allí tienen a la figura del maestro y de los directores de las escuelas.

Por desgracia, en España es más fácil decir "Estos maestros y profesoras de qué se quejan si tienen demasiadas vacaciones" queja que podría traducirse por "No se qué hacer con mis hijos, niños cuando no van a la escuela".

Por otra parte, no se tiene en cuenta que los maestros y profesores deben prepararse cada curso académico. Si se quiere que los pequeños aprendan, como se explica algo en una clase ha de ser distinto de un año a otro ya que también lo son los propios niños de la clase. Además, el trabajo del maestro o de la profesora no se termina a las cinco de la tarde cuando suena el timbre, parte de él se lo lleva a casa, hay que corregir trabajos incluso en sábados, domingos y festivos. Nosotros todavía tenemos mucho que mejorar.

La conclusión final podría ser que nosotros, los países occidentales, en relación con la enseñanza Primaria y Secundaria, no somos tan diferentes en la forma de enseñar ni en la de aprender de aquella que se utiliza en los países del tercer mundo. Ni ellos enseñan y aprenden de forma distinta a la nuestra.

5. Agradecimientos

A los administradores y alumnado de los últimos centros visitados: Rainbow 4Kids en Mombasa, Kenya y la Escuela Mbuyisa Makhubu en el barrio de Soweto en Johannesburg, Sudáfrica.

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Aprendiendo observando fuera del aula universitaria

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Abstract

Within the University training in technical areas, it is essential to promote self-learning among students, so that they can improve their skills and requirements for professionals in the future. This article shows the experience of different academic work required from students of a course in the master of construction which takes place in the Universitat Politècnica de València, in which students must perform a work of observation and description of the subject concerning elements seen on the outside of the University.

Keywords: *Self-learning; College classroom; Academic work; Efficient learning.*

Resumen

Dentro de la formación universitaria en áreas técnicas es fundamental fomentar el autoaprendizaje entre los alumnos, de manera que puedan mejorar sus habilidades y requerimientos profesionales en el futuro. En este artículo se muestra la experiencia de diferentes trabajos académicos solicitados a los alumnos de una asignatura del master de edificación que se realiza en la Universitat Politècnica de València, en que los alumnos deben realizar un trabajo de observación y descripción de diversos elementos referentes a la asignatura vistos en el exterior de la universidad.

Palabras clave: *Autoaprendizaje; Aula universitaria; Trabajo académico; Aprendizaje eficiente.*

Introducción

Dentro de la formación en carreras técnicas universitarias es importante conseguir en los alumnos el adecuado nivel científico-técnico para conseguir las competencias adecuadas en su futura profesión técnica, pero además, es necesario formar sus competencias en el autoaprendizaje y la formación autónoma, dado que el estado de la técnica está en continua evolución y ello será necesario para conseguir profesionales de primer nivel en las áreas técnicas.

Los primeros trabajos que hablan del autoaprendizaje se sitúan en los años 70 (Web 1), consideraban que el aprendizaje autodirigido o asistido se caracterizaba por los siguientes criterios: fijar objetivos, retos y necesidades de los alumnos, formar a los alumnos para que aprendan a aprender con sus propias capacidades y con los materiales que ellos consideren necesarios, incentivarlos a que dirijan su proceso de aprendizaje, y por último formar a los profesores para que guíen a los alumnos en su aprendizaje (Benson, 2001).

En el contexto del aprendizaje asistido se destaca la función del profesor de los alumnos en su aprendizaje. En este caso, el aprendiente tampoco tiene las mismas funciones que tenía en otros contextos: se considera que el alumno es el responsable de su propio aprendizaje, es una persona capaz de dirigirse, tiene que ser autónomo.

Por lo tanto, la autonomía es la capacidad que tiene el alumno que hay que fomentar. Uno de los métodos que fomenta la autonomía es el aprendizaje asistido, ya que los alumnos trabajan individualmente, intentando desarrollar y mejorar su capacidad de análisis y de reflexión.

En este trabajo se muestra la experiencia de diferentes trabajos académicos solicitados a los alumnos de una asignatura del master de edificación que se realiza en la Universitat Politècnica de València, en que los alumnos deben realizar un trabajo de observación y descripción, de manera que puedan mejorar sus habilidades y requerimientos profesionales en el futuro.

1. Ambiente de aprendizaje

En un ambiente de aprendizaje en el modelo educativo basado en recursos entrega variadas oportunidades y beneficios a los alumnos y profesores, fomentando cambios en los roles. De acuerdo con Fernández (2007) bajo este enfoque los alumnos deben ser capaces de planificar la búsqueda, localizar, recuperar, procesar, registrar, presentar y evaluar información, frente a lo cual los profesores deben estimular a sus alumnos para:

- Ser activos en el aprendizaje.
- Intentar averiguar algo discutiendo o con preguntas.
- Responsabilizarse de su propio aprendizaje.
- Fomentar la originalidad y la creatividad.
- Desarrollar habilidades de resolución de problemas, toma de decisiones.
- Desarrollar una visión ampliada del mundo que les toca vivir.

El profesor debe orientar al estudiante y proporcionarle las herramientas adecuadas para seleccionar la información adecuada y ofrecida por diferentes vías, la que pudiera estar sesgada en función de diferentes intereses.

El uso de variados recursos, desde el punto de vista del aprendizaje, mejora en los alumnos la retención de la información debido a que emplean los diferentes sentidos en dicho proceso, aprendiendo a observar y extraer conclusiones. El profesor pasa a ser un guía de alumnos para facilitarles el uso de recursos y herramientas que necesitan para explorar y elaborar nuevo conocimiento y destrezas profesionales, acentuando su papel de orientador. El profesor podrá abordar temáticas de acuerdo a los intereses de sus alumnos, trabajar los contenidos al ritmo y estilo de aprendizaje

2. Experiencia en una asignatura técnica

La experiencia está basada en una asignatura de 3 créditos del Máster oficial en Edificación de la Universitat Politècnica de València llamada "Instalaciones eléctricas, mantenimiento de instalaciones". La práctica totalidad de los alumnos de esta asignatura está formada por titulados en áreas técnicas de arquitectura, edificación y obras públicas. El 80% de los estudiantes son de nacionalidad española, el resto de otras nacionalidades con predominancia de los países latino-americanos. El estudio se realizó durante 3 cursos académicos, desde el 2014/15 hasta al 2016/17. El número de alumnos que participaron en la fase de entrevistas para el estudio cualitativo fue de 32.

Para fomentar el autoaprendizaje e incentivar la capacidad de análisis y observación, se proponen dos actividades. La primera al comienzo de las clases (cuando todavía no se tienen los conceptos y conocimientos suficientes sobre la asignatura) y la segunda actividad, tres meses después, cuando ya se ha desarrollado prácticamente el temario de la asignatura.

Para fijar objetivos y necesidades de los alumnos, se realizó una pequeña charla para formar a los alumnos para que aprendan a aprender utilizando sus capacidades y con los materiales que ellos consideren adecuados, incentivarlos a que dirijan su proceso de aprendizaje.

a) La primera actividad consiste en lo siguiente:

Trabajo individual para los alumnos del máster de edificación de la asignatura "Instalaciones eléctricas", con el fin de observar diferentes tipologías de instalaciones y búsqueda de materiales usualmente utilizados en las instalaciones eléctricas. Constará de dos partes diferenciadas, una con descripción y fotografías de diferentes elementos reales instalados y otra parte, en que se buscará en catálogos y web de fabricantes diferentes imágenes de elementos que intervienen en las instalaciones eléctricas.

Buscar, fotografiar y comentar diferentes elementos que vayamos observando en nuestra búsqueda cotidiana, que puede ser en diferentes actividades de edificios (ejemplo: distribución eléctrica, grandes centros comerciales, garajes, edificios de otros usos, etc.).

buscando diferentes sistemas de instalación y comentando o añadiendo notas sobre las fotografías realizadas.

- Diferentes tipos de centros de transformación (aéreos, prefabricados, en obra, etc.)
- Diferentes tipos de redes de distribución eléctrica.
- diferentes tipos de CGP.
- Diferentes tipos de centralización de contadores.
- Cuadros de distribución.
- Sistemas de protección.
- Sistemas de canalización (tubos, bandejas material plástico, bandejas metálicas, etc.)
- Cajas de empalme y derivación, cajas de mecanismos, elementos para empalmes.
- Puestas a tierra y conexiones equipotenciales.
- Conexiones y mecanismos,
- etc. (y todo aquello que nos enseñe diferentes sistemas).

b) La segunda actividad consiste en lo siguiente:

El trabajo a realizar individualmente por los alumnos del máster de edificación de la asignatura “Instalaciones eléctricas”, es descriptivo con el fin que se pueda identificar las partes fundamentales y la misión de los diferentes elementos de una instalación eléctrica, para que mediante la observación y los comentarios que se puedan hacer, ampliar vuestros conocimientos (muchas veces se aprende mas viendo casos y comentándolos), por ello es interesante que se vea todo lo que pueda involucrar esa instalación eléctrica en base a todo lo que hemos visto en clase, y comentar de una manera descriptiva y crítica la misión de todo lo observado de la manera más amplia y con gran detalle, que esté al alcance del alumno. Se valorará el trabajo en función de la dificultad y la elaboración del alumno. Consistirá en lo siguiente:

Se trata de un trabajo descriptivo de una instalación eléctrica elegida por el alumno, para que con su observación y comentarios pueda afianzar el conocimiento de los diferentes elementos intervinientes en una instalación eléctrica, para ello se debe hacer:

- *Descripción general de la instalación de manera que se pueda entender de una manera básica la actividad para la que está diseñada esa instalación eléctrica (edificio de viviendas, centro comercial, hotel, industria, etc.).*
- *Se debe realizar el proceso descriptivo, mediante tomas fotográficas de las diferentes partes de la instalación comentadas y comentarios sobre lo observado en referencia a las fotografías u otras observaciones del alumno (Desde el centro de transformación, cgp, centralización de contadores y sus partes, tipos de registros, canalizaciones, cuadros de distribución, protecciones magnetotérmicas y diferenciales, redes de tierra, cableado, bases de enchufe, etc).*
- *En la observación deberán estar los comentarios de aquellas partes que a juicio del alumno sean de destacar.*

Hay que tener en cuenta que durante la realización de la primera actividad, los alumnos tienen algunos (aunque muy reducidos) conceptos sobre instalaciones eléctricas, lo cual provoca que al observar diferentes elementos en el exterior de la universidad se le planteen numerosas dudas y con ello provoca mayor observación y comentarios al profesor sobre los diferentes elementos observados. En la segunda actividad, en la parte final del curso, en la observación descriptiva por parte del alumno de una instalación eléctrica, se observa mayor seguridad en sus consideraciones, provocando que vean los numerosos detalles que anteriormente habían pasado desapercibidos.

3. Análisis de la experiencia mediante estudios cualitativos

Se han utilizado métodos de investigación cualitativos. En la investigación cualitativa (Strauss y Corbin, 1998), ser objetivos no significa controlar las variables sino ser abiertos, tener la voluntad de escuchar y de “darle la voz” a los entrevistados, sean estos individuos u organizaciones. Significa oír lo que otros tienen para decir, y ver lo que otros hacen, y representarlos tan precisamente como sea posible. Significa, al mismo tiempo, comprender y reconocer que lo que conocen los investigadores suele estar basado en los valores, cultura, educación y experiencias que traen a las situaciones investigativas y que puede ser muy diferente de lo de sus entrevistados.

Dentro de las técnicas cualitativas, en el análisis de los datos de la investigación, se ha utilizado la teoría fundamentada (Grounded Theory) (Charmaz, 2006; Glaser y Strauss, 1967). Para ello, se ha seguido el proceso indicado por Charmaz (Charmaz, 2006):

- Recogida de datos mediante muestreo teórico.
- Codificación inicial.
- Codificación orientada.
- Elevación de los códigos a categorías provisionales por codificación teórica.
- Redacción de los resultados obtenidos.

La característica fundamental de la investigación con teoría fundamentada es el procedimiento de muestreo teórico, donde se deben seleccionar los casos en función de su potencial para el desarrollo de nuevos puntos de vista y refinamiento de aquellos ya obtenidos. (Pace, 2004)

Como resultados de la aplicación de la teoría fundamentada, se debe obtener (Cutcliffe, 2005):

- La exposición de las principales variables que explican cómo resuelven sus problemas el colectivo estudiado.
- Los resultados identifican y conceptualizan los procesos básicos que las personas usan para resolver los problemas que consideran como clave.

- No es suficiente con describir los fenómenos. Es necesario dar un paso más y llegar a interpretar y explicar lo que sucede.

A diferencia de los estudios cualitativos, la muestra que se utiliza es muy diferente, comenzándose por una muestra general del tipo de empresas o personas donde deben comenzar las entrevistas, y la muestra será ajustada conforme avanza la investigación del tema de estudio.

Para este estudio, se ha utilizado una población formada por 32 alumnos que han realizado los dos trabajos de observación externos a la universidad. Se comienza con la recogida de datos hasta que se alcanza la saturación teórica, que es el punto donde un aumento de la muestra no aporta elementos ni categorías a los resultados (Pace, 2004).

Se han entrevistado a los 32 alumnos, de ellos, 20 eran hombres y 12 mujeres. Con el fin de obtener información que no estén condicionadas las respuestas de los entrevistados, se sigue un protocolo de entrevista en profundidad semi-estructurada con un estilo flexible, para extraer y entender las experiencias desde la visión del entrevistado.

El guión de la entrevista que se preparó fue el siguiente:

Basándose en los trabajos de la asignatura realizados de observación en el exterior de la universidad, de diferentes elementos y tipologías de instalaciones eléctricas, se pretende estudiar los factores en relación al autoaprendizaje por medio de la observación fuera del aula universitaria y el conocimiento adquirido y utilizado, contésteme a las siguientes preguntas:

- 1) *En el primer trabajo al comienzo del curso, ¿Recuerda cuáles fueron los problemas fundamentales que se encontró para realizar el trabajo de manera autónoma? ¿Dónde o cómo obtenía la información/conocimiento que necesitaba? ¿Cuáles considera que han sido las ventajas de realizar dicho trabajo para su formación?.*
- 2) *En el segundo trabajo al final del curso, ¿Recuerda cuáles fueron los problemas fundamentales que se encontró para realizar el trabajo de manera autónoma? ¿Dónde o cómo obtenía la información/conocimiento que necesitaba? ¿Cuáles considera que han sido las ventajas de realizar dicho trabajo para su formación?.*
- 3) *¿Qué ha aprendido en cuanto al desempeño por medio del autoatrendizaje y la observación fuera del aula universitaria? ¿Se puede extrapolar a otras asignaturas o al ámbito profesional?.*

Se realizaron las entrevistas de esta investigación durante los meses de Mayo de 2015, 2016 y 2017, entre diferentes alumnos del curso, siendo grabadas (se tomaron 375 minutos de grabación en total) y transcritas (23.102 palabras), creándose códigos (Glaser y Strauss, 1967) basados en las respuestas obtenidas. Se utiliza la codificación in-vivo y la codificación focalizada. El análisis de los datos se realizó con la ayuda de la aplicación Atlas.ti 5.0.

4. Resultados de los comentarios de los alumnos

En este apartado se enumeran los diferentes elementos identificados en relación al aprendizaje autónomo y la observación fuera del aula universitaria, y en que afecta al conocimiento adquirido y nuevas pautas de trabajo.

4.1. Relación del conocimiento adquirido por medio de la observación.

La totalidad de los entrevistados, da por hecho que durante la realización del primer trabajo, se producen numerosas dudas durante la observación de diferentes elementos eléctricos vistos en diferentes lugares fuera del aula universitaria y sin el apoyo del profesor. Destacan que existían elementos que se encuentran habitualmente en su vida que nunca se habían parado a observar: “[...]al observar un elemento veía el conjunto de todo, fijaba atención en los diferentes elementos que lo componían y apuntaba lo que no sabía que era, motivandome a buscar dicha información en internet o preguntar al profesor [...] he aprendido a observar y pensar, antes sólo miraba pero no observaba[...]”. Ponen todos de manifiesto, que en las siguientes horas de clase (donde se avanzaba en la asignatura), se tomaba mayor atención y se entendía al tratar los elementos que ellos anteriormente habían observado fuera del aula. Se pone de manifiesto en 31 de los 32 entrevistados, que la experiencia ha sido muy positiva para aprender observando y buscar información que lo relacione.

4.2. Relación del aprendizaje autónomo y aplicación a su vida profesional.

Los alumnos entrevistados, relacionan el aprendizaje autónomo como algo necesario que deberán utilizar en su vida profesional, por el avance de la técnica o por los diferentes cambios en la actividad, con lo cual les ayudará a auto-formarse y reciclarse a nuevos retos profesionales. Con el primer trabajo han aprendido a ser más observadores y sacar conclusiones de lo visto): “[...] para mí, ha sido muy positivo saber prestar la atención sobre un elemento que anteriormente pasaba desapercibida, con ello aprendía y me formulaba preguntas[...] el problema era saber todos los componentes vistos, me ha motivado a buscar en internet y preguntar al profesor[...]” Con el segundo trabajo en la fase final del curso, han aprendido con la experiencia del primer trabajo asociándolos a los conocimientos adquiridos durante las horas de clase de la asignatura): “[...] al aprender a observar con el primer trabajo, me sirvió para afianzar conceptos al tratarlos después en clase. En el segundo trabajo me resultó mucho más fácil, entendiendo todo el contexto de la instalación[...] en la vida profesional es fácil cambiar de actividad o de contexto, con lo cual es muy importante saber observar y auto-aprender[...]” Los alumnos opinan, que con la experiencia pueden resolver con mayor eficiencia y menor tiempo acoplarse a nuevas actividades que antes no habían tratado.

4.3. Ventajas y desventajas observadas por medio del aprendizaje autónomo y la observación fuera del aula

Como principales ventajas, los entrevistados consideran que les ha fomentado el ver lo obvio (que antes no lo habían tenido en cuenta), la importancia de la observación que les ha motivado a hacerse preguntas ante las dudas observadas, así como aprender a adaptarse a nuevos retos en su vida profesional. No creen que haya desventajas en aprender a observar y fomentar el auto-aprendizaje, aunque consideran que al principio era duro, dado que no sabían como empezar, y les faltaba práctica.

5. Discusión

Se extrae de las entrevistas, que los alumnos están acostumbrados a realizar trabajos tutorizados por el profesor, pero cuando el entorno es el de preparar algo en base a la observación y bajo su elección se les plantean numerosas dudas. Los trabajos solicitados y que han realizado les han visto ver lo que antes les pasaba desapercibido, ha fomentado en ellos el aprendizaje autónomo, y ha fomentado en ellos el prepararse para nuevos retos en la vida profesional que se encontrarán a la finalización de sus estudios. En la tabla 1 se muestran un resumen de las principales implicaciones que estos trabajos han tenido sobre los alumnos en función de su capacidad de observación, capacidad de auto-aprendizaje, adaptación a nuevos conocimientos y favorecer nuevos retos profesionales, en base a los datos obtenidos en las entrevistas.

Se extrae de la investigación, la gran aceptación de los alumnos ante estos trabajos de observación y análisis de instalaciones eléctricas. Consideran fundamental el aprender en base a la observación, fomenta su seguridad ante nuevos retos profesionales. Les ha motivado también a prestar mayor detalle en clase cuando se explicaban aquellos elementos que anteriormente habían observado en los trabajos iniciales.

Tabla 1: Componentes fomentados con la observación y el auto-aprendizaje.

COMPONENTE ESTRATÉGICO	PRIMER TRABAJO (al comienzo del curso)	SEGUNDO TRABAJO (al final del curso)
Capacidad de observación	Se aprende a observar. Se fomentan las preguntas.	Se afianza la capacidad de observación. Se adquiere mayor seguridad.
Capacidad de auto aprendizaje	Se fomentan las dudas que fomentan el aprendizaje autónomo	Se acostumbra a auto-aprender, se orienta en buscar información, se apoya ocasionalmente con el profesor
Adaptación a nuevos conocimientos	Se adaptan a nuevos conocimientos. Fomenta nuevos retos	Rápida evolución en la adaptación a nuevos conocimientos. Se quita el miedo a introducirse en nuevos retos
Favorecer adaptarse a nuevos retos profesionales o actividades	Fomenta el adaptarse a nuevas actividades, nuevas tecnologías, etc.	Forman la conciencia de poder evolucionar hacia otras actividades que hayan tocada en menor medida en sus estudios formales.

6. Conclusiones

Las principales conclusiones que podemos extraer de este trabajo serían los siguientes:

- Es conveniente fomentar en los alumnos las practicas de observación y discusión de lo visto. con ello aprenden a entender los contextos y formularse preguntas.
- Los alumnos, en general, .consideran muy positivos estos tipos de trabajos que le ayudan a fomentar su auto-aprendizaje. Consideran que estas habilidades deberían ser fomentadas en los primeros cursos de carrera.
- Ante nuevos retos profesionales, consideran que aprender de la observación y fomentar el auto-aprendizaje le ayudará a cambios de sectores, empresas nuevas tecnologías, etc.
- No se observan diferencias entre los comentarios realizados por hombres o mujeres, Sería conveniente ampliar este trabajo a otras asignaturas y a una población mayor de alumnos, que afianzaran los resultados obtenidos con este estudio.

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Desarrollo y uso de las Tecnologías de la Información y Comunicación en la asignatura de Trabajo de Fin de Grado

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Resumen

El desarrollo e implantación del uso de las nuevas tecnologías en nuestro día a día, ha modificado el escenario actual docente. El nuevo contexto supone un desafío en la búsqueda de nuevos patrones de acceso al conocimiento por medio de las Tecnologías de Información y Conocimiento (TIC).

El eje temático de este trabajo se basa en el uso de estas tecnologías como herramienta didáctica desarrollada por el docente, y enfocada en paliar las dificultades del alumno de una asignatura obligatoria en los estudios de grado. Cualquier docente que dirija o haya dirigido trabajos académicos es consciente de la cantidad de tiempo que consume esta tarea, y en muchos de los casos, gran parte del mismo, es consecuencia de explicar aspectos que nada tienen que ver con los contenidos propios del trabajo, sino con aspectos formales, tales como: cumplir con los requisitos de formato, importancia de la bibliografía, defensa del trabajo, etc.

Por todo ello, los autores de este trabajo proponen una metodología de aprendizaje autónoma por medio de las TIC basada en la explicación por medio de videotutoriales de los aspectos genéricos de la asignatura obligatoria en estudios superiores, denominada “Trabajo Fin de Grado (TFG)”.

Palabras clave: *Tecnologías, Información, Comunicación, Trabajo, Fin, Grado, Metodología, Autodidacta*

Introducción

La Agencia Nacional de Evaluación de la Calidad y Acreditación (ANECA) es un organismo cuya misión es contribuir a la mejora de la calidad del sistema de educación superior mediante la evaluación, certificación y acreditación de enseñanzas, profesorado e instituciones. Este organismo tiene diferentes programas de evaluación, unos enfocados a la acreditación de nuevas enseñanzas e instituciones, y otros a la acreditación del profesorado.

En lo que respecta a esta última, los requisitos necesarios para la acreditación nacional a los cuerpos docentes universitarios, regulados por el Real Decreto 1312/2007, son cada vez más exigentes y los méritos aportados por los solicitantes son revisados por un tribunal que evalúa los siguientes aspectos: 1) actividad docente, 2) actividad investigadora, 3) transferencia de conocimiento y experiencia profesional, 4) experiencia de gestión y 5) formación académica. La evaluación de los méritos aducidos y debidamente justificados dan lugar a una calificación alfabética de la A a la E. La calificación alfabética tiene el siguiente significado:

-A, excepcional. – B, bueno. – C, compensable. – D, insuficiente. – E, circunstancia especial. En la acreditación para el Cuerpo de Catedráticos de Universidad no se tiene en cuenta la formación académica, y una evaluación positiva pasa por obtener alguna de las combinaciones de la Tabla 1.

Tabla 1. Baremos acreditación para la figura de Catedrático de Universidad. Fuente: Real Decreto 1312/2007

	Investigación	Docencia	Transferencia/Actividad profesional	Gestión
Calificación mínima	B	B		
Calificación mínima	A	C,E ¹		
Calificación mínima	B	C	B	
Calificación mínima	B	C		B
Calificación mínima	C	B	A	
Calificación mínima	C	B		A

¹ El nivel E solo es válido para la acreditación cuando un solicitante haya desarrollado su carrera principalmente en una institución no universitaria o en una universidad no española donde el cómputo y los instrumentos de medición de la calidad de la actividad docente resulten difíciles de trasladar al sistema español.

Una resolución positiva para el Cuerpo de Profesores Titulares de Universidad implica alguna de las combinaciones mostradas en la Tabla 2.

Tabla 2. Baremos acreditación para la figura de Profesor Titular de Universidad. Fuente: Real Decreto 1312/2007

	Investigación	Docencia	Transferencia/Actividad profesional	Gestión	Formación
Calificación mínima	B	B			
Calificación mínima	A	C,E ²			B
Calificación mínima	B	C	B		B
Calificación mínima	B	C		B	B
Calificación mínima	C	B	A		B

² El nivel E solo es válido para la acreditación cuando un solicitante haya desarrollado su carrera principalmente en una institución no universitaria o en una universidad no española donde el cómputo y los instrumentos de medición de la calidad de la actividad docente resulten difíciles de trasladar al sistema español.

En definitiva, el nuevo sistema de acreditación comparado con el anterior, ha incrementado de forma exponencial los niveles de exigencia requeridos para obtener una plaza fija en la universidad.

Por otra parte, no hay que olvidar las directrices del Espacio Europeo de Educación Superior (EEES) (R.D 1393/2007), puesto que también han supuesto cambios en los métodos educativos, alterando sus costumbres rutinarias de funcionamiento y aproximándola a las prioridades sociales. En los últimos años se han incorporado nuevas metodologías didácticas que abarcan el uso de Tecnologías de la Comunicación e Información (TIC), herramientas 2.0, y la comunicación mediática, etc.

Todos estos cambios afectan de forma diaria y constante a los docentes universitarios, que deben gestionar eficazmente su tiempo al objeto de desarrollar la gran cantidad de tareas docentes e investigadoras que reclaman los mencionados organismos.

Competencias académicas

Un puesto de trabajo requiere de una serie de competencias que se deben adquirir con el objetivo de promocionar laboralmente. Éstas se definen como los conocimientos, habilidades y actitudes que se desarrollan para resolver de forma satisfactoria las situaciones a las que un individuo debe enfrentarse en su jornada diaria. Las competencias se construyen a lo largo de toda la carrera profesional, a partir del contexto, de circunstancias cambiantes, de la

evolución del propio sujeto, de su formación continua, y del conocimiento que da la experiencia.

Las competencias en el sistema educativo español, tal y como se ha explicado anteriormente, son impuestas por la ANECA, y se resumen en cinco. Por otra parte, las competencias del alumnado vienen fijadas en los planes de estudio y se clasifican en dos tipos:

- las genéricas o transversales, comunes a todas las titulaciones, y,
- las específicas, correspondientes a cada titulación (Rekalde Rodríguez I., 2011).

Los planes de estudio garantizan que, al finalizar los estudios cursados, los alumnos hayan adquirido las competencias necesarias para resolver problemas complejos y abiertos, en distintos escenarios y momentos que le permitan desarrollarse profesionalmente (Fondón *et al.*, 2008). Para alcanzar este objetivo, el docente debe usar los recursos que tiene a su alcance para interrelacionar la formación teórica con la práctica, y transmitírselo así a sus alumnos.

Trabajo Fin de Grado

En los estudios de grado de ingeniería de la Universidad de Oviedo figura una asignatura obligatoria que consiste en que el alumno realice un trabajo individual, y original, que debe presentar y defender ante un tribunal universitario (Tabla 3). Esta asignatura se conoce como Trabajo Fin de Grado y garantiza que el estudiante trabaje todas las competencias generales y algunas específicas de la titulación, por lo que, cualquier alumno que quiera obtener su título, debe superar esta asignatura.

Respecto a la tutela de este tipo de trabajos, cualquier docente que dirija o haya dirigido alguno, es consciente de la cantidad de tiempo que consume esta tarea, y en muchos de los casos, gran parte del mismo, es consecuencia de explicar aspectos que nada tienen que ver con los contenidos propios del trabajo, sino con aspectos formales, tales como: cumplir con los requisitos de formato, importancia de la bibliografía, defensa del trabajo, etc.

Este trabajo se focaliza en minimizar el tiempo invertido en la dirección de trabajos académicos garantizando la calidad de los mismos. Para ello, se propone el uso de las TIC como herramienta autodidáctica desarrollada por el docente, y enfocada en paliar las dificultades del alumno de la asignatura Trabajo Fin de Grado.

En este sentido, se ha elaborado una metodología de aprendizaje autónoma por medio de las herramientas tecnológicas basadas en la explicación por medio de videotutoriales de los aspectos genéricos de un Trabajo Fin de Grado (TFG).

Tabla 3. Características de las titulaciones de ingeniería de la Universidad de Oviedo.

Tipología de estudio	Titulación	TFG (Créditos ECTS)
Ingeniería y Arquitectura	Grado en Ingeniería Civil	12
	Grado en Ingeniería de los Recursos Mineros y Energéticos	12
	Grado en Ingeniería de Tecnologías Mineras	12
	Grado en Ingeniería Eléctrica	12
	Grado en Ingeniería Electrónica Industrial y Automática	12
	Grado en Ingeniería Informática del Software	12
	Grado en Ingeniería en Tecnologías Industriales	12
	Grado en Ingeniería en Tecnologías y Servicio de Telecomunicación	12
	Grado en Ingeniería Forestal y del Medio Natural	12
	Grado en Ingeniería Geomática y Topografía	12
	Grado en Ingeniería Informática en Tecnologías de la Información	12
	Grado en Ingeniería Marina	12
	Grado en Ingeniería Mecánica	12
	Grado en Ingeniería Náutica y Transporte Marítimo	12
	Grado en Ingeniería Química	12
	Grado en Ingeniería Química Industrial	12

1. Metodología de autoaprendizaje propuesta

La experiencia de los autores respecto a la dirección de Trabajos de Fin de Grado se resume en los siguientes patrones de actuación tutor-alumno:

- 1) Primer contacto alumno-tutor. Acuerdo de dirección del trabajo académico.
- 2) Tutor:
 - Asigna temática del trabajo.
 - Explica formalismos de los trabajos: cómo debe presentar el trabajo para cumplir los requisitos de formatos requeridos por el centro.
 - Expone los contenidos mínimos que deben figurar en el trabajo según la temática del mismo.

- Explica cómo realizar una bibliografía y citarla correctamente en el texto, etc.
 - Concierta siguiente cita.
- 3) Alumno:
- Dificultad para asistir a la cita, por motivos laborales u otros.
 - Dificultad para recordar todas las explicaciones realizadas previamente y relacionadas con los formalismos del trabajo.
 - Dudas durante la elaboración del trabajo desarrollando los contenidos del mismo.
- 4) Tutor:
- Explica los formalismos de una defensa del trabajo frente a un tribunal.
 - Concierta cita para ensayar la presentación previa a su defensa.
- 5) Alumno:
- Dificultad para asistir a la cita, por motivos laborales u otros.

Los patrones de actuación demuestran que gran parte del tiempo invertido durante la tutela de trabajos consiste en: concertar una siguiente cita (caso de alumnos que trabajan y estudian simultáneamente), corregir fallos en los contenidos del documento, y, explicar formalismos relacionados con el mismo. Por este motivo, surge la idea de:

- encontrar la forma en que el tutor pueda corregir el documento sin tener que obligar al alumno a desplazarse, y
- responder de forma masiva y on-line, las cuestiones recurrentes durante la tutela de trabajos. Algunas de estas cuestiones son:
 - ¿Qué diferencia existe entre referencia y cita bibliográfica?
 - ¿Cómo cumplo con los requisitos de formato establecidos por el centro?
 - ¿Cómo tengo que hacer la presentación para defender el trabajo ante un tribunal?, etc.

Con el objetivo de optimizar el tiempo de tutela de trabajos académicos, se han elaborado una serie de videotutoriales donde se responden a este tipo de cuestiones:

Módulo I: Tipos y contenidos de los Trabajos de Fin de Grado (TFG).

Módulo II: Formatos del Trabajo de Fin de Grado (TFG) usando como procesador de texto:

- Microsoft Office.
- Libre Office

Módulo III: Bibliografía del Trabajo de Fin de Grado (TFG).

Módulo IV: Herramientas complementarias (TFG).

Módulo V: Defensa del Trabajo de Fin de Grado (TFG) usando como procesador de texto:

- Microsoft Office.
- Libre Office

Los módulos I, II, III y V están relacionados con aspectos formales del trabajo y son recomendables para todo tipo de estudiantes, mientras que el módulo IV está enfocado a alumnos que compaginan sus estudios con la actividad laboral, ya que analiza el uso y las ventajas que ofrecen los servicios en la nube.

Estos contenidos se han puesto a disposición de los alumnos de la Universidad de Oviedo en una página web proporcionada por la institución (Universidad de Oviedo, 2017), y también se han subido los materiales a plataformas en abierto como Youtube, Slideshare, etc.

Para poder analizar los resultados, se ha pedido a los alumnos de la Universidad de Oviedo que realicen una encuesta voluntaria tras la defensa del Trabajo de Fin de Grado. Asimismo, en las plataformas en abierto, se ha dado acceso al mismo cuestionario.

2. Análisis de resultados

Se han obtenido veinte respuestas a la encuesta de calidad de acceso abierto, durante un periodo de dos meses. En total, un 70% de las respuestas corresponden a alumnos que han sido informados de estos contenidos por medio de un profesor de la Universidad de Oviedo (Figura 1).

¿Cómo ha encontrado los contenidos de este proyecto?

20 respuestas

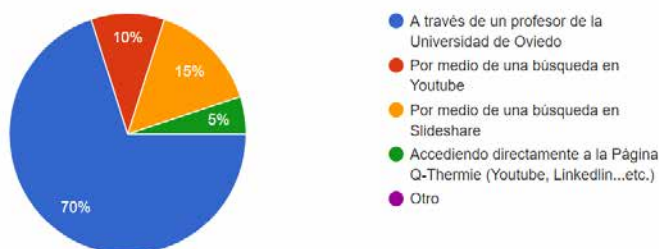


Figura 1. Encuesta de calidad. Respuestas a la pregunta ¿Cómo ha encontrado los contenidos de este proyecto?

Se ha podido comprobar que el módulo referido a la elaboración del documento mediante diferentes procesadores de texto es el que está teniendo mejor acogida por parte de los usuarios (Figura 2). Y un 90% de los mismos, considera que ha mejorado su manejo del mismo. El siguiente módulo mejor valorado, es el referido a cómo realizar una bibliografía correctamente.

De los diferentes módulos que hay en el proyecto, señale el que le ha resultado más interesante.

20 respuestas

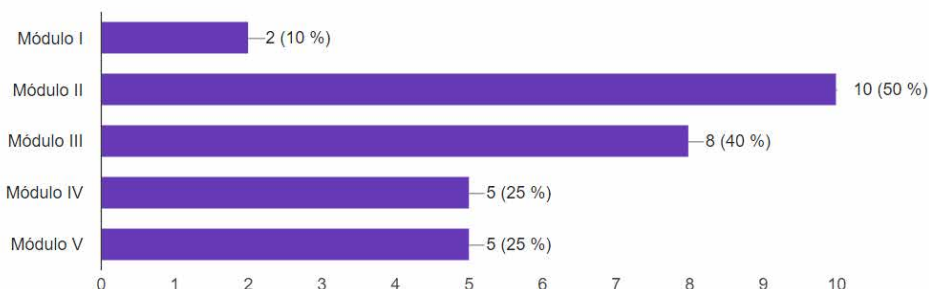


Figura 2. Encuesta de calidad. Respuestas a la pregunta: De los diferentes módulos que hay en el proyecto, señale el que le ha resultado más interesante

Por otra parte, la experiencia obtenida después de realizar este trabajo permite afirmar que que proporcionar el link de estos contenidos a los estudiantes, reduce significativamente el tiempo invertido en cuestiones generales, permitiendo centrar todos los esfuerzos del tutor en mejorar y desarrollar los propios contenidos del Trabajo de Fin de Grado.

3. Conclusiones

A la vista de los resultados mostrados, realizar videotutoriales para la tutorización online de trabajos académicos, cumple con creces el objetivo planteado. Asimismo, cabe destacar algunas de las ventajas de este sistema de autoaprendizaje y que se resumen dependiendo de la persona sobre la que recae el beneficio:

Alumno: Puede aclarar las dudas concernientes a la elaboración del trabajo:

- mediante videotutoriales claros y sencillos online,
- sin necesidad de desplazarse de su domicilio,
- y aplicarlo posteriormente, a su futuro profesional.

Profesor: Puede tutorizar de forma simultánea varios alumnos, y:

- ahorrar tiempo en explicar aspectos formales y repetitivos comunes a todos los trabajos académicos,
- centrarse únicamente en los aspectos relevantes a la temática del trabajo elegido por cada alumno,
- enseñar de manera no presencial mediante el uso de las TIC.

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Mejora de la docencia en Gestión de Servicios TI mediante aprendizaje basado en proyectos

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Resumen

Se ha planteado el aprendizaje basado en proyectos (ABP) como vía de mejora natural de la docencia en las asignaturas que tratan sobre Gestión de Servicios TI (GSTI) en la Universidad de Oviedo. Los alumnos han trabajado en equipos y esbozado los principales procesos de las etapas de estrategia, diseño, transición, operación y mejora continua de un servicio de eSalud. Los indicadores planteados para la evaluación han arrojado interesantes resultados que apuntan al éxito de nuestra propuesta.

Keywords: GSTI; ABP; eSalud

Introducción

En este trabajo se describe un proyecto de innovación docentes enmarcado en las asignaturas sobre Gestión y Gobierno de Servicios TI en los grados y másteres de Ingeniería informática e Ingeniería de telecomunicación impartidos en la Escuela Politécnica de Ingeniería de Gijón [1]. Tres son las asignaturas objeto del estudio, indicadas en la tabla 1.

Tabla 1. Asignaturas objeto del estudio

Asignatura	Titulación	Curso
Gestión Tecnologías Información (GTI)	Grado Ingeniería Informática en TI	4º
Gestión Servicios Telemáticos (GST)	Grado Tecnologías Servicios Telecom.	4º
Gobierno Servicios Telemáticos (GobST)	Máster Ingeniería Telecomunicación	2º

La temática de estas asignaturas, muy novedosa a nivel de grado en el panorama universitario [2], tiene una fuerte conexión con el mundo empresarial, ya que aborda la estrategia, diseño, construcción, operación y mejora continua de los servicios basados en las tecnologías de la información y las comunicaciones (TIC). Este tipo de servicios son los ofertados por muchas empresas de nueva creación en el ámbito TIC y son también los provistos por los departamentos de TI en cualquier tipo de empresa, siendo claves en el funcionamiento de las mismas.

Dentro de la gestión de TI, el contenido de las mencionadas asignaturas se centra en el conjunto de buenas prácticas ITIL (IT Infrastructure Library) [3], fuertemente consolidadas en el mundo empresarial a nivel internacional, siendo casi siempre las propias empresas las que deben formar a sus empleados.

La metodología propuesta se ha implantado progresivamente en cursos anteriores, pero sin un seguimiento sistemáticos mediante indicadores de evaluación.

El proyecto plantea el uso del aprendizaje basado en proyectos (ABP/PBL) [4], de modo que los alumnos puedan trabajar en un entorno similar al empresarial. Así, tanto las prácticas como el trabajo en grupo planteado en las asignaturas se orientan hacia un proyecto de gestión de un servicio real e innovador definido por los miembros de cada grupo de trabajo. La temática propuesta en el curso actual para dicho servicio es la salud digital (eSalud).

Las tres asignaturas utilizadas en el estudio plantean diferentes interrogantes ante la misma materia a impartir en ellas:

- **GTI** es una asignatura muy afín a la Ingeniería Informática en TI, aunque es poco frecuente a nivel de grado y supone un gran contraste con la inmensa mayoría de asignaturas de perfil técnico en dicho nivel.
- **GST** es una asignatura que se imparte solo en la especialidad de telemática de la titulación de grado en Ingeniería de Telecomunicación, muy afín a dicha especialidad, pero también muy infrecuente a nivel de grado.
- **GobST** se imparte en el máster en Ingeniería de Telecomunicación, aunque se da la circunstancia de que no hay apenas alumnos matriculados procedentes de la especialidad de telemática en el grado durante el curso en el que se ha realizado el estudio.

El reto de este proyecto es conocer y comparar los resultados de la metodología propuesta en los tres diferentes escenarios que plantean las asignaturas.

1. Metodología

Material didáctico

- Contenidos teóricos de la asignatura sobre ITIL
- Guiones de prácticas sobre la gestión de un servicio de ejemplo de catering online
- Plantilla de la memoria a entregar sobre la gestión del servicio propuesto

Actividades a realizar

- Clases expositivas sobre Gestión de Servicios con ITIL (V3, edición 2011)
- Prácticas sobre gestión de un servicio de ejemplo orientado a catering online
- Aprendizaje basado en proyectos mediante el desarrollo en grupo de un proyecto de gestión de un servicio de eSalud

Recursos materiales disponibles

- Laboratorios de prácticas con ordenadores donde se imparten las asignaturas
- Software como servicio (en la nube) ProactivaNet [5] para gestión de servicios proporcionado por la empresa colaboradora Espiral MS con sede en Gijón

Indicadores y modo de evaluación

Se han utilizado los siguientes 5 indicadores para la evaluación de los resultados:

- Tasa de aprobados por evaluación continua (AEC)
- Ayuda en la asimilación de teoría (AAT)
- Utilidad del caso de estudio (UCE)
- Adecuación a la demanda laboral (ADL)
- Mejora de las competencias profesionales (MCP)

Para aprobar la asignatura por evaluación continua es preciso superar la evaluación del proyecto de gestión llevado a cabo (con un peso de 6 puntos en la calificación final) y también un examen de teoría de tipo test similar al correspondiente a la certificación en *ITIL Foundation* [6] (con un peso de 6 puntos en la calificación final). La evaluación del proyecto consiste a su vez en la valoración tanto de la memoria del proyecto como de dos defensas públicas por parte de los miembros del grupo, una sobre la memoria y otra sobre la implementación de la gestión del servicio en la herramienta ITSM de soporte utilizada (*ProactivaNET*).

La evaluación de los últimos 4 indicadores se realiza mediante dos encuestas, realizadas respectivamente al inicio y fin de curso. Las respuestas a la encuesta inicial corresponden a las expectativas iniciales (EI) sobre la asignatura, mientras que las respuestas a la encuesta final corresponden a la opinión final (OF) de los alumnos sobre la asignatura.

Se indican a continuación las preguntas utilizadas en la encuesta inicial y final respectivamente para cada uno de ellos.

Ayuda en la asimilación de teoría (AAT):

- *Espero que las herramientas utilizadas en las prácticas me ayuden a relacionar la parte práctica con la teoría, facilitándome así la asimilación de contenidos.*
- *Las herramientas utilizadas en las prácticas me han ayudado a relacionar la parte práctica con la teoría, haciéndome más fácil la asimilación de contenidos.*

Utilidad del caso de estudio (UCE):

- *Espero que el uso de las herramientas en el caso de estudio guiado de la asignatura sea didáctico y me permita abordar el correspondiente al trabajo en grupo de forma eficaz.*
- *El uso que se ha hecho de las herramientas en el caso de estudio de la asignatura ha sido bastante didáctico y me ha permitido abordar el correspondiente al trabajo en grupo de forma eficaz.*

Adecuación a la demanda laboral (ADL):

- *Esta asignatura me ayudará a adecuarme a las demandas del mundo laboral sobre gestión de servicios TI.*
- *Esta asignatura me ha ayudado a adecuarme a las demandas del mundo laboral sobre gestión de servicios TI.*

Mejora de las competencias profesionales (MCP):

- *Considero muy útil esta asignatura para mejorar las competencias profesionales que se requieren en el mundo laboral actual.*

- *Esta asignatura ha sido muy útil para mejorar las competencias profesionales que se requieren en el mundo laboral actual.*

La tasa de aprobados por evaluación continua (AEC) se calcula como el porcentaje de alumnos aprobados en la convocatoria ordinaria y se consideran tres umbrales de satisfacción del resultado:

AEC: > 90% resultado muy bueno, AEC > 80% bueno, > 70% aceptable

Para el resto de indicadores, basados en las encuestas, se consideran también tres niveles de satisfacción del resultado:

Indicador: > 4,0 resultado muy bueno, > 3,5 bueno, > 3,0 aceptable

2. Desarrollo del proyecto

El trabajo se resume en las 10 fases y fechas indicadas en la tabla 2.

Tabla 2. Fases del proyecto

Fases		Fechas de ejecución
1	Presentación de la metodología de trabajo de en la asignatura	1ª clase expositiva
2	Encuesta inicial	1 ^{er} día de prácticas
3	Propuesta de la temática sobre servicios de eSalud y documentación	2º día de prácticas
4	Entrega de una plantilla de memoria sobre la gestión del servicio a elegir	2º día de prácticas
5	Desarrollo guiado de un caso de estudio de servicio a modo de ejemplo	Resto de prácticas
6	Desarrollo y supervisión de la gestión del servicio de eSalud elegido	Resto de prácticas
7	Defensa de la memoria del proyecto	Clase expositiva
8	Defensa de la implementación llevada a cabo en la herramienta ITSM	Última clase prácticas
9	Encuesta final	Última clase prácticas
10	Cálculo de los indicadores de evaluación y extracción de conclusiones	Segundo semestre

3. Resultados

Se muestran en este apartado los resultados obtenidos para los indicadores de evaluación propuestos. Para su mejor interpretación se ha optado por la representación gráfica de los mismos.

En primer lugar, se analiza cada uno de los indicadores, mostrando en el eje Y el valor del indicador y en el eje X las 3 asignaturas incluidas en el estudio (GTI, GST y GobST). En el caso de los indicadores calculados a partir de las encuestas se muestran tanto los

correspondientes a las expectativas iniciales (EI) como a las opiniones finales (OF) de los alumnos. Se muestran siempre además los valores medios de los indicadores para el conjunto de las 3 asignaturas, denotados como $M(AEC)$ / $M(EI)$ / $M(OF)$. Finalmente se analizan de forma conjunta los resultados de todos los indicadores para cada una de las asignaturas.

La participación en las encuestas por asignatura se indica en la tabla 3.

Tabla 3. Participación en las encuestas

Asignatura	Alumnos	Encuesta inicial (%)	Encuesta final (%)
GTI	44	86	77
GST	39	56	36
GobST	11	82	73
Total	94	75 (media)	62 (media)

La notación común utilizada en las gráficas es la siguiente:

- *Curva de expectativas iniciales (EI):* discontinua, gris y con rombos marcadores
- *Curva de opiniones finales (OF):* continua, gris y con cuadrados marcadores
- *Curva de tasa de aprobados por evaluación continua (AEC):* ídem
- *Colores para marcadores y valores medios:*

resultado muy bueno / *resultado bueno* / *resultado aceptable*

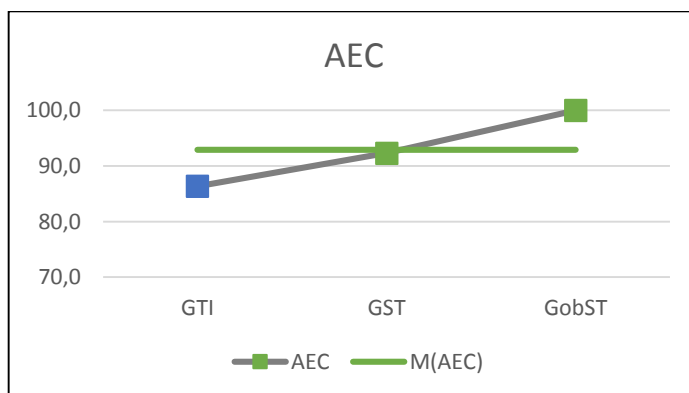


Figura 1. Tasa de aprobados por evaluación continua

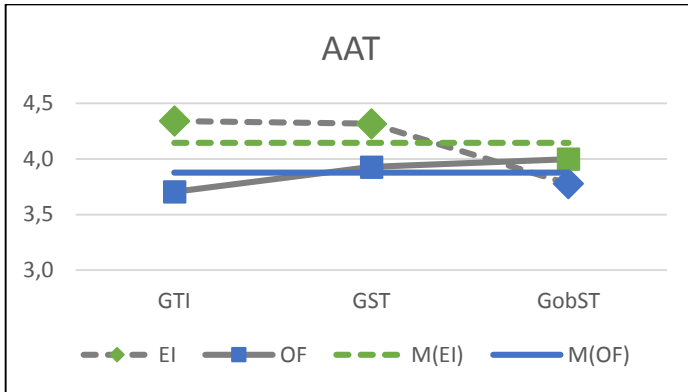


Figura 2. Ayuda en la asimilación de teoría

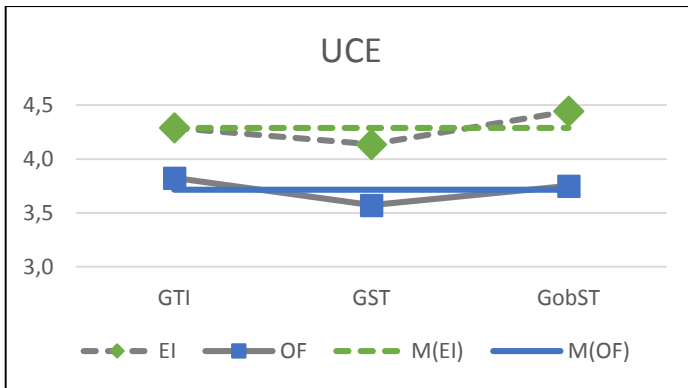


Figura 3. Utilidad del caso de estudio

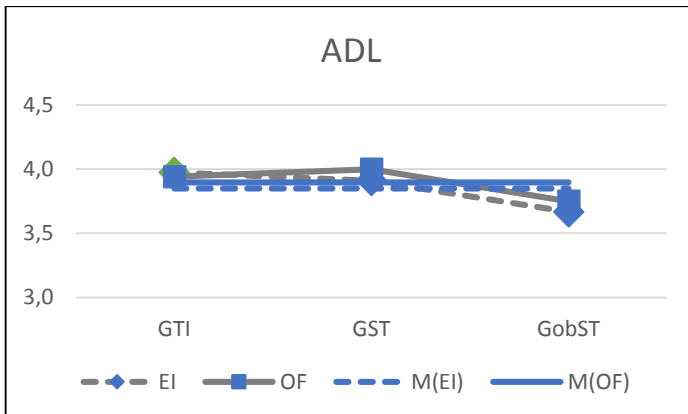


Figura 4. Adecuación a la demanda laboral

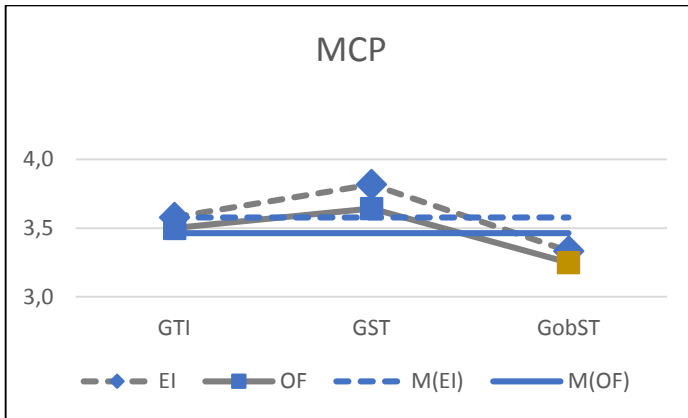


Figura 5. Mejora de las competencias profesionales

Tabla 4. Intervalos de confianza (90%) de los indicadores

Indicador	GTI	GST	GobST
AAT	0,19 - 0,33	0,20 - 0,40	0,46 - 0,44
UCE	0,25 - 0,23	0,24 - 0,32	0,39 - 0,37
ADL	0,22 - 0,18	0,21 - 0,30	0,47 - 0,41
MCP	0,26 - 0,23	0,23 - 0,41	0,55 - 0,27

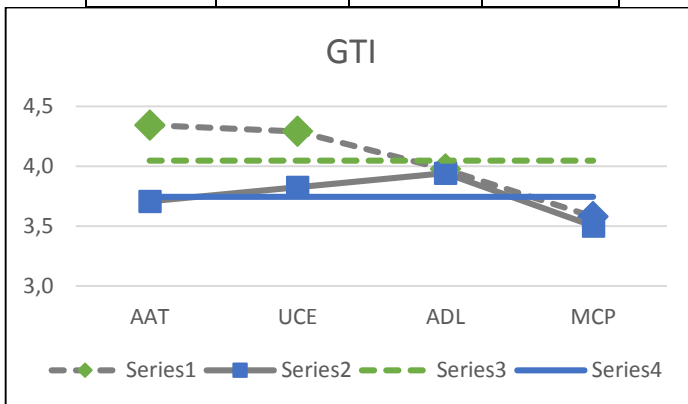


Figura 6. Asignatura GTI

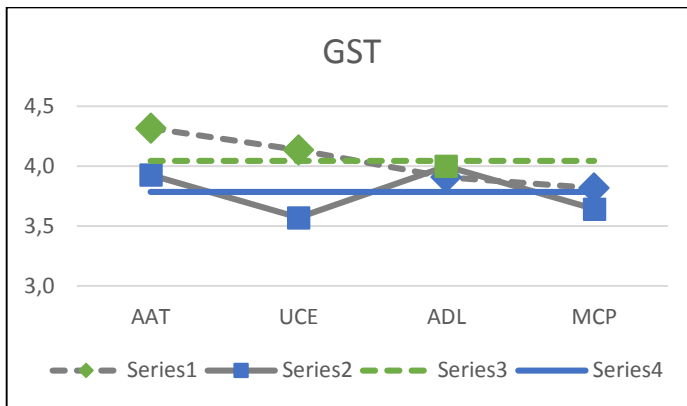


Figura 7. Asignatura GST

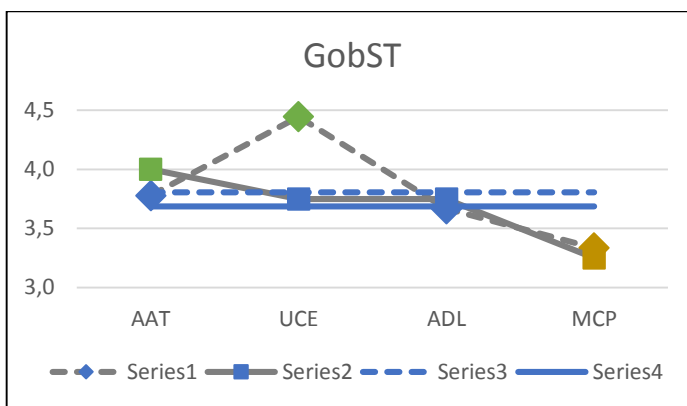


Figura 8. Asignatura GobST

4. Discusión

Tasa de aprobados por evaluación continua (AEC). El indicador se calcula para cada asignatura a partir del número de alumnos aprobados en la convocatoria ordinaria sobre el total de alumnos matriculados. Los resultados son buenos o muy buenos y el resultado medio muy bueno (figura 1).

Ayuda en la asimilación de teoría (AAT). Las expectativas son superiores a las opiniones finales salvo en el caso de la asignatura de máster (figura 2). Los resultados finales son buenos en las asignaturas de grado (ligeramente inferiores en el caso de GTI) y muy buenos en la de máster. El resultado medio es bueno.

Utilidad del caso de estudio (UCE). Las expectativas son sensiblemente superiores a las opiniones finales en todas las asignaturas (figura 3). Los resultados finales son buenos y ligeramente menores en el caso de GST.

Adecuación a la demanda laboral (ADL). Los resultados finales son ligeramente superiores a las expectativas iniciales en todas las asignaturas (figura 4) y ligeramente inferiores en la asignatura del máster.

Mejora de las competencias profesionales (MCP). Los resultados finales son ligeramente inferiores las expectativas iniciales (figura 5). Los resultados finales son buenos en las asignaturas de grado y aceptables en el caso de la asignatura del máster. Estos resultados sensiblemente inferiores en el caso del máster posiblemente sean debidos a la inexistencia de alumnos procedentes de la especialidad de telemática en el grado, especialidad a la que es más afín la asignatura. El resultado final medio es bueno.

En la tabla 4 se muestran las medidas de dispersión en las encuestas realizadas mediante los intervalos de confianza al 90% de los indicadores utilizados. La dispersión es muy similar en las dos asignaturas de grado, aumentando ligeramente en la encuesta final de GST, y sensiblemente superiores en la asignatura de máster.

Gestión de tecnologías de la Información (GTI). Los resultados finales son sensiblemente inferiores a las expectativas iniciales para los dos primeros indicadores (AAT y UCE), pero prácticamente iguales en el caso de los dos últimos (ADL y MCP), lo cual implica una sólida valoración de la temática de la asignatura (figura 6). Todos los resultados finales son buenos.

Gestión de Servicios telemáticos (GST). Los resultados finales son sensiblemente inferiores a las expectativas iniciales para los indicadores AAT y UCE, pero muy similares para ADL y MCP, siendo incluso superiores los resultados finales del indicador ADL a las expectativas iniciales (figura 7). Al igual que en la otra asignatura de grado, ello implica una sólida valoración de la temática de la asignatura. Todos los resultados finales son buenos y para el indicador ADL muy buenos.

Gobierno de Servicios Telemáticos (GobST). Los resultados finales son muy similares a las expectativas iniciales salvo en el caso del indicador UCE, donde son sensiblemente inferiores (figura 8). En el caso del indicador AAT son en cambio superiores los resultados finales. Los resultados son muy buenos para el indicador AAT, buenos para UCE y ADL y aceptables para MCP. La valoración del inferior resultado en el caso de este último indicador ya se había comentado más arriba.

5. Conclusiones

Teniendo en cuenta que el 100% de proyectos llevados a cabo con éxito, la ausencia de conflictos reseñables en los equipos de trabajo y la presentación posterior de alguno de los proyectos desarrollados en iniciativas de emprendimiento, podemos estar razonablemente satisfechos con los objetivos alcanzados respecto a los planteados inicialmente. Las principales conclusiones a las que hemos llegado tras el proyecto son las siguientes:

- Todos los indicadores han arrojado resultados buenos o muy buenos salvo el indicador MCP en la asignatura de máster, donde a pesar de no resultar excesivamente atractiva la materia para la especialidad de los alumnos matriculados el resultado ha sido aceptable.

- Las opiniones finales son muy similares a las expectativas iniciales en el caso de los indicadores ADL y MCP, lo que indica solidez en la percepción de la importancia de la materia de estudio para los alumnos.
- La colaboración en grupo en proyectos de gestión de servicios TI junto con el uso de herramientas ITSM parece pues una metodología apropiada para motivar a los alumnos en la materia de estudio y potenciar la asimilación de sus contenidos.

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Estándares de Project Management del PMI para docentes universitarios en la organización de asignaturas

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Abstract

According to the standards of the Project Management Institute, project management is one of the most successful and proven systems. Its application in the preparation of University courses represents added value to teachers and students, ensures learning success and is able to measure the performance of teaching throughout the lifecycle of any subject at all times. We expose here the way to understand that kind of management through the interrelation between the various phases of the Educational Project, with special emphasis on the planning and control of the whole process.

Keywords: standards, best practises, project management, university teaching, educational project.

Resumen

La gestión de proyectos según los estándares del Project Management Institute es uno de los sistemas más exitosos y probados. Su aplicación en la preparación de asignaturas universitarias supone un valor añadido al docente y a los alumnos, al garantizar el éxito del aprendizaje y ser capaz de medir en todo momento el desempeño de la docencia a lo largo del ciclo de vida de la asignatura. Se expone aquí la forma de entender esa gestión a través de la interrelación entre las distintas fases del proyecto educativo, con especial énfasis en la planificación y control de todo el proceso.

Palabras clave: estándares, mejores prácticas, project management, docencia universitaria, proyecto educativo, gestión.

Introducción

La docencia universitaria actual está en plena evolución hacia nuevos planteamientos del aprendizaje a nivel de contenidos así como en lo referente a las herramientas y métodos de enseñanza. El lógico papel de las universidades en el núcleo de nuestra realidad como motor social de innovación y su condición de liderazgo en la creación de los nuevos escenarios de futuro merecen toda reflexión que pueda colaborar a su evolución y mejora. Las nuevas sociedades de la información en que vivimos no deberían ir por delante de los planteamientos docentes, todavía en ocasiones anclados al pasado o con modelos y técnicas claramente agotados. En el esfuerzo por modificar reflexivamente los sistemas de enseñanza en la docencia universitaria se inserta la propuesta que planteamos en las siguientes líneas.

Son múltiples los nuevos modelos de docencia y aprendizaje que se están implementando poco a poco en los centros universitarios como alternativa a la docencia tradicional de clases magistrales teórico-prácticas y evaluación del alumnado. Se aplican ya la *gamificación*, los sistemas de *e-learning*, la docencia inversa o *Flip Teaching*, plataformas y campus virtuales o la docencia basada en proyectos (PBL), entre otros. No es el propósito del presente trabajo abundar en las bondades o defectos de unas propuestas respecto de otras, ni si la introducción de los nuevos planes de estudio en el marco de la convergencia europea, ha fomentado o frenado la introducción de nuevas formas de enseñar. Nuestro principal objetivo es proponer la introducción de una de las prácticas más exitosas en la gestión de proyectos, como sistema de gestión de asignaturas en el ámbito de la universidad siguiendo las prescripciones del Project Management Institute, Inc. (en adelante PMI). Se expone aquí un estándar en la gestión de proyectos concreto, puesto que el del PMI es uno de los modelos más extendidos en el mundo. No es tanto una metodología sino un conjunto de herramientas y procesos basado en las «mejores prácticas» reconocidas a lo largo del tiempo y que por tanto está en constante evolución, si bien el modelo en su conjunto está completamente probado con éxito en infinidad de proyectos de todos los niveles y disciplinas.

La gestión de proyectos y su aplicación en el campo de la enseñanza es variada en cuanto a los planteamientos y alcance y tiene un componente genérico basado en el sentido común. Aquí vamos a plantear la comunicación de una práctica concreta que permita garantizar cualitativa y cuantificablemente el éxito de los proyectos, analizando el «ciclo de vida de la asignatura» por el profesor, la coordinación e intervención en cualquier fase del desarrollo del curso o de la preparación del material docente, con un especial énfasis en la retroalimentación desde el alumnado para el aseguramiento de los objetivos marcados.

1. La docencia como proyecto

La *Guía de los Fundamentos para la Dirección de Proyectos, 5ª Ed. (Guía del PMBOK®)* – en septiembre de 2017 se ha publicado la 6ª Ed. del *PMBOK*– es el documento que proporciona las pautas para la dirección de proyectos individuales y define los conceptos

relacionados con la dirección de proyectos (Project Management Institute, 2013). En él, se define el término «proyecto» como un esfuerzo temporal que se lleva a cabo para crear un producto, servicio o resultado final.

Desde nuestro punto de vista, cualquier objetivo, tanto en la vida cotidiana, como en la profesional o en la educativa, puede ser considerado un «proyecto». Así, la docencia, tanto en cuanto a la organización de las asignaturas por el profesor como en el aprendizaje o desarrollo por el alumnado junto con el docente de los diferentes cursos, con independencia de las titulaciones, contenidos y orientaciones de los centros universitarios, es susceptible de ser dirigida a través del prisma de la gestión de proyectos.

En este doble planteamiento, la responsabilidad del «Director del Proyecto» (Project Manager, PM), recae principalmente en la figura del profesor. Es el representante nombrado por la organización ejecutante para liderar al equipo que es responsable de alcanzar los objetivos del proyecto. En nuestro contexto, la «organización» puede ser asimilada a la propia Universidad o, jerárquicamente, la Escuela o Facultad, el Departamento, la Unidad Docente u otras, dependiendo de la estructura administrativa de cada entidad.

Toda asignatura tiene finalmente un responsable, un profesor que organiza los temarios, calendario, sistemas de evaluación, etc., que acabarán siendo implantados en un curso académico. Tal organización de los diferentes aspectos que vinculan durante un período de tiempo a los alumnos con el profesor, suponen el proyecto educativo a gestionar. Cada proyecto es diferente, cada asignatura, escuela y docente lo son, por lo que los resultados, entendidos como objetivos a alcanzar, serán a su vez distintos, con la base común del trasfondo ético de toda docencia: la mejor formación intelectual posible y el crecimiento personal de los alumnos.

Como trataremos de exponer, el sistema de estándares de gestión aplicado al proyecto docente supone un valor añadido al profesor y al propio alumnado.

2. El proyecto educativo como caso de aplicación

El PMI no describe el «proyecto educativo» como un concepto discreto. Pese a ello, existe dentro de la organización una sección, la *Project Management Institute Educational Foundation*, como plataforma desde la que se promueve el conocimiento y en la que se recopilan constantemente proyectos y prácticas relacionadas con la educación, que sirven como corpus de apoyo y referencia. Podemos encontrar en ella multitud de ejemplos de experiencias internacionales de aplicación y material como guías para tutores para la incorporación de la disciplina en todo el marco educativo, desde la formación primaria a la universitaria.

Con este trabajo, pretendemos establecer el paralelismo entre las áreas y procesos que plantea la gestión de proyectos con las tareas docentes universitarias.

Así, el PMI establece cinco grupos de procesos:

- iniciación

- planificación
- ejecución
- seguimiento y control
- cierre

Estas acciones y actividades están interrelacionadas (Fig. 1) y se encaminan a obtener unos resultados preestablecidos y verificables. Los resultados de la docencia, en cuanto a expectativas y resultados, si estos se alcanzan, pasan por el equilibrio y la gestión del alcance, el tiempo, los costes y la calidad, como en cualquier tipología de proyecto (Kerzner, 2013).

El proyecto educativo parte por definir, con total exactitud, los requisitos a cumplir. En muchas ocasiones, distintas circunstancias obligan a los docentes a incorporarse a disciplinas en las que no tienen la suficiente maestría, o en cuya preparación, pese a tenerla, se sobredimensionan los objetivos o no se dispone, por el contrario, de suficiente tiempo para la preparación de los materiales o para su desarrollo adecuado durante el calendario docente. La planificación de las asignaturas adolece, como hemos podido comprobar en demasiadas ocasiones tras las reformas en las universidades hacia el marco de convergencia europeo, del suficiente análisis de los objetivos, niveles de calidad y recursos necesarios.

Siguiendo con las prácticas del PMI, este establece diez áreas de conocimiento que se desarrollan en torno a los cinco grupos de procesos comentados:

- alcance
- calidad
- tiempo
- recursos humanos
- integración
- comunicación
- coste
- aprovisionamiento
- riesgo
- interesados

En la preparación de las asignaturas es práctica común que alguna de las áreas quede desatendida. Se hace necesaria pues una correcta planificación de todas ellas. Sin duda, el *alcance*, entendido como el desarrollo de la docencia propiamente, debe estar claro y consensuado con la organización (unidad docente y resto de profesores, escuela, etc.). Su formalización, evidentemente variable en función de las características de cada materia, será de un alcance que pueda ser posible. No significa esto que debamos imponer una fotografía fija de la asignatura a cualquier coste en este caso personal (incluso económico en determinadas circunstancias), puesto que la monitorización del proyecto se aplica durante todo su ciclo de vida, realimentando como «entradas» procesos como el alcance, el tiempo y la calidad.

Esto implica que durante el ciclo de vida de la docencia, los resultados u objetivos parciales, deben ser controlados durante su ejecución, suponiendo en muchas ocasiones necesidades de cambios que afectan a la planificación y obligan a la reconsideración del alcance o la calidad del resultado final en las asignaturas, puesto que en general el tiempo suele estar tasado por unos calendarios académicos externos, sobre los que no podemos intervenir.

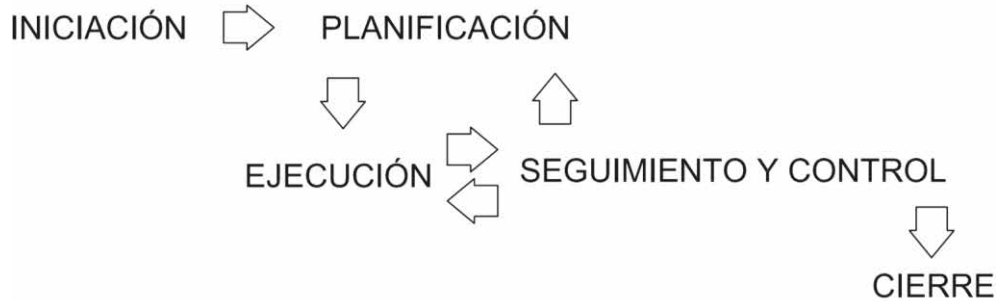


Figura 1. Esquema de los procesos del proyecto según PMI. Fuente: modificado a partir de PMBOK®

3. Buenas prácticas para la gestión de proyectos en la docencia

Hasta el momento, podría decirse que las áreas y procesos, así como las acciones de interacción que estamos desgranando son de puro sentido común. Sin embargo las prácticas de gestión de proyectos según el PMI, establecen unas estructuras que permiten tener un control de todo el proceso. Ahí radica la importancia de la disciplina. Para empezar, todo deber estar registrado por escrito, en papel o según la práctica habitual, en formato digital, teniendo en cuenta que hoy en día existen infinidad de recursos informáticos para la gestión de todo tipo de proyectos, incluidos los educativos.

De los cuarenta y siete procesos que establece la *Guía del PMBOK®* (PMI, 2013), únicamente aplicaremos a cada proyecto, aquellos que sean estrictamente necesarios y con la *intensidad* ajustada, la mínima en realidad, adaptándonos al alcance del proyecto: no tendrá las mismas necesidades de gestión, por ejemplo, la organización de una nueva titulación a implantar en una escuela o universidad, que la gestión de una asignatura de prácticas de laboratorio de tres créditos de docencia.

Así, el primer paso sería definir el tema del proyecto y sus fases. Esto puede parecer superfluo, pero en realidad la preparación de la docencia se inicia cuando se establece con total claridad su título, contenidos y la distribución de los mismos en el tiempo lectivo. Las fases del proyecto serán de alguna manera «virtuales» en los procesos de iniciación y planificación, puesto que corresponderán al docente o a la unidad docente o grupo de interesados que proponen los contenidos (Fig. 2). La ejecución y el control, y por supuesto el cierre serán las fases de «elaboración real», en las que se producirá la interacción docencia-aprendizaje. De forma sucinta, aplicaremos a continuación el estándar del PMI al objetivo de proyecto educativo.

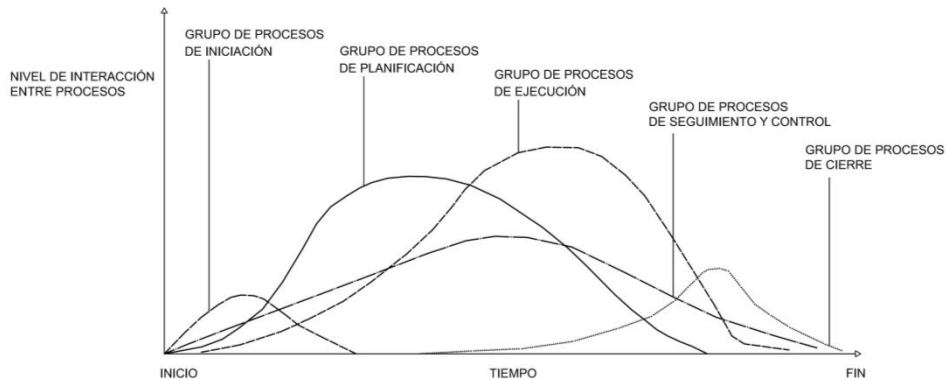


Figura 2. Esquema de interacción entre procesos de un Proyecto. Fuente: PMBOK®

3.1. Grupo de procesos de iniciación

Algunas de las acciones de gestión del proyecto vienen previamente dadas, como es el acta de constitución del proyecto (ACP) que supone el desarrollo del enunciado del trabajo del proyecto, en nuestro caso la docencia a impartir (asignatura, seminario, máster, ponencia, etc.). Debe justificarse el alcance de la docencia que el proyecto se encargará de crear, esto es, las competencias susceptibles de alcanzarse con el aprendizaje.

3.2. Grupo de procesos de planificación

Toda vez que el ACP ha sido aprobada, empieza la verdadera tarea de construcción del plan integral de dirección del proyecto. Como entrada, aparte de las circunstancias y características ambientales de la organización que plantea la necesidad, disponemos del acta de constitución.

Hemos dicho unas líneas más arriba que la gestión del proyecto se basa fundamentalmente en el equilibrio del alcance, el tiempo y la calidad (por supuesto, otros aspectos podrían ser la gestión de los recursos humanos: ¿disponemos de más colaboradores?, o la gestión de las estrategias con los interesados, la gestión de riesgos, etc.). Para controlar el contenido del proyecto, sin duda una de las más importantes acciones es la redacción de la «estructura de desglose de tareas» (EDT). Supone el análisis de los contenidos docentes y la descomposición de los mismos en tareas discretas, la organización del flujo del trabajo y la asignación de responsables de las tareas. Supongamos que nuestra docencia se reparte entre clases teóricas por medio de vídeos y clases presenciales de manejo de alguna herramienta informática. Debemos estructurar los conocimientos a adquirir de forma que secuenciamos las actividades, estimando su duración, costos si los hubiere y documentar siempre la gestión del cambio.

En cuanto al tiempo, es muy importante la confección de un cronograma, imponiendo al calendario una serie de hitos que permitan comprobar constantemente el estado del proyecto

en cada fase. Nos parece fundamental que el cronograma sea un recurso compartido con los intervinientes (todos ellos, incluye unidad docente y por supuesto alumnado), porque siendo un proyecto un ser vivo, el cronograma deberá readaptarse durante el monitoreo de la ejecución (durante el curso lectivo). Ser realistas con el cronograma supone establecer márgenes y tareas críticas, así que debemos planificar las interrelaciones entre las diferentes tareas: ¿Podemos plantear determinadas tareas docentes, por ejemplo de resolución de problemas que requieren la formación del alumno en un determinado software? ¿Está correctamente secuenciado el programa educativo para asegurar ese «entregable» sin que se vea afectado el desarrollo de la línea de alcance del proyecto?

Identificar los riesgos puede parecer una tarea innecesaria en un ambiente controlado como el docente. Sin embargo, al referirnos a «riesgo» entendemos según la *Guía del PMBOK®* (PMI, 2013), cualquier evento o condición incierta que, si se produce, tiene un efecto positivo o negativo en uno o más de los objetivos del proyecto. El riesgo es difícil de cuantificar pero imposible de evitar si no se ha planificado: ¿Qué hacer ante una eventual baja laboral del docente? ¿Cuál puede ser la estrategia docente a seguir en caso de que el alumnado no esté alineado en alcance, sea por encima o por debajo de las expectativas a conseguir? Hay decenas de cuestiones que suponen riesgos que hay que identificar y cuantificar. La planificación es un proceso iterativo, que se realimenta con las salidas de los diferentes procesos de control, porque el Plan del Proyecto siempre tiene que estar actualizado (Fig. 3):

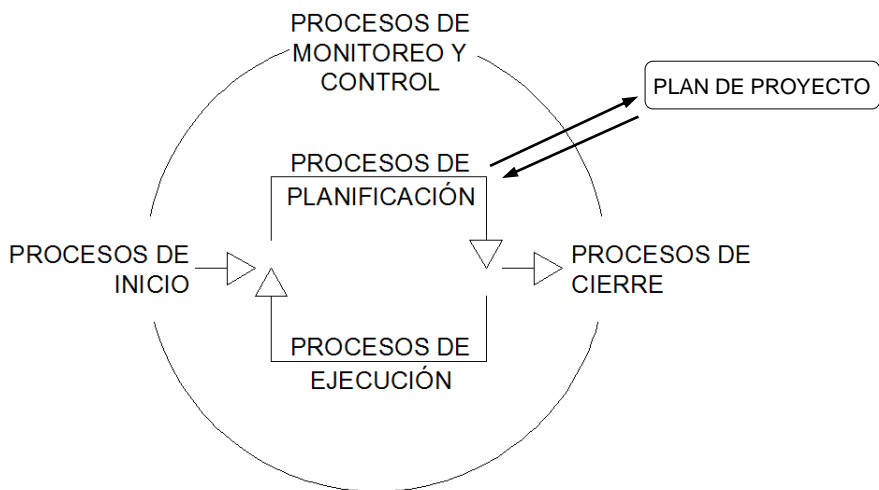


Figura 3. Interdependencia de la planificación y otros procesos. Fuente: modificado a partir de PMBOK®

3.3. Grupo de procesos de ejecución

Durante la ejecución del proyecto se deben ir resolviendo las tareas que conforman el proyecto educativo: clases en la modalidad que sea, visitas formativas, prácticas, desarrollo de portfolios o de proyectos personales por parte de los alumnos, etc. Al mismo tiempo se irá adquiriendo el material necesario que se haya planificado en el grupo de proceso anterior (por ejemplo en caso de un viaje de estudio, necesidades de materiales para laboratorios o licencias de software) y se seguirá el plan de comunicaciones, según los canales que los interesados hayan acordado en su momento.

3.4. Grupo de procesos de seguimiento y control

Una de las mayores ventajas que suponen las prácticas de gestión de proyectos es la capacidad de monitoreo constante y control del proceso de proyecto. Debemos comprobar si los pronósticos del cronograma son correctos, para si fuera necesario introducir reajustes. Por supuesto, chequeamos la línea base del alcance, validando los entregables (por ejemplo trabajos parciales) que permitan al docente verificar si se mantienen los objetivos o hay que revisar contenidos y recalcular y por tanto re-planificar el alcance sin mermar la calidad y cuál es el coste del proceso. Debemos controlar si el plan de comunicaciones es operativo, así como el registro de riesgos, manteniendo una lista de observación y una serie de hitos de control. Todas estas acciones deben fijarse mediante informes, más o menos simplificados que permitan su seguimiento.

3.5. Grupo de procesos de cierre

Es fundamental el *feedback* en el proyecto educativo: el cierre y el beneficio de las «lecciones aprendidas». Un proyecto no está completo hasta que tiene la total aceptación del patrocinador. Aunque el período lectivo marca un final en el cronograma del proyecto, es imprescindible recopilar y archivar todos los registros del proyecto y redactar un informe final sobre la consecución de los objetivos.

Las lecciones aprendidas suponen una actualización de los activos de la organización, es decir, alimentan el conocimiento de potenciales mejoras en la estructura docente y en futuros proyectos. El formato debería incorporar un resumen de todo lo aprendido, un repaso de la documentación desarrollada, de los informes generados durante el monitoreo de la ejecución del proyecto y las conclusiones que los interesados puedan aportar. Sólo cuando el «equipo» al completo haya aportado la documentación generada para el repositorio del proyecto podremos darlo por terminado.

La aplicación de la información histórica a proyectos futuros, incluyendo riesgos potenciales detectados, cambios necesarios implementados, datos sobre comunicaciones y cronograma, técnicas y rutinas recopilados de forma ordenada y documentada supone un activo enorme aplicable a proyectos educativos venideros.

4. Conclusiones

Las prácticas establecidas sucintamente en este trabajo pretenden hacer hincapié en que la gestión del proyecto educativo en el ámbito universitario siguiendo las prácticas del PMI supone una mejora sustancial en los resultados esperados. Se basa en la gestión de los contenidos, planificación temporal, riesgos potenciales, control del cambio, gestión de la comunicación y de los interesados, etc. Es una forma distinta de afrontar la docencia, con un cierto coste inicial superior por cuanto supone un esfuerzo de planificación previo y que sin embargo redundará en un nivel de control exhaustivo del alcance y del desarrollo del proyecto. Las lecciones aprendidas recopiladas en la fase de cierre son un valioso recurso aplicable no sólo a nuevas ediciones de la misma asignatura sino que puede facilitar progresivamente la tarea del profesor y la creación de una línea de trabajo que el propio alumnado será capaz de reconocer. La acumulación de experiencia hará más flexible la estructura. Además, el control sobre el mapa de lo ocurrido, permitirá la fácil implantación de cambios, evoluciones o sustituciones de los contenidos y de los interesados, del propio director del proyecto y de sus colaboradores.

¿Cuál es en definitiva, el valor añadido por utilizar los estándares del PMI? Creemos firmemente que contribuye a dotar al profesorado y a los alumnos de unas habilidades en gestión de proyectos, útiles tanto en su labor académica como profesional. Cada vez más, las empresas y grandes corporaciones e instituciones están implementando planificación por objetivos y seguimiento de indicadores de calidad en sus desarrollos. A través del vocabulario y de la comunicación con el docente del ciclo de vida del aprendizaje, se articulan de este modo con la nueva realidad a la que se enfrentarán en su posterior desarrollo profesional.

En una sociedad cambiante como la nuestra, en la que presente y futuro son prácticamente lo mismo, debemos tener la seguridad de que los proyectos docentes en que nos involucramos tienen capacidad de alcanzar los niveles de excelencia exigidos por nuestras organizaciones. Sólo podremos verificarlo con el uso de estándares de gestión medibles de todos los aspectos vinculados a esos proyectos. Las buenas prácticas del PMI en la gestión de proyectos de las que aquí hemos dado sólo unas pinceladas, pueden contribuir de forma activa y segura a ello.

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Desarrollo e implementación de técnicas de gamificación basados en modelos virtuales para facilitar el proceso de enseñanza-aprendizaje en asignaturas de motores térmicos

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Abstract

The present work aims to enhance the motivation of the learning process of the Thermal Engines subjects taught in the engineering degrees of the Polytechnic University of Valencia, through the implementation of gamification methodologies based on the use of simulation and virtual models.

The virtual models that are developed in this work deal with the interaction of the real physical processes of injection-combustion in an engine and highlight the fundamental concepts of the subject. The tool transcends the technological and instrumental motivation and stands out as a potential virtual test in the classroom (or outside) to understand the effect of physical parameters on combustion phenomena and the formation of pollutants. Obtaining such parameters by means of traditional experiments in the lab is complicated and expensive, therefore, the simulated alternative has been chosen.

This paper describes the objectives and characteristics of the virtual model and the methodology proposed for both the development of the activity and its evaluation. Indicators are also proposed to evaluate the teaching-learning process.

Keywords: Simulation, learning, thermal engines, competences, evaluation

Resumen

El presente trabajo tiene por objetivo incrementar el nivel de motivación para el aprendizaje de las asignaturas relacionadas con los Motores Térmicos impartidas en los grados de ingeniería de la Universidad Politécnica de Valencia, mediante la implementación de metodologías de gamificación basadas en el uso de entornos de simulación y modelos virtuales.

Los modelos virtuales que se desarrollan en este artículo representan la interacción de los procesos físicos reales de inyección-combustión y han sido

adaptados para resaltar conceptos fundamentales de la asignatura. La herramienta trasciende el estímulo tecnológico e instrumental, y se destaca como un medio potencial de ensayo virtual en el aula (o fuera de ella) para comprender el efecto de parámetros físicos sobre fenómenos de combustión y formación de contaminantes. Obtener dichos parámetros a través de los medios experimentales tradicionales resulta complicado y costoso, y es por ello que se ha optado por la alternativa simulada.

En este trabajo se describen los objetivos y las características del modelo virtual y la metodología propuesta tanto para el desarrollo de la actividad como para su evaluación. También se proponen indicadores para evaluar el proceso de enseñanza-aprendizaje.

Palabras clave: *simulación, aprendizaje, motores térmicos, competencias, evaluación*

Introducción

La práctica docente requiere de una planificación de actividades a fin de establecer satisfactoriamente los pasos del proceso de aprendizaje. En general, el proceso de planificación se puede dividir en las siguientes etapas: definir adecuadamente los resultados de aprendizaje de la unidad didáctica, ordenar las secuencias de los contenidos y el tiempo disponible, definir las metodologías y diseñar las actividades de aprendizaje que las concretan, y evaluar la formación en función de los resultados de aprendizaje planteados. Concretamente, para las metodologías y actividades de aprendizaje se cuenta con un abanico de posibilidades que se pueden implementar, desde herramientas más tradicionales como clases magistrales hasta las más vanguardistas que incorporan las nuevas tecnologías. En los últimos años, las técnicas de simulación y juego han surgido como una herramienta para las actividades de aprendizaje en el ámbito universitario (Jakubowski, 2014), (Andreu-Andrés, 2014; Azhari, 2014). Las técnicas de simulación y juego se diseñan de tal manera que involucren al usuario, permitiendo dar un feedback instantáneo. Estudios previos confirman que aumentan la productividad, tanto en el ámbito de la educación como en el empresarial.

Las actividades que se presentan en este trabajo están relacionadas con los procesos de simulación y gamificación, ya que utilizan simuladores virtuales en el aula e invitan a los alumnos a jugar y competir para encontrar el motor más optimizado, como se mostrará posteriormente. Las herramientas utilizadas están basadas en simuladores creados previamente en el Departamento en distintos proyectos de Investigación y Desarrollo.

La finalidad de la utilización de este tipo de estrategias es el de aumentar el grado de implicación del alumnado, mejorando así el proceso de enseñanza-aprendizaje de la asignatura de motores térmicos, concretamente en el ámbito de los fenómenos de inyección – combustión – formación de contaminantes en motores. Se pretende además que los

estudiantes mejoren sus capacidades técnicas, de pensamiento crítico, de resolución de problemas, entre otros, de una manera interactiva y usando entornos similares a los que se emplean en la industria y en las empresas de automoción.

Por último, se propone una serie de metodologías y herramientas de evaluación, tanto para evaluar las competencias científico – técnicas como las competencias transversales que se trabajan durante la actividad. En particular, se ha decidido trabajar sobre dos competencias incluidas en el Proyecto Institucional de Competencias Transversales de la Universitat Politècnica de València: Análisis y resolución de problemas (CT03) y Trabajo en equipo y liderazgo (CT06)(UPV, 2017).

1. Antecedentes y objetivos

Esta experiencia se enmarca dentro de la asignatura de Motores Térmicos, que se imparte como materia optativa (con pequeñas adaptaciones) en los Grados de Ingeniería Aeroespacial, Ingeniería Mecánica, Ingeniería de la Energía e Ingeniería en Tecnologías Industriales. También se imparte como asignatura optativa en los Másteres de Ingeniería Industrial y de Ingeniería Aeronáutica, aunque para el planteamiento del presente trabajo nos hemos centrado en las asignaturas de grado.

La segunda unidad didáctica de la asignatura se dedica a mostrar que la preparación de la mezcla es determinante en el rendimiento del motor y en la calidad de las emisiones contaminantes. En ésta se da a conocer el funcionamiento básico de los sistemas de inyección, se describen los elementos que los componen y se introduce el efecto de algunos parámetros de operación sobre el funcionamiento de la inyección en un sistema *common-rail*, que es el que llevan la mayoría de motores de encendido por compresión en la actualidad. De hecho, en la industria los fabricantes de motores de automoción dedican tiempo y dinero en el desarrollo y optimización de estos sistemas para poder cumplir con la normativa y satisfacer la demanda de los consumidores.

Por esta razón, en la planificación de la asignatura se ha introducido una sesión práctica para profundizar en el conocimiento de este tipo de sistemas. Hasta el curso anterior, esta práctica consistía en la realización de un ensayo de visualización del chorro de combustible inyectado con un sistema de inyección mecánica, ejecutado por el técnico de laboratorio. Del mismo modo, se hacía un ensayo para medir la tasa de inyección con un sistema de medida similar al que se utiliza en la industria para calibración. En este caso también las medidas son ejecutadas por el técnico de laboratorio, con participación muy limitada de los alumnos. Sin embargo, las medidas realizadas eran aprovechadas para proponer algunos cálculos y análisis posteriores, que sí eran realizados directamente por los estudiantes.

A pesar de que la práctica era muy visual e interesante porque mostraba las técnicas de medida más actuales, restringía la participación de los alumnos. Es por ello que se plantea reformular la estructura de la misma, de tal manera que los estudiantes sean los actores principales. Para ello se hace uso de una serie de herramientas informáticas, que permiten

crear un motor virtual sobre el que los alumnos puedan ver de forma inmediata e interactiva el efecto que tienen los parámetros de inyección sobre el proceso de combustión, el rendimiento del motor y la formación de emisiones contaminantes. Este ejercicio está además muy alineado con la metodología usada en la industria para la calibración de motores, uno de los campos de trabajo habituales para ingenieros que trabajen en el ámbito de los motores alternativos.

2. Metodología propuesta

La metodología seguida a lo largo de este trabajo se fundamenta en los pasos básicos del proceso “enseñanza – aprendizaje”, comenzando por la definición de los resultados de aprendizaje, seguido por el diseño de las actividades y evaluación de competencias específicas. La misma metodología se presenta para el diseño de actividades y evaluación de competencias transversales. Estas etapas se describen en detalle a continuación.

2.1. Diseño de actividades y evaluación de competencias específicas

2.1.1. Determinación de aspectos científico-técnicos y definición de objetivos: resultados de aprendizaje

Los resultados de aprendizaje concretos y evaluables se enumeran a continuación:

- Conocer las características de la ley de inyección de los motores de combustión interna alternativos.
- Comprender el efecto de los parámetros de operación sobre la ley de inyección y la masa inyectada.
- Evaluar el impacto de diferentes estrategias de inyección sobre el rendimiento y emisiones de óxidos de nitrógeno de un motor de encendido por compresión.

2.1.2. Descripción de las tareas que realizan el profesor y el alumno

La integración VIM-SiCiclo combina diferentes metodologías de enseñanza-aprendizaje activo; por un lado el aprendizaje basado en el juego, (ya que el VIM es un juego de simulación) y también un juego de rol, donde el alumno forma parte activa y protagonista, donde aprende haciendo. Las actividades se realizan en el aula de informática del laboratorio, durante la sesión de prácticas, y consisten en:

- Señalar los parámetros que afectan la evolución de la tasa de inyección y de la cantidad de masa total que se entrega en la cámara de combustión. [10min]
- Obtener varias curvas del proceso de inyección usando la aplicación informática “Virtual Injector Model” cambiando los parámetros que afectan la inyección (tecnología de inyector, presiones de rail, diámetros de toberas, tiempo eléctrico, entre otros) [Trabajo grupal, 2-3 personas - 60min]

- Implementar diferentes estrategias (usando la metodología del punto anterior), por ejemplo combinando presiones en el rail y múltiple inyección, para mejorar las prestaciones del motor [Trabajo grupal, 2-3 personas – 25 min].
- Selección de la configuración del motor que dará la configuración ganadora. A partir de una matriz extensa (de guía) de casos de ensayo, proporcionadas por el profesor.
- Completar el cuestionario / guion disponible [Trabajo grupal, 2-3 personas – 30 min]
- Todas las actividades se realizan en el aula de clase, durante la sesión de prácticas

2.1.3. Instrumentos de evaluación (indicadores)

A la hora de diseñar actividades de evaluación, es importante que sean coherentes con los objetivos de la asignatura y con las actividades de enseñanza-aprendizaje que se lleven a cabo durante el curso. En este sentido, es necesario recalcar que la comprensión básica de los contenidos teóricos respecto al proceso de formación de la mezcla ya se evalúa de forma independiente en las pruebas objetivas realizadas a lo largo del curso. Es por esto que la evaluación de la actividad propuesta se centra en campos de conocimiento más avanzados, proponiendo ejercicios más cercanos a la práctica profesional. En particular, se pide al alumno que sea capaz de sintetizar los distintos conocimientos adquiridos para proponer soluciones que permitan mejorar las prestaciones del motor desde el punto de vista de rendimiento y emisiones.

La evaluación de este objetivo se realizará mediante la entrega de un guion dirigido a modo de memoria de la práctica. Este guion está estructurado en tres partes. En primer lugar, se propone a cada grupo el análisis de un caso base, que servirá como referencia para los estudios posteriores. En este caso base se debe realizar el cálculo de la tasa de inyección mediante el modelo de inyector virtual (VIM), y su posterior aplicación mediante el modelo de motor virtual (SiCiclo) para calcular las prestaciones y emisiones. Se pedirá al alumno obtener las prestaciones del motor en términos de ley de liberación de calor, rendimiento y emisiones de óxidos de nitrógeno. Los resultados correctos serán proporcionados posteriormente al alumno, permitiendo la autoevaluación, así como asegurar una correcta comprensión de las distintas herramientas. El valor de este apartado será de 1 punto sobre 10 en la nota del guion.

Posteriormente, se pide a cada grupo realizar un estudio evaluando el efecto de algunos parámetros de funcionamiento del inyector sobre la tasa y la cantidad inyectada. Se propondrá un total de 4 casos, con el cambio de un parámetro en cada uno de ellos con respecto a la base. En el guion se deberá introducir una gráfica con el resultado de la tasa obtenida en cada caso, así como una breve justificación de los resultados. Esta parte se evaluará con 4 puntos sobre 10, en base a la correcta identificación de la razón física de los resultados obtenidos en cada uno de los casos.

Finalmente, se propone un estudio de optimización de la calibración de la inyección en el modelo virtual de motor. Este estudio se realizará en dos fases, una enfocada al aumento del

rendimiento indicado, y una segunda donde el objetivo será minimizar las emisiones de óxidos de nitrógeno. Ambos estudios se realizarán en un punto de funcionamiento fijo, igual al del caso base previamente analizado. Para asegurar que las condiciones de inyección sean consistentes con el punto de funcionamiento del motor propuesto, se proporcionará al alumno una lista de 20 combinaciones de parámetros de inyección (casos) previamente definidos entre los que debe escoger la opción más adecuada para la optimización de cada uno de los parámetros. Para cada estudio se pide responder a dos cuestiones, cada una valorada con 1,5 puntos:

- a) Elige, justificando de forma razonada la elección, un caso que permita la optimización del rendimiento/emisiones de NO_x
- b) Compara la ley de liberación de calor obtenida para el caso elegido con respecto al caso base y analiza el resultado obtenido.

Adicionalmente, el grupo o grupos que alcancen el mejor resultado para cada uno de los dos estudios de optimización contará con 0,5 puntos adicionales.

2.1.4. Descripción de la herramienta virtual

Para la consecución de los resultados de aprendizaje establecidos en el apartado 2.1.1. se ha implementado una herramienta computacional que funciona como un simulador de eventos de inyección y se ha acoplado a un software de simulación de un motor de combustión y prestaciones de motor.

- Simulador Virtual de Inyección (VIM)

El simulador está basado en un modelo 0D simplificado que reproduce la tasa de inyección. El modelo se basa en expresiones matemáticas y correlaciones que pueden simular el caudal másico obtenido con resultados experimentales realizados en el laboratorio del Departamento de Máquinas y Motores Térmicos. El desarrollo del modelo se describe en (Payri, 2016). El resultado de la simulación provee la forma y la masa inyectada, usando pocos parámetros de entrada, como por ejemplo: presión de inyección, la contrapresión, El tiempo eléctrico, y el régimen de giro. En la **Fig. 1.** se muestra un esquema del modelo virtual.

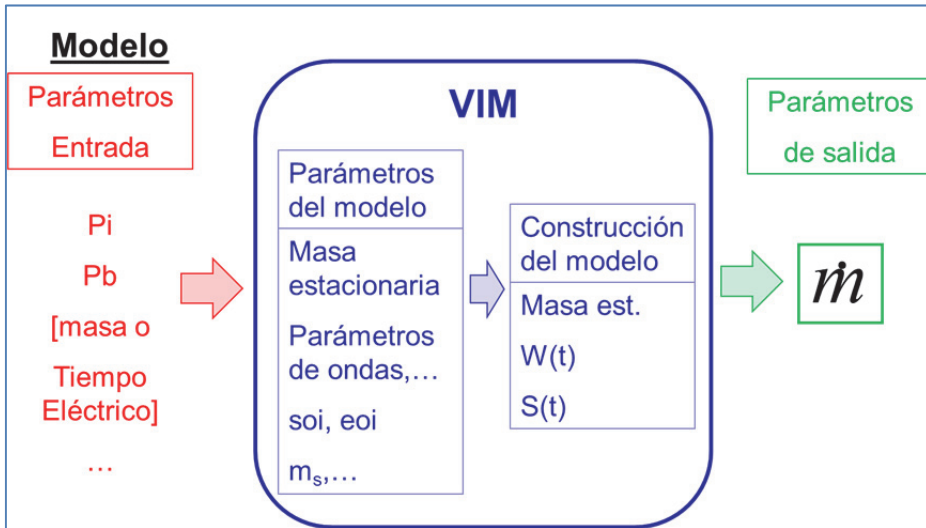


Figura 1. Esquema del modelo virtual VIM, donde P_i = presión de inyección, P_b =Presión de contrapresión, soi=inicio de la inyección, eoi= final de la inyección, m_s = masa inyectada, $W(t)$ = función de onda amortiguada, $S(t)$ = función de forma, \dot{m} =tasa de inyección

El modelo satisface dos condiciones: coste computacional bajo y reproducir la cantidad inyectada realista. Los beneficios potenciales del modelo son que las simulaciones se pueden realizar rápida y fácilmente para cualquier punto de operación y, por otro lado, que el modelo puede ser utilizado en tiempo real para procesos de calibración.

- Integración con el software SiCiclo

El software SiCiclo es una herramienta predictiva que sirve para abordar de una manera eficiente el diseño y la puesta a punto de un motor (Fenollosa, 2005). Este código también ha sido desarrollado previamente en el Departamento de Máquinas y Motores Térmicos. Está basado en un modelo 0D o termodinámico que permite calcular la evolución de las condiciones termodinámicas en la cámara de combustión para la predicción de las prestaciones del motor. Concretamente, consiste en la simulación de las curvas de presión y temperatura dentro del motor a partir de una ley de combustión impuesta, mediante la resolución de la ecuación del primer principio de la termodinámica dentro de la cámara (Carreño, 2016). Un esquema global del modelo se muestra en la Figura 2. SiCiclo para poder realizar los balances energéticos, considera el motor como un bloque formado por los cilindros, la admisión y el escape, estos dos últimos son modelados mediante volúmenes de control a los cuales poder imponerles restricciones y condiciones de contorno (mostrados también en la Fig. 2

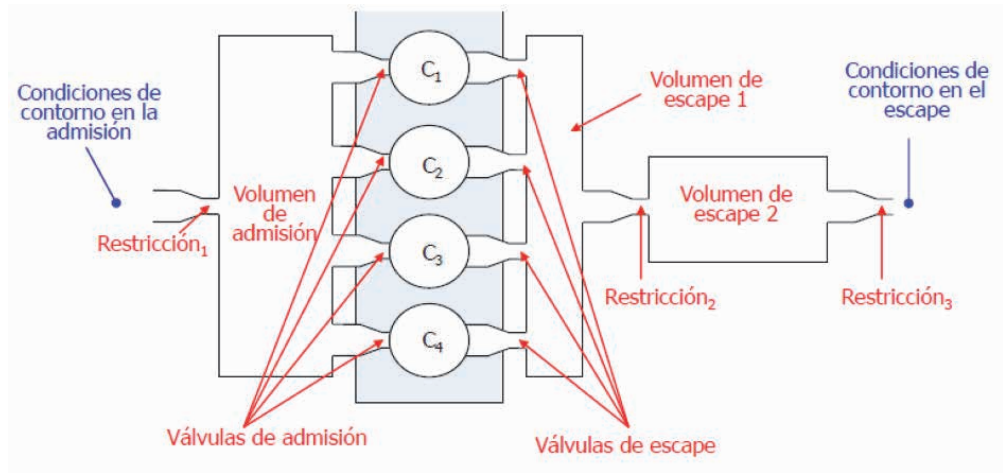


Figura 2. Esquema del modelo predictivo SiCiclo. En la Figura C1, C2, C3, C4, son el número de cilindros respectivamente

2.2. Diseño de actividades y evaluación de competencias transversales

Las competencias transversales que se trabajan en la asignatura son: la CT03 de análisis y resolución de problemas y la CT06 trabajo en equipo y liderazgo. Las actividades planteadas para cada caso se describen a continuación:

2.2.1. Diseño de actividades para la CT03 análisis y resolución de problemas

Las actividades de la CT03 están de manera intrínseca dentro de las tareas que debe realizar el alumno para alcanzar la optimización propuesta en el guión de la práctica, ya que para conseguir el resultado óptimo no existe una secuencia única de pasos, sino que analizando la influencia de los parámetros y la matriz de puntos propuesta, se puede encontrar la mejor solución de una manera más o menos rápida y con un número de pasos mayor o menor.

Tabla 1. Cuestiones del guion referentes a la CT03 Análisis y resolución de problemas

Item	Cuestiones específicas del guion
1	Explica con tus propias palabras los pasos que has seguido para la optimización
2	Da una breve justificación de los resultados
3	Explica la razón física de los resultados obtenidos en cada uno de los casos
4	¿Qué otra alternativa se podría implementar para obtener un mejor resultado?

Para detectar el nivel de desempeño respecto al análisis y resolución de problemas durante la actividad, se pide responder diversas cuestiones específicas en el cuestionario que deben entregar los alumnos, y que posteriormente se evaluará pasando una lista de control descrita en el próximo subapartado. Las cuestiones que se toman en cuenta para las evidencias de las actividades de la CT03 se enumeran en la Tabla 1.

2.2.2. Actividades para la CT06 trabajo en equipo y liderazgo

Para desarrollar la práctica los estudiantes se dividen grupos de 3-4 personas, con la idea de que participen y colaboren activamente en las tareas del equipo, orientándose hacia el trabajo común, y conseguir el mejor resultado de optimización.

Tabla 2. Cuestionario de coevaluación de Competencia Transversal 6

El presente cuestionario pretende que valores a tus compañeros con respecto a su trabajo en equipo. El cuestionario comprende cuatro afirmaciones. Para cada uno de tus compañeros, valora cada afirmación con una escala de A a D según tu grado de acuerdo con la misma, siendo A- Muy de acuerdo, B- Bastante de acuerdo, C- Bastante en desacuerdo, D- Totalmente en desacuerdo			
Número de compañeros	1	2	3
1. El compañero se ha mostrado participativo en la elección de los puntos de optimización			
2. La aportación del compañero ha sido clave para la elección de los puntos óptimos del estudio			
3. El compañero ha realizado adecuadamente las tareas asignadas en la redacción del guion			
4. El compañero ha compartido los resultados de sus tareas y ha ofrecido su colaboración en las tareas asignadas al resto del grupo			

Para completar el desarrollo de la CT06 se propone la realización de una encuesta de cuatro preguntas con la que los alumnos coevaluarán a sus compañeros respecto a su trabajo en grupo. La misma se detalla en la Tabla 2. Las primeras dos preguntas van enfocadas al primer apartado de la rúbrica, mientras que las dos segundas se corresponden con el segundo apartado (que se presenta en el subapartado 2.2.3.).

2.2.3. Evaluación de competencias basada en rúbricas

Además de la evaluación del contenido técnico de la asignatura descritos en el apartado 2.1.3., para la evaluación de las Competencias Transversales se proponen los siguientes instrumentos

Tabla 3. Rúbrica para la evaluación de Competencia Transversal 03 Análisis y resolución de problemas

Indicadores	Descriptorios			
	D. No alcanzado	C. En desarrollo	B. Bien / adecuado	A. Excelente / Ejemplar
Identifica el problema, y las variables que afectan la ley de inyección	No identifica las partes de la tasa de inyección	Identifica los parámetros que afectan la ley de inyección pero no las relaciona con la mejora de las prestaciones del motor	Identifica las partes de la tasa. Relaciona los datos (P_i , diámetros, etc.) con las incógnitas (parámetros de motor)	Identifica con facilidad las variables que afectan la tasa de inyección y establece una relación causa-efecto para optimizar el sistema
Elije una solución óptima para mejorar las prestaciones del motor	No consigue mejorar las prestaciones del motor	Elije una solución apropiada pero no justifica los criterios para su elección	Consigue mejorar las prestaciones del motor y explica los criterios usados	Mejora las prestaciones del motor usando una estrategia de inyección novedosa y argumenta las soluciones planteadas

- Observación de los grupos durante el trabajo.
- Como evidencia para la Competencia Transversal 03 (Análisis y resolución de problemas) se pide completar el guion/cuestionario con secciones y cuestiones de razonamiento, análisis y resolución de problemas.
- En el caso de la Competencia Transversal 06 (Trabajo en equipo y liderazgo), se toma además una componente de coevaluación mediante una encuesta de 4 preguntas que se usa como evidencia, de la Tabla 2.

Las rúbricas que se plantean se describen en la Tabla 3 para el caso de la Competencia Transversal 03 (Análisis y resolución de problemas) y en la Tabla 4 para la Competencia Transversal 06 (Trabajo en equipo y liderazgo)

Tabla 4. Rúbrica para la evaluación de Competencia Transversal 06

Indicadores	Descriptorios			
	D. No alcanzado	C. En desarrollo	B. Bien / adecuado	A. Excelente / Ejemplar
Participa activamente en la elección de los casos a simular	No participa en la elección de los casos	Escucha a sus compañeros y acepta las decisiones tomadas	Participa en la elección de los casos, aportando su punto de vista	Lleva la iniciativa en la discusión relativa a la elección de los casos
Colabora en el análisis de los resultados y la redacción del guion	No se implica en el trabajo	Realiza una parte del guion, pero no implica en la misma a los compañeros	Realiza una parte del guion, preguntando a sus compañeros cuando lo necesita	Comparte activamente los resultados con sus compañeros, discutiéndolos para su análisis

NOTA: Los criterios/indicadores y las escalas de valoración planteados para esta actividad están basados en rúbricas planteados por los especialistas del tema en la UPV, y en función de del Nivel de Dominio II, ya que se desarrolla en una asignatura del tercer o cuarto curso de grado. Para la aplicación de esta práctica en las asignaturas de Máster será necesario revisar las rúbricas para tener en cuenta el mayor grado de desarrollo de estas competencias.

3. Resultados

A continuación se presenta la interfaz de la herramienta desarrollada para el modelo virtual de tasa de inyección y del programa predictivo Sículo (Fig. 3 y Fig. 4).

El usuario debe introducir distintos casos en el programa VIM, que arrojen los mejores resultados respecto al rendimiento del motor y de menores emisiones contaminantes. En todo momento asumirán el rol de un profesional de la “Calibración de Motores” dentro del aula. Los parámetros que los alumnos pueden configurar son los que se muestran en la izquierda de la Figura 3 de una manera intuitiva: En el primer recuadro deben seleccionar el tipo de inyector; en el segundo recuadro insertan el número de inyecciones y la cantidad de masa de cada una, así como el tiempo de separación entre cada evento de inyección; por

último, en el recuadro de “inputs” introducen los parámetros referidos a la presión de inyección y régimen de giro del motor. Seguidamente deberán presionar el botón de Calcular, y en el lado derecho de la interfaz aparecerán los resultados de la simulación, a modo gráfico y numérico.

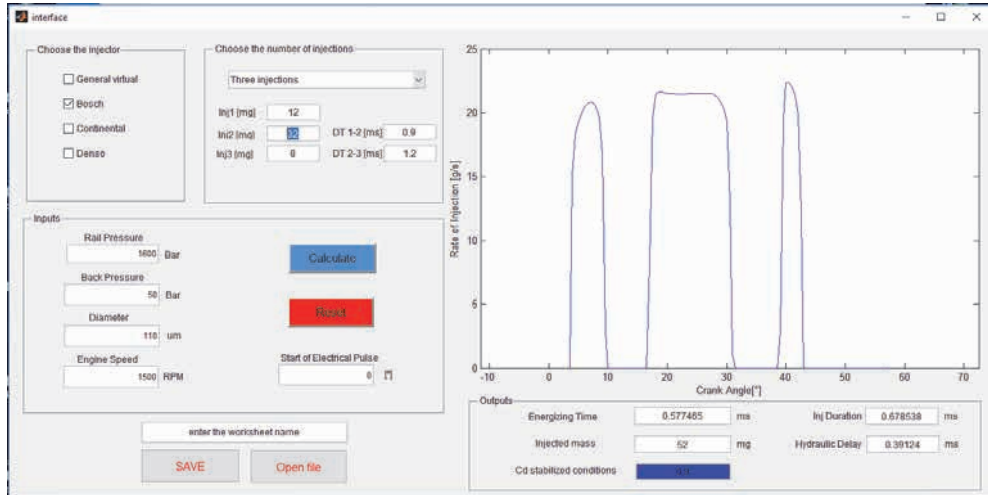


Figura 3. Interfaz gráfica del Simulador de tasas de Inyección

Los parámetros objeto de análisis se muestran en la Figura 4, donde los alumnos deben evaluar cuantitativamente los recuadros de “Emisiones” y de “Parámetros Indicados”, concretamente apuntando los valores de NOx Total, Soot, Potencia Indicada y Rendimiento Indicado.

Finalmente, aunque se ve un gran potencial en esta herramienta, un posible inconveniente que se presenta en el aula de clases es que los estudiantes no puedan ver el valor educativo del juego y del simulador virtual, por tanto es importante que al final de la sesión se haga una reflexión o “debriefing” de los conceptos aprendidos.

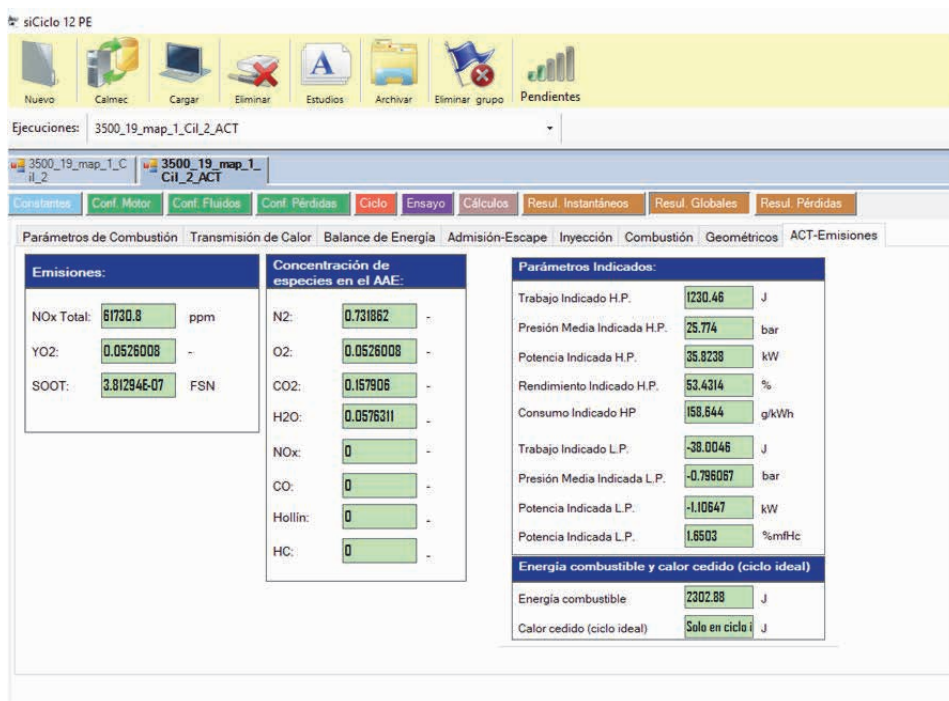


Figura 4. Interfaz gráfica de programa predictivo Siculo

4. Conclusiones

Como se ha descrito, los modelos virtuales implementados en este trabajo tienen como finalidad mejorar la enseñanza-aprendizaje de los procesos físicos de inyección-combustión de la asignatura de Motores Térmicos. En este documento se presentan los objetivos y las características del modelo virtual y la metodología para el desarrollo de la actividad en el aula y su evaluación. El propósito de la implementación del modelo virtual es conseguir una mayor interacción de los estudiantes y evitar la pasividad, desde un entorno divertido, incitando la necesidad de conseguir el motor con más rendimiento y menos contaminantes. Por otro lado, se han definido actividades e instrumentos de evaluación de las competencias transversales, las cuales se han basado en rúbricas diseñadas en la UPV y se han adoptado para el caso específico de la signatura y de la unidad didáctica. Sin duda, la experiencia (a pesar de tener cierto grado de dificultad) ha permitido valorar las competencias transversales, reconociendo que son fundamentales para que los estudiantes mejoren su aprendizaje, impulsando extender las metodologías hacia otras unidades didácticas y otras asignaturas.

5. Agradecimientos

Los autores desean agradecer a Diego Blanco por su colaboración en la programación para acoplar los dos modelos.

6. Nomenclatura y Abreviaciones

CT	Competencia Transversal	eo_i	Final de la inyección
NO_x	Óxidos de Nitrógeno	m	Tasa de Inyección
S(t)	Función de Forma	m_s	Masa inyectada
VIM	Modelo Virtual de Inyección	P_b	Presión de Contrapresión
W(t)	Función de onda Amortiguada	P_i	Presión de inyección
0D	Modelo cero-dimensional	so_i	Inicio de la inyección

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Desarrollo de WebApps sobre Transmisión de Calor

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Abstract

The article presents four virtual laboratories related to the subject of Conduction Heat Transfer and its application in lectures. The laboratories pretend to present the concepts related to this subject and the different equations that describe them in a visual and parameterized way so that the student can observe the influence of the different variables that intervene in the problem.

Keywords: *webapp, transmisión, calor, conducción, resitència, térmica.*

Resumen

El artículo presenta cuatro laboratorios virtuales sobre el tema de conducción de la asignatura de Transmisión de Calor y su aplicación en las clases de la asignatura. Los laboratorios pretenden presentar los conceptos relacionados con esta temática y las diferentes ecuaciones que los describen de una forma visual y parametrizada para que el alumno pueda observar la influencia de las diferentes variables que intervienen en el problema.

Palabras clave: *webapp, transmisión de calor, conducción, resitència térmica.*

Introducción

La asignatura de Transmisión de Calor es una asignatura que se imparte en el segundo curso de diferentes grados de la Universitat Politècnica de València: Grado de Ingeniería en Tecnologías Industriales, Grado de Ingeniería en Energía, Grado de Ingeniería en Organización Industrial y Grado de Ingeniería Química, entre otros. El tema de conducción de calor es el tema inicial de la asignatura. Es un tema de contenido amplio que se divide en varias secciones: ecuación general de conducción de calor, elementos multicapa, superficies extendidas y transitorio. Las ecuaciones que se manejan en el tema son ecuaciones diferenciales, materia que se imparte en paralelo con la asignatura. Por este motivo, se han desarrollado una serie de Laboratorios Virtuales que permiten al alumno profundizar en el tema de una forma interactiva y mucho más visual. Los Laboratorios Virtuales desarrollados corresponden a las distintas secciones del tema de conducción de calor comentadas anteriormente. Estas herramientas permiten completar las explicaciones de clase, de los apuntes de teoría y de los libros que se sugieren como bibliografía. (Pinazo et al, 1999)(Cengel, 2011)

En los siguientes puntos se explica el formato utilizado para los laboratorios virtuales, una justificación del contenido de los mismos y una explicación de cómo se utilizan en la asignatura de Transmisión de Calor. El formato de los laboratorios virtuales se basa en una guía elaborada por el ICE de la Universitat Politècnica de València (ICE, 2016) y un documento publicado por el Vicerrectorado de Tecnologías de la Información y Comunicación de la UPV (UPV, 2017) para unificar este tipo de publicaciones en el repositorio.

1. Uso de WebApps desarrollados en HTML y Javascript

El objetivo de los laboratorios virtuales es facilitar al alumno a entender el contenido de la asignatura utilizando material sobre el que pueden interactuar y cuyos resultados se pueden representar de forma inmediata sobre gráficos. Los laboratorios virtuales se dividen en dos secciones, que en informática se conocen como front-end y back-end. El primero hace referencia al interfaz sobre el que trabaja el usuario. Esta parte queda definida con código HTML. El formato utilizado es: una presentación del contenido, presentación de las ecuaciones que describen el fenómeno y posibilidad de definir valor a las distintas variables que intervienen para poder representar los resultados sobre un gráfico.

La parte de cálculos de la aplicación, back-end, se ha programado en código javascript. Existen diferentes modos de programar el back-end, plugin de java, de MatLab, etc. Se ha decidido utilizar javascript porque no requiere de elementos adicionales para su visualización, de manera que se puede visualizar de forma en cualquier dispositivo móvil o pc sin necesidad de instalar elementos adicionales.

2. Laboratorio Virtual: Ecuación general de conducción de calor

El objetivo de este laboratorio virtual es presentar la ecuación de conducción de calor al alumno y facilitar la comprensión de la misma observando la importancia de las variables que la describen.

En base a la ecuación de Fourier de conducción de calor y al primer principio de la termodinámica, se demuestra en clase la ecuación general de conducción de calor (Ec. 1). Esta ecuación presentada en coordenadas cartesianas puede definirse también en coordenadas cilíndricas y esféricas.

$$\frac{\partial}{\partial x} \left(k \frac{\partial T}{\partial x} \right) + \frac{\partial}{\partial y} \left(k \frac{\partial T}{\partial y} \right) + \frac{\partial}{\partial z} \left(k \frac{\partial T}{\partial z} \right) + q''' = \rho C_p \frac{\partial T}{\partial t} \quad (1)$$

En el laboratorio virtual se representan, de forma parametrizada, las soluciones de la ecuación del perfil de temperaturas en el interior de una pieza sólida y el flujo de calor de la misma, ambas ecuaciones se obtienen de la Ec.1. En el laboratorio se describen los pasos seguidos para la resolución de la ecuación en estado estacionario y con un valor de conductividad constante. El desarrollo de la resolución se puede consultar en (Cengel, 2011). En un gráfico se representan los valores en función del espesor de la pieza. El eje x representa el espesor de la pieza en metros. La figura 1 muestra la configuración de la pantalla del laboratorio.

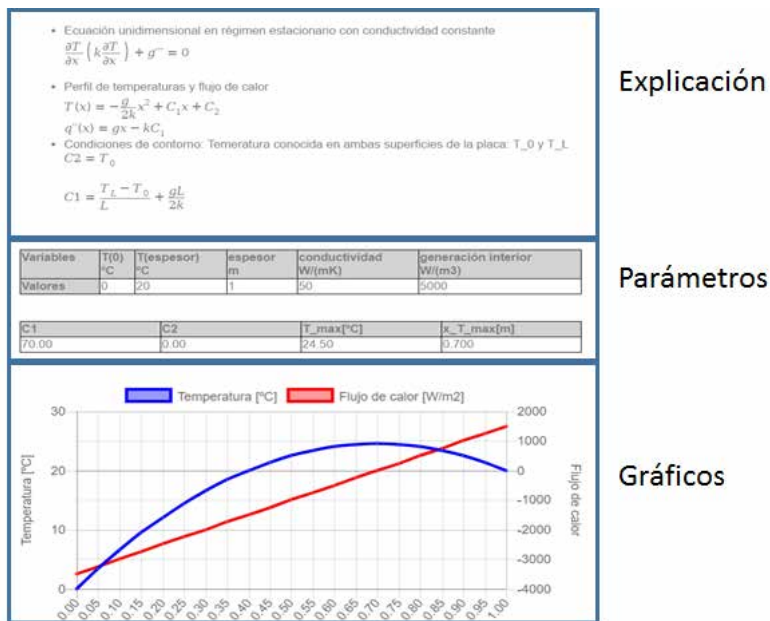


Figura 1. Ventana de datos del laboratorio virtual ecuación general de conducción de calor.
 <<http://labvirtual.webs.upv.es/ConduccionDeCalor.html>>

La ventaja de presentar la ecuación con una de sus soluciones en este formato es que el alumno puede introducir valores para las diferentes variables que intervienen y con ello observar la influencia de cada una de ellas sobre la solución final que adopta el problema. Es decir, no es una visión estática del modelo, sino que se puede observar la sensibilidad de cada variable.

2.1. Ejercicio planteado

Se plantea en clase que el alumno determine el perfil de temperaturas en el interior de una pieza sólida con generación conocida las temperaturas en ambas caras de la misma. Una vez terminado, se presenta el laboratorio virtual, donde está la solución al problema. Los problemas que se plantean a continuación tienen como objetivo observar la distribución de temperaturas al modificar las diferentes variables:

- ¿El punto de máxima temperatura aparece siempre en el interior de la pieza?
- Indicar qué pasa cuando aumentamos el valor de la generación interior
- ¿Qué influencia tiene la conductividad sobre el perfil de temperaturas?
- ¿Cómo influye la generación sobre la recta del flujo de calor?

El ejercicio con el laboratorio virtual se plantea de forma grupal, normalmente grupos de 5-6 personas y finalmente se analizan los resultados de los grupo de forma colectiva. Los alumnos suelen tener una buena predisposición al ejercicio, ya que requiere del uso de dispositivos electrónicos de los que disponen para el análisis de los conceptos trabajados en clase.

3. Laboratorio Virtual: Elementos multicapa

El objetivo de este laboratorio virtual es mostrar al alumno la influencia de las resistencias térmicas sobre el perfil de temperaturas y el flujo de calor. En la clase teórica se explica el concepto de resistencia térmica y se obtienen sus valores para diferentes configuraciones de elementos: placas planas, cilindros y esferas.

El laboratorio virtual permite introducir diferentes números de capas y valores de conductividad y espesor en las mismas, de manera que el alumno pueda configurar cualquier elemento y observar el perfil de temperaturas que se produce en el interior del elemento. El eje x representa el espesor en metros.

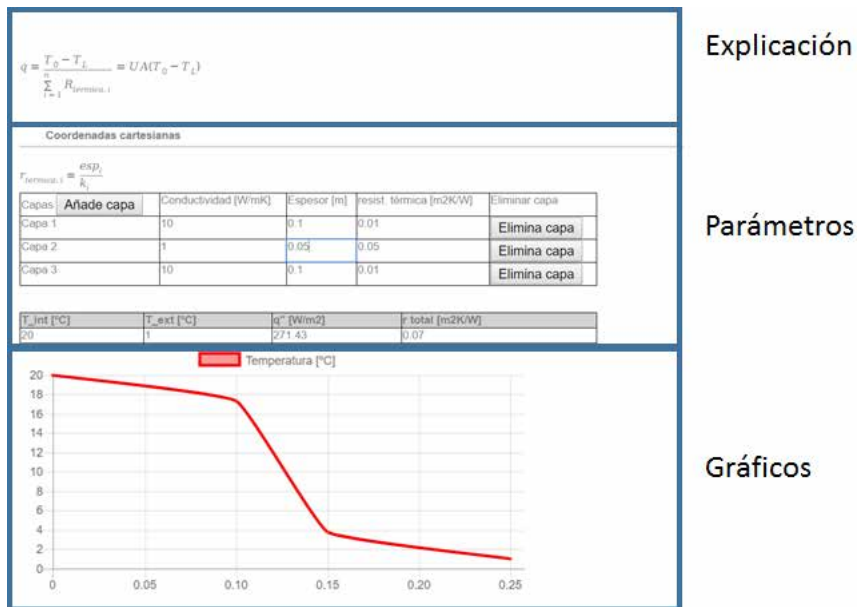


Figura 2. Ventana de datos del laboratorio virtual elementos multicapa.

<<http://labvirtual.webs.upv.es/ResistenciasTermicas.html>>

3.1. Ejercicio planteado

Las cámaras frigoríficas están compuestas del conocido panel sándwich, formado por dos placas metálicas y una interior de un espesor determinado de aislante. Se plantea calcular el espesor de aislante necesario en la cámara frigorífica para limitar el flujo de calor a un valor determinado (impuesto por la legislación). Se proporcionan los valores de conductividad de los materiales.

Observaciones que deben realizarse:

- ¿Se pueden obviar los valores de resistencia térmica de las capas metálicas? ¿Por qué?
- ¿En qué repercute modificar la conductividad del aislante sobre el flujo de calor?

Se plantea un segundo problema en el que se muestra un muro de construcción formado por diferentes capas de material. Se indican las temperaturas interior del edificio y exterior. Se plantea una situación de invierno y el alumno debe determinar en qué capa de material se alcanzará una temperatura de 0°C. Se hace modificar la capa de aislante y observar cómo influye sobre esta situación.

Los dos problemas se plantean para resolución individual o por parejas (grupos reducidos) y posterior resolución en clase.

4. Laboratorio Virtual: Superficies adicionales

El objetivo de este laboratorio virtual es mostrar al alumno la distribución de temperaturas y la potencia disipada en el interior de superficies adicionales de sección uniforme teniendo en cuenta diferentes condiciones de contorno para su cálculo.

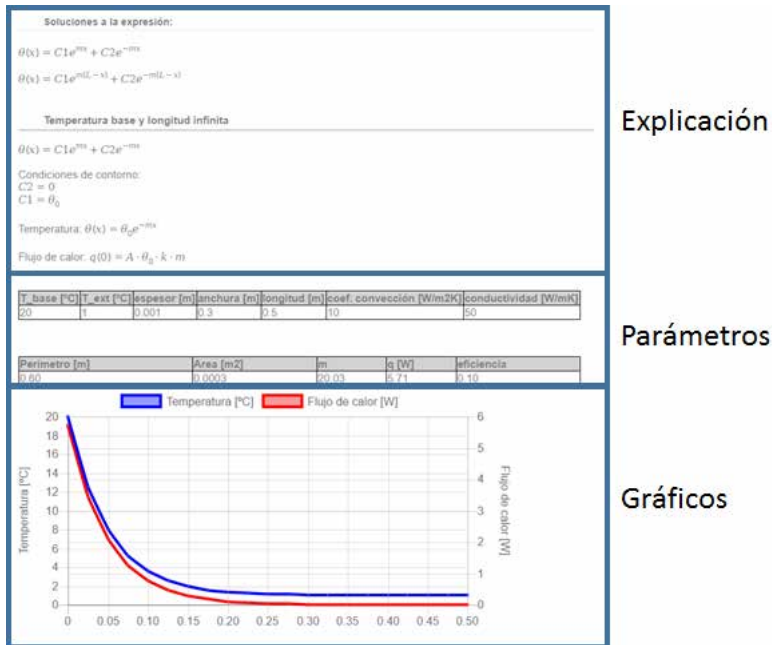


Figura 3. Ventana de datos del laboratorio virtual superficies adicionales. El eje x representa el espesor en metros. <<http://labvirtual.webs.upv.es/SuperficiesAdicionales.html>>

Como muestra la figura 3, la estructura del laboratorio virtual es idéntica al resto, con el fin de sintetizar la información y fijar la atención sobre el contenido que se intenta mostrar. La parte de la explicación contiene la resolución de la ecuación general de aletas, Ec. 2, para tres condiciones de contorno en el extremo de la misma: flujo de calor igual a cero, longitud infinita y temperatura en el extremo conocida. Los parámetros permiten introducir diferentes valores a las variables del problema y los gráficos se modifican en función del valor de las variables.

$$\frac{d^2\theta(x)}{dx^2} + \frac{d\theta(x)}{dx} \frac{dA_0(x)}{dx} \frac{1}{A_0(x)} - \frac{hP(x)}{kA_0(x)} \theta(x) = 0 \quad (2)$$

4.1. Ejercicio planteado

Se plantean diferentes observaciones:

- ¿Cómo influye la conductividad de la aleta sobre el flujo de calor que es capaz de evacuar?
- Determinar a partir de qué longitud la influencia de la aleta sobre la superficie es insignificante.
- ¿Cómo se modifica la eficiencia de la aleta en función de la longitud de la misma?
- Para una aleta que conecta dos superficies con diferentes temperaturas se plantea determinar a partir de qué longitud se puede disipar el máximo flujo de calor de las dos superficies. Es decir, qué longitud es necesaria para que la aleta se comporte como dos aletas independientes, una sobre cada superficie.

Se plantea la resolución individual de las cuestiones y se limita el tiempo de resolución a 10 minutos. Finalmente se comparten los resultados obtenidos y se discuten en conjunto.

5. Laboratorio Virtual: Conducción en régimen transitorio. Sólidos de temperatura uniforme

El objetivo del laboratorio es mostrar al alumno el comportamiento transitorio del intercambio de calor entre cuerpos e identificar los parámetros que influyen en el mismo. El análisis del proceso de conducción transitoria es diferente en función de las características del sólido y el proceso de convección a través del que se intercambia calor. Este análisis depende del parámetro adimensional número de Biot, que se explica en el primer apartado del laboratorio.

El análisis puede realizarse para diferentes tipos de configuraciones de material: placas, cilindros y esferas. Este parámetro puede seleccionarse en la parte de Parámetros del laboratorio.

El gráfico muestra la evolución de la temperatura de la pieza en función del tiempo, Ec. 3, de acuerdo con los parámetros anteriormente definidos. El eje x representa el tiempo en segundos. Además de la temperatura, la gráfica muestra la energía cedida o absorbida por la pieza a lo largo del tiempo. Se representa la energía por unidad de volumen (“densidad de energía”).

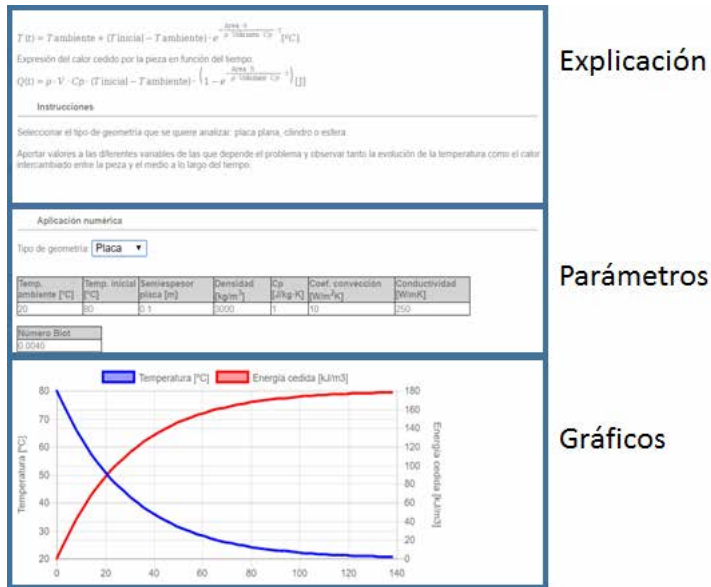


Figura 4. Ventana de datos del laboratorio virtual conducción régimen transitorio.
 <<http://labvirtual.webs.upv.es/ConduccionRegimenTransitorio.html>>

$$T(t) = T_a + (T_i - T_a) e^{-\frac{Ah}{mCp}t} \quad (3)$$

5.1. Ejercicio planteado

Se plantean diferentes problemas con el fin de que el alumno observe la influencia de las diferentes variables sobre la evolución térmica de la pieza.

- Se analiza el comportamiento de dos piezas con diferentes valores de mCp y se pregunta cuál de ellas alcanzará antes el régimen estacionario.
- Se pregunta sobre el valor límite que debe tener el coeficiente de convección para poder evaluar la pieza con el análisis cero-dimensional.
- Determinar de qué parámetros depende el valor de la energía necesaria para cambiar la pieza desde una temperatura a otra.

Los ejercicio se plantean de forma individual y posteriormente por grupos se discuten los resultados obtenidos. Finalmente se realizan algunas observaciones por parte del profesor de las conclusiones obtenidas por cada grupo.

6. Conclusiones

Después de haber llevado a la práctica el uso de los laboratorios virtuales en las clases de la asignatura se observan una buena acogida por parte de los alumnos de este tipo de actividades, ya que permiten hacer una clase más dinámica. Además, los alumnos han transmitido una serie de puntos de mejora de estas actividades.

Las actividades planteadas con los mismos están diseñadas para realizarse en el aula como complemento de las sesiones teóricas, con el fin de facilitar la comprensión de los contenidos. Por tanto, la idea original es que los alumnos puedan utilizarlos al final de algunas sesiones de aula. Los laboratorios tienen una resolución óptima para el uso de los mismos a través de pc o tablet, pero cuando se trabajan con otros dispositivos de menor tamaño como teléfonos móviles, estos presentan mayor dificultad para la introducción de datos y visualización de resultados. En la práctica, los móviles son los dispositivos que más se han utilizado, por ser los que se tienen en mayor disposición.

Se plantean dos alternativas, o ampliar el tiempo de uso de los laboratorios a una sesión entera, a la que los alumnos deben traer el portátil o asignar una aula informática; o modificar los laboratorios virtuales para que se adapten a dispositivos de menor tamaño de forma cómoda, lo que en informática se conoce como *response html*. Ésta última parece la más adecuada para la función por la que han sido creados.

Otra sugencia por parte de los alumnos es la ampliación de laboratorios virtuales para el resto de temas de la asignatura: convección, intercambiadores y radiación; ya que resulta muy ilustrativo poder observar de forma gráfica la sensibilidad de las diferentes variables en el cálculo de transmisión de calor entre objetos.

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Análisis de los distintos escenarios en relación a la Orden ECI/3855/2007 para la integración de la metodología BIM en los planes de estudio del Grado en Arquitectura Técnica

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Abstract

According to the RD 1393/2007, universities are competent to design, impart and issue his own titles. The Government is the one who establishes the requirements of verification of his plans of studio in the case of enabling titles for the exercise of professional activities: the Orden ECI/3855/2007 for the degree of building engineering.

BIM (Building Information Modeling) is the process of creation and management of the information of a construction in a three-dimensional computer model that incorporates relative data to all his cycle of life. The Directive 2014/24/EU recommends to the states members the use of BIM in the projects funded with public funds from April of 2016.

The managers of the upper education in Engineering and Architecture have to guarantee graduates with BIM skills. This communication poses a strategy of work in front of a hypothetical proposal of plan of studios for the Degree AT with BIM integrated. It splits of the comparison of four possible stages in relation with the professional attributions and with the generic and specific skills that must be guaranteed.

The results obtained are of interest to pose the leaf of route more convenient: it concludes the favourable stage for the integration of BIM in the plan of studios of the Degree AT is the modification the Order ECI.

Keywords: *building engineering, BIM, skills, habilitation, attributions, university, teaching curriculum, information management, projects..*

Resumen

Según el RD 1393/2007 las universidades son competentes para diseñar, impartir y expedir sus propios títulos. Pero para los títulos habilitantes para el ejercicio de actividades profesionales es el Gobierno quien establece los requisitos de verificación de sus planes de estudio: la Orden ECI/3855/2007 para la titulación de arquitecto técnico.

BIM (Building Information Modeling) es el proceso de creación y gestión de la información de una construcción en un modelo informático tridimensional que incorpora datos relativos a todo su ciclo de vida. La Directiva 2014/24/UE recomienda a los estados miembros el uso de BIM en los proyectos financiados con fondos públicos a partir de abril de 2016.

Los responsables de la educación superior en Ingeniería y Arquitectura deben garantizar egresados con competencias BIM. Esta comunicación plantea una estrategia de trabajo ante una hipotética propuesta de plan de estudios para el Grado AT con BIM integrado. Se parte de la comparación de cuatro escenarios posibles en relación con las atribuciones profesionales y con las competencias genéricas y específicas que deben garantizar sus contenidos.

Los resultados obtenidos son de interés para plantear la hoja de ruta más eficaz para conseguirlo: se concluye con que el escenario propicio para la integración de BIM en el plan de estudios del Grado AT es la modificación de la Orden ECI.

Palabras clave: *arquitectura técnica, BIM, competencias, habilitación, atribuciones, universidad, programación docente, gestión de la información, proyectos.*

Introducción

La actividad profesional de los titulados arquitectos técnicos está regulada por ley de tal manera que sus atribuciones profesionales son claras y concretas. Eso, sin embargo, no significa necesariamente que su perfil competencial se mantenga invariable en el tiempo.

Según el RD 1393/2007 las universidades son completamente competentes para crear y proponer los títulos que ellas mismas vayan a impartir y expedir. No obstante existe una excepción para los títulos que habilitan para el acceso o ejercicio de actividades profesionales. En este caso es el Gobierno el que establece los requisitos de verificación de los respectivos planes de estudio. En el caso de la titulación que habilita para la profesión de arquitecto técnico esto se materializa en la Orden ECI/3855/2007.

La Directiva 2014/24/UE sobre Contratación Pública de la Unión Europea recomienda a los estados miembros el uso de la metodología BIM en los proyectos financiados con fondos públicos a partir de abril de 2016. BIM (Building Information Modeling) es el proceso de creación y gestión de la información de una construcción en un modelo informático tridimensional que incorpora datos relativos a todo su ciclo de vida

El Gobierno Español, por su parte, aprobó en 2015 la trasposición de la Directiva y además constituyó la Comisión es.BIM. Liderada por el Ministerio de Fomento, su misión es la implantación de la metodología BIM en España a partir de 2018.

La transformación que esto supone para el sector de la construcción tiene importantes implicaciones para los responsables de la educación superior en Ingeniería y Arquitectura:

deben garantizar la salida de egresados con las competencias BIM que, a causa de la Directiva, van a ser requeridas a los futuros profesionales del sector.

Las universidades, en las que recae la responsabilidad del diseño de los títulos en nuestro país, deben responder a ese requerimiento. Y lo deben hacer de forma eficiente en un contexto de crisis generalizada todavía no resuelto y cuyos efectos siguen siendo notables. Además, lo deben hacer en un entorno un tanto hostil: a día de hoy la apreciación por esta metodología es todavía baja a pesar de que en breve se va a imponer por ley.

1. Objetivos

Esta comunicación plantea una estrategia de trabajo ante una hipotética propuesta de plan de estudios para el Grado en Arquitectura Técnica (en adelante AT) con BIM integrado que pueda responder a estas necesidades.

Se parte de la definición de los posibles escenarios (4) en relación con las atribuciones profesionales y con las competencias genéricas y específicas que deben garantizar los contenidos de ese plan de estudios (en adelante, PE). Posteriormente se hace una comparación entre ellos. Para ello se establecerán las categorías (5) a evaluar para cada escenario. Se pretende concluir con la determinación del escenario más propicio para la integración de BIM en los planes de estudios del Grado en AT.

Se considera que los resultados obtenidos del estudio comparativo son de interés para plantear la hoja de ruta más conveniente a las universidades y al sector de la arquitectura-ingeniería-construcción en este momento socio-económico concreto.

2. La tramitación administrativa de los Planes de Estudio universitarios

La Ley Orgánica 4/2007 vino a modificar la Ley 6/2001 Orgánica de Universidades. Fue el RD 1393/2007, por el que se establece la ordenación de las enseñanzas universitarias oficiales, el que otorgó a la Universidad la competencia de crear y proponer las enseñanzas y títulos que ella fuese a impartir y expedir.

Sin embargo, el RD 1393/2007 planteó una excepción. En su artículo 12.9 concretó que en el caso del diseño de títulos que habiliten para el acceso o ejercicio de actividades profesionales:



Figura 1. Procedimiento de verificación de títulos universitarios. 2015. Elaboración propia

- Es el Gobierno el que establece las condiciones a las que deberán adecuarse los PE. El objetivo de esta excepción es garantizar que los títulos acrediten la adquisición de las competencias y de los conocimientos adecuados para dicho ejercicio profesional. En consecuencia el Gobierno dicta sendas órdenes ministeriales para cada una de esas titulaciones de grado habilitantes. En el caso de la titulación que habilita para la profesión de arquitecto técnico, la orden en cuestión es la ORDEN ECI/3855/2007, de 27 de diciembre, por la que se establecen los requisitos para la verificación de los títulos universitarios oficiales que habiliten para el ejercicio de la profesión de Arquitecto Técnico.
- Es la universidad que otorga el título la que decide cuál ha de ser la denominación de las titulaciones que imparte y su estructura programática y de contenidos. Se inicia ahí el proceso de verificación regulado en el RD, que se detalla en la Fig.1, y que culmina con la aprobación del título para cada una de las universidades.

3. Metodología de trabajo

La secuencia que se va a seguir en el análisis es la siguiente:

- [1] Se plantearán los escenarios que podrían darse según el grado de intervención en la Orden ECI que requieran:
- [2] Se evaluará su *ajuste* a la normativa vigente, el nivel de *adecuación* de cada una de ellas a los intereses generales y su *efectividad* o hasta qué punto dse lograría con ella exactamente el efecto deseado o esperado; de forma relativa, es decir, con respecto a las demás, se medirá el *tiempo* que requeriría cada propuesta para

ponerse en marcha; y por último, se indicará en qué consistiría la tramitación legal necesaria para la aprobación del PE que de cada escenario se derivase.

- [3] Para la cuantificación de estas cinco categorías se utilizará inicialmente una escala de valoración cualitativa, no numérica, que indique el grado en el cual se halla presente esa característica en el escenario supuesto. La escala cuenta con cuatro grados: nulo, bajo, medio y alto.
- [4] Posteriormente se le dará valor numérico a esos grados (nulo 0, bajo 1, medio 2 y alto 3) lo cual nos permitirá representarlos gráficamente y compararlos; y serán positivos o negativos dependiendo de la connotación que tenga la categoría (positivos para la adecuación y el ajuste, y negativos para el resto).
- [5] Se determinará la valoración global del escenario y la propuesta a partir de los resultados obtenidos.

4. Definición de los escenarios y su análisis según las categorías

4.1. La Orden ECI/3855/2007 permanece invariable

Las universidades no se plantearían modificaciones sustanciales ni en el perfil del futuro profesional que se desea formar, ni en las competencias que el mismo debe adquirir. El Gobierno se mantendría al margen y dejaría hacer a las universidades. Las competencias de la Orden ECI permanecerían intactas.

Se seguiría formando al arquitecto técnico actual, que actuaría como agente del proceso de edificación con la definición que da la LOE para cada agente y con las atribuciones profesionales establecidas en la Ley 12/1986 y en el CTE; y ejercería su profesión de acuerdo con la LSP vigente o la que se aprobase.

Cada universidad haría sus propias modificaciones en su PE introduciendo contenidos BIM de acuerdo a sus propios criterios, cuando quisiera, hasta un nivel tal que no supusiera modificación sustancial de manera que la ANECA también pudiese considerarlo así y requeriría un *simple informe favorable* de su parte para salir adelante. Desde ese punto de vista se la podría calificar de *adecuada* para los intereses particulares de cada universidad.

El *periodo* de tramitación sería el *más corto* que se pudiese requerir.

Desde el interés del colectivo profesional, los profesionales ya titulados no verían amenazado su estatus profesional. No más que en cualquier otra situación de avance tecnológico, etc., en la que se hayan encontrado con anterioridad y que haya requerido de ellos un reciclaje. Sería totalmente *adecuada*.

El hecho de ser una propuesta nacida desde la entidad responsable del título, contribuiría a favorecer la multidisciplinariedad de los planteamientos de trabajo, la adquisición de las competencias transversales y específicas BIM, etc, lo cual la haría *adecuada* para los nuevos egresados.

Esta situación, similar a lo que ha ocurrido en la universidad española en los últimos 15 años, no garantiza que provoque lo mismo en otras universidades. El tiempo nos ha demostrado que es poco efectiva.

4.2. La Orden ECI/3855/2007 se modifica

En esta situación el Gobierno tomaría la iniciativa de modificar la Orden ECI. La hipótesis consistiría en que el Gobierno podría introducir las instrucciones necesarias en la Orden ECI que forzasen a las universidades a incluir en los PE contenidos BIM. Pero también directrices para que las universidades, aun en su autonomía, diseñasen las programaciones y las metodologías docentes de sus PE incluyendo la forma de trabajo en entorno BIM como una competencia más. Se trataría pues de una situación en un *grado medio de ajuste a normativa*.

El hecho de haber necesitado modificar, aun mínimamente, la Orden ECI/3855/2007 actual, generaría una nueva. Según el RD 1393/2007 cualquier título habilitante para ejercer una profesión regulada por ley debe verificarse según la Orden vigente. Eso obligaría a todas las universidades a iniciar el proceso de verificación de sus títulos. Además la nueva Orden ministerial, podría, incluso, marcar plazos para la adaptación de los títulos, con lo cual el ritmo podría ser también homogéneo en todas las universidades del país.

Esta circunstancia convertiría a la segunda en la situación *más adecuada* tanto para los futuros egresados como para el sector productivo que los espera y para los profesionales en activo.

Pero además, en este caso, se garantizaría uniformidad en los criterios de diseño de los PE a partir de ese momento; la obligatoriedad de adaptación para todas las universidades provocaría la salida de egresados, no solo formados según las exigencias del sector, sino en número adecuado a las necesidades de aquel. Las universidades estarían en igualdad de condiciones a la hora de ofertar sus titulaciones.

Colateralmente el hecho de tener que pasar por un proceso completo de verificación del título prolongaría el *tiempo* necesario de tramitación (con respecto a la anterior, por ejemplo) y de implantación del PE resultante.

4.3. Se define un nuevo perfil de competencial

La universidad propondría al Gobierno la definición de un nuevo perfil de técnico, de formación exclusivamente en competencias BIM (nuevas competencias específicas, genéricas y transversales). Se estaría ante una nueva titulación competencial sin atribuciones profesionales propias. Las universidades a partir de ese momento expedirían dos títulos paralelos: cualquiera de las titulaciones actuales AEC, con sus atribuciones profesionales vigentes, y un título de especialista en BIM con los conocimientos suficientes de AEC para poder serlo pero no mucho más. Esto provocaría que:

- El actual profesional, titulado profesional, sin formación BIM, debería recurrir al titulado en competencias BIM cuando la legislación le exigiese desempeñar sus funciones en ese entorno, cosa que en breve será generalizado.
- Los futuros egresados de cualquiera de las cuatro titulaciones españolas AEC deberían hacer lo mismo ya que la universidad en este hipotético escenario no tendría intención de formarles en BIM.
- Cualquier empresa del sector de la construcción necesitaría de la concurrencia de dos técnicos, el técnico AEC que cubriese las obligaciones y las responsabilidades que le corresponden por sus atribuciones legales, y el “técnico BIM”, que haría posible llevar adelante en entorno BIM cuando sea requerido por ley.

Este escenario no parece adecuarse demasiado a las necesidades del sector en general y mucho menos a los intereses de la industria: a medio plazo la industria acabaría optando por contratar técnicos AEC que se hubiesen formado en BIM paralelamente al grado o en cursos de posgrado, capaces de cubrir así las dos vertientes de sus demandas.

Con respecto a su ajuste a la legislación actual no supondría ninguna modificación legal más que la redacción de un Libro Blanco de la nueva titulación; que la universidad que desease expedir ese título presentase la correspondiente memoria de verificación. Todo dentro del actual marco normativo pero suponiendo la creación de un nuevo título, por tanto se convertiría en la tramitación más larga.

4.4. Se define un nuevo perfil de profesional

El cuarto escenario supondría también la definición de un nuevo perfil técnico pero con otro alcance: la modificación de las competencias actuales del arquitecto técnico con contenidos de metodología BIM, hasta tal punto que todo ello supusiese la aparición de nuevas e hipotéticas atribuciones profesionales. Tanto los pasos para la tramitación del PE, como los plazos necesarios para ello son los mismos que los que requería el escenario anterior.

El ajuste a la normativa actual sería nulo ya que debería modificarse la definición del técnico en cuestión en la LOE, sus atribuciones en la Ley 12/1986, y a partir de ahí el resto de documentos normativos.

Desde el punto de vista académico quizá podría calificarse como la más adecuada.

Pero desde la perspectiva del colectivo profesional la aprobación de este nuevo perfil dejaría a los profesionales con un título obsoleto en sus atribuciones que requeriría de un proceso de adaptación no previsto en la ley y que habría que diseñar. En esta hipotética situación, serían los colectivos profesionales, los colegios, los que manifestarían su rechazo y ejercerían la presión sobre la Administración Estatal para que pusiese freno a tales propósitos. No parece ser lo más adecuado. Se estaría con toda seguridad ante un escenario fuera de cualquier consenso y de cualquier ajuste a la normativa.

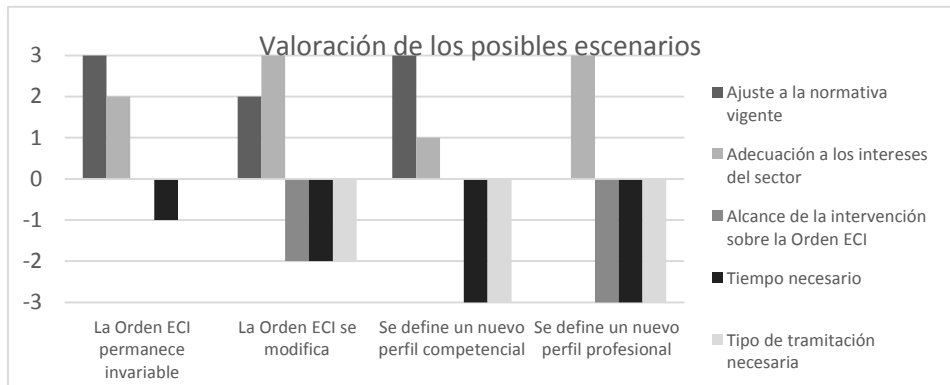


Figura 2. Valoración de los distintos escenarios. 2015. Elaboración propia

La gráfica de la Fig. 2 recoge los resultados de las cinco categorías una vez que se les ha dado valor a cada una de ellas.

5. Resultado del análisis: determinación de la propuesta. Justificación

El escenario finalmente propuesto es el que requiere la modificación de la Orden ECI/3855/2007. En este escenario, el Ministerio de Educación, Cultura y Deporte, a instancias de la Comisión BIM del Ministerio de Fomento, y según las indicaciones de la Conferencia de Rectores de Universidades, propondría la modificación de la Orden ECI actual.

Para apoyar nuestra valoración cualitativa, la podemos comparar con el resultado que obtendríamos de las gráficas utilizadas anteriormente. En la Fig.3 se observa como la opción más compensada, es decir, la que daría un valor global más cercano a cero es la que contempla el escenario de intervenir solo en la Orden ECI, la cual arroja un resultado global de -1.

Esa modificación supondría, como se ha visto:

- Integración de BIM como metodología de aprendizaje de construcción para garantizar la adquisición de las competencias propias de la titulación pero en un entorno BIM.
- Integración de BIM como una forma de trabajo cuya esencia coincide con las competencias básicas exigidas por el EEES y la legislación de las enseñanzas universitarias, como integrador de conocimientos, de relaciones personales y de metodologías.
- Integración de las herramientas BIM como herramienta/medio muy eficaz para la enseñanza de materias de construcción (de la mayoría de ellas) por su característica de “construcción de un modelo virtual” y por permitir la realización de simulaciones de multitud de condiciones diversas de proyecto que hacen al modelo susceptible de ser analizado.

- Asunción de BIM como motor del cambio en la forma de trabajo de los profesionales y las empresas AEC, cuyo aspecto colaborativo y multidisciplinar y cuyos flujos de trabajo se puede reproducir fielmente en el ámbito académico dentro del aula. Por tanto, también permite simular durante la formación, situaciones de trabajo y de relaciones personales y laborales para el alumno.
- Adición de competencias al técnico formado según los PE que se derivasen pero con las mismas atribuciones legales que hasta ahora.

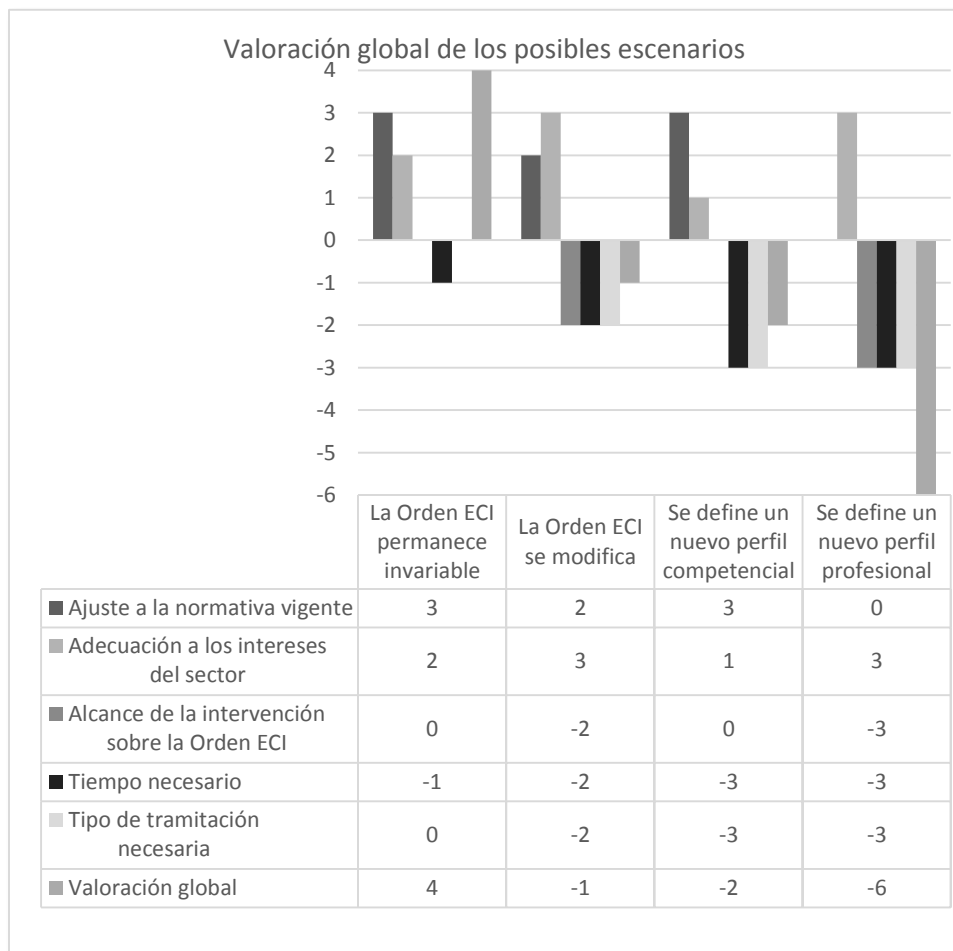


Figura 3. Valoración global de los distintos escenarios. 2015. Elaboración propia

Los cambios en la Orden ECI conllevarían:

- La modificación obligatoria de todos los PE de todas las universidades españolas. Los títulos expedidos a partir del momento en que la Orden cambia deben ser nuevamente

verificados de acuerdo con la Orden ECD vigente. Se trata de las mismas profesiones reguladas por ley.

- Todas las universidades empezarían a expedir títulos “adaptados” a la vez con lo cual la salida de egresados formados al mercado sería uniforme en el tiempo y al ritmo que la industria los demandase, porque habría universidades dispuestas para formarlos.
- La existencia de unos requisitos mínimos de diseño. La formación sería homogénea en todo el país hasta un determinado nivel. La ANECA contaría con una referencia universal a partir de la cual podría emitir sus informes de adecuación.
- El MECD con sus objetivos estaría marcando el nivel mínimo de madurez BIM que los alumnos deberían alcanzar al terminar su formación de grado, no solo competencias como hasta ahora.
- La materialización y la expresión explícita de la voluntad de la Administración Pública en apoyar esta metodología y lo que ello supone en cuanto a la apreciación positiva del cambio por parte de la sociedad en general y del sector de la construcción en particular.
- La tramitación relativamente rápida de los ajustes normativos, porque no supone cambios legislativos más allá de la modificación de una orden ministerial. Las órdenes ministeriales son normas que nacen y se desarrollan en un ministerio y salen a la luz por decisión del ministro. No necesitaría de cambios radicales en el sistema legislativo actual que pudiesen afectar a otras partes del sector, a otros sectores de sociedad, o que demorasen en el tiempo la formación y la consiguiente salida de técnicos al mercado.
- No sería en ningún caso fruto de iniciativas aisladas sino que supondría aquel cambio de paradigma global que se pedía desde la EUPPD, respaldado por la Administración estatal. Se estaría caminando al ritmo de Europa.

6. Conclusiones

La vía más eficaz para implantar BIM en los planes de estudio con el mínimo impacto para las estructuras universitarias, garantizando a los egresados AEC la adquisición de competencias BIM al finalizar el grado, de forma homogénea en todas las universidades, al ritmo en que el mercado laboral lo va a demandar, y con el mayor ajuste a la legislación actual, es mediante la adición de dicha competencia BIM como una más de las que se exigen en la actual Orden ECI 3855/2007.

Este hecho supone la aparición de una nueva Orden lo cual obliga a todas las universidades a adaptar sus títulos a ella necesariamente.

La continuación necesaria de este trabajo es la definición de las competencias BIM que debería recoger la Orden en dicha modificación.

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Los técnicos del futuro y los hombres del renacimiento. Formación específica y transversal para un aprendizaje eficiente

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Abstract

By acquiring professional experience, one gains a diverse knowledge by relating concepts or by receiving additional training not taught in a collegiate education. This way of learning reminds us of how the renaissance technicians learned from their experience, those same technicians we admire so much. This article shows how this learning process is developed and presents the similarities with the renaissance period, highlighting that an efficient professional requires experience and an accumulative education.

Keywords: *Technicians; Renaissance; Specific training; Efficient learning; Purchase competitions.*

Resumen

Conforme se avanza en experiencia profesional, se adquieren multitud de conocimientos de manera intuitiva o con formación adicional, que comúnmente no han sido enseñados en la formación universitaria inicial tradicional. Esto hace pensar en la formación basada en la experiencia de los técnicos renacentistas que tanto nos impresiona. En este artículo se muestra como se desarrolla este proceso de aprendizaje y los puntos en común con la antigüedad, que marcan un profesional eficiente en base a la experiencia y formación acumulada.

Palabras clave: *Técnicos; Renacimiento; Formación específica; Aprendizaje eficiente; Adquirir competencias.*

Introducción

Los técnicos del renacimiento adquirían destreza, saber hacer y maestría en base a un aprendizaje (y auto-aprendizaje), en muchas ocasiones absorbido de sus maestros con los cuales empezaban apoyándose como aprendices y durante años. Esta formación basada en la experiencia y observación, fomentaba la creatividad y la creación de nuevas técnicas para resolver los problemas encontrados. Los aparejadores, arquitectos técnicos e ingenieros de edificación, al igual que en otras titulaciones técnicas universitarias, han adquirido y adquieren en el transcurso de sus estudios, conocimientos y destrezas que les otorgan gran versatilidad profesional y les capacitan para realizar un aprendizaje continuo durante el desarrollo de su labor profesional.

En una investigación realizada en la escuela de Ingeniería de Edificación de Sevilla por Alducin et al. (2017) se concluye que si bien se dan los 4 estilos de aprendizaje, el estilo de aprendizaje dominante de los alumnos de primer curso es reflexivo y “el alumnado cuando egrese y se incorpore al mundo profesional desarrollará un trabajo minucioso, argumentado y preciso; sin embargo estará limitado para ofrecer las respuestas y acciones rápidas que exige el desempeño de la ingeniería”.

La figura del aparejador de larga tradición de más de 5 siglos (Gracia, 2005) surge en la era moderna entre finales de la Edad Media y el Renacimiento fruto de la disociación entre el diseño y la técnica de edificios y nos preguntamos cuál sería el estilo de aprendizaje y la formación de aquellos primeros aparejadores surgidos de una organización gremial.

En la actualidad poseemos una gran cantidad de recursos que nos ayudan a resolver problemas complejos relacionados con la construcción. Tenemos programas de cálculo, de dibujo, de simulaciones para comprobar soluciones constructivas, laboratorios y empresas especializados en materiales, multitud de herramientas y maquinaria con la que abordar cualquier obra de construcción. Aún disponiendo de todos esos medios, debido a la velocidad de los procesos constructivos y las exigencias cada vez mayores de concluir proyectos bajo el yugo de la competitividad y la economía, no somos capaces de abordarlos con creatividad sino que nos esforzamos por lograr el objetivo que marcan los ritmos de hoy en día.

Los grandes proyectos que se realizaron durante el renacimiento con el impulso de los mecenas permitían que los técnicos pudieran lanzarse a construir lo desconocido e idear soluciones cada vez más complejas.

Es la capacidad de los hombres del renacimiento para crear nuevas soluciones e innovar sin los medios que hoy tenemos a nuestra disposición, lo que nos fascina aún hoy en día. Abordaban con ingenio y creatividad problemas reales e ideaban herramientas y mecanismos para lograr construir sus obras. Gracias a su esfuerzo la arquitectura y la construcción fueron estableciéndose como una ciencia en la sociedad.

En este artículo se muestran unas pinceladas para hacer reflexionar sobre unos técnicos del pasado que nos inspiran admiración, y trasladarlo hacia los procesos de adquisición de

competencias actuales, desde una visión de los actuales jefes de obra como pueden ser los ingenieros de la edificación.

1. Formación de los renacentistas

Hasta el renacimiento la figura del maestro de obras había estado ligada al “saber hacer” (Macedo, 2013); el oficio de construir se transmitía de manera oral y sus integrantes pasaban por distintas etapas relativamente largas de aprendices donde practicaban las técnicas y ampliaban el conocimiento de los materiales siendo los aprendices más destacados los que conseguían la maestría.

A partir del renacimiento los maestros de obras debían conocer disciplinas como la pintura, la matemática, filosofía, la geometría y ser artífices de la idea sufriendo una mitosis que los transformaría en arquitectos dejando de lado la actividad manual para ejercer una actividad intelectual (Alfaraz, 2016) como pensadores y ordenadores del espacio.

Con la eclosión del antropocentrismo y los grandes nombres del renacimiento como Leonardo da Vinci o Brunelleschi apareció la actividad intelectual de diseño de edificios, la búsqueda de las técnicas de construcciones grandiosas y la arquitectura como ciencia. La necesidad de profesionales de la construcción que dominasen las técnicas constructivas, la organización de los trabajos y su control propició la aparición de la figura del aparejador (Bonilla, 1997) que ejercía estas labores rindiendo cuentas al tracista arquitecto que continuaba siendo el maestro de obras mayor.

La formación de los maestros en el renacimiento se iniciaba temprano, Leonardo Da Vinci ingresó en uno de los talleres más prestigiosos de su época como aprendiz de su maestro Verrocchio y paulatinamente fue instruido en técnicas artísticas como el dibujo, la escultura la pintura pero además, aprendió las bases de la química, la mecánica y de oficios como la metalurgia, la carpintería o el yeso y la mecánica. La formación, además de multidisciplinar era muy larga, permitiendo el conocimiento teórico y práctico de las artes.

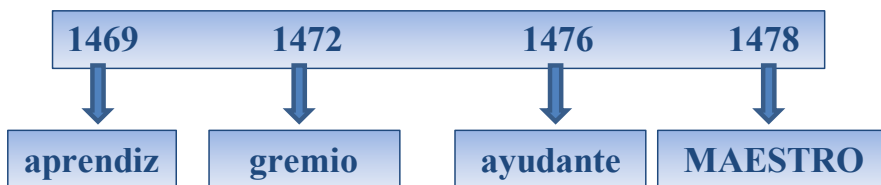


Figura 1. Cronología de formación Leonardo da Vinci. Fuente: Elaboración propia (2017).

Además de sus capacidades personales abrumadoras, su gran curiosidad y capacidad inventiva le catapultaron como símbolo del hombre del Renacimiento, su formación práctica y tutorizada durante casi 10 años fueron cruciales en el desarrollo de su trabajo.

2. Proceso de aprendizaje actual

Como ya se ha dicho, el ingeniero de edificación aborda su aprendizaje desde diferentes estilos y en cada proyecto aumentará su experiencia y los conocimientos serán ampliados y revisados, se adquirirán nuevos conocimientos según los ritmos que marcan las innovaciones tecnológicas, los métodos y sistemas de gestión empresariales y las nuevas herramientas.

Durante el ejercicio de la profesión, la constante evolución de la construcción nos obliga a adquirir conocimientos de manera intuitiva y el estilo de aprendizaje se orienta hacia el estilo pragmático (Cárcel et al, 2014), y con cada obra terminada aumenta la formación exponencialmente dada la multitud de técnicas y proyectos diferentes que se abordan (no hay dos obras iguales) y la gran cantidad de tareas que los ingenieros de edificación desempeñan simultáneamente y en periodos relativamente cortos en el tiempo.

Pero en muchas ocasiones y en cada obra se complementa el aprendizaje ayudándonos de otros profesionales expertos y escuelas especializadas en áreas de conocimiento concretos. A continuación se relacionan diferentes áreas en las que, según nuestra experiencia y el oficio ejercido, se han tenido que formar los ingenieros de edificación:

- Negociación y liderazgo
- Habilidades para el trabajo en equipo
- Dirección, liderazgo
- Recursos humanos
- Contabilidad y finanzas
- Herramientas ofimáticas y redes
- Software especializados (autocad, BIM, certificaciones energéticas, diseño de instalaciones)
- Ejecución de Instalaciones
- Rehabilitación
- Técnicas Constructivas y Materiales de Construcción
- Cálculo estructural
- Acústica
- Calidad y medioambiente
- Prevención de riesgos
- Normativa nueva, específica o actualización de las existentes
- Sistemas de gestión
- Gestión de clientes, permisos
- Estudios, licitaciones y obras públicas

La obtención del título de ingeniero de edificación otorga facultad legal para el ejercicio de la profesión de arquitecto técnico reglada por la Ley de Ordenación de la Edificación, sin embargo existen profesiones reconocidas y altamente demandadas por la sociedad que carecen de formación académica específica.

El ejemplo del oficio de jefe de obra es sin duda uno de los ejercidos por los titulados en arquitectura técnica que adquieren conocimientos según la experiencia acumulada y los cursos de formación que van necesitando realizar según las características de la obra ejecutar (del Burgo, 2013). En el mejor de los casos, cuando su labor se desarrolla dentro de una organización de cierta envergadura, inician su trabajo como estudiante en prácticas o con funciones de ayudante (Portales, 2007) a las órdenes de un jefe de obra de mayor experiencia. Pretendemos poner en énfasis el problema de la falta de escuelas de aprendices en las que se desarrolle la formación orientada a oficios concretos, ya que en las escuelas donde se imparten las titulaciones de arquitectura técnica e ingeniería de edificación sí se obtiene una base sólida teórica pero no completa la formación necesaria en muchos de los oficios demandados por el sector productivo de la construcción, rehabilitación, conservación y mantenimiento de edificios.

Ante las altas cuotas de responsabilidad de algunos de estos oficios, son los propios egresados que comienzan su andadura profesional los que deben “aprender haciendo” y solo con el transcurso de los años van completando la formación necesaria para un correcto desempeño de sus labores.

3. Puntos en común con el Renacimiento

Como hemos visto, en el Renacimiento una formación sólida era la base para que los maestros constructores pudieran ejercer su actividad con creatividad y solvencia. La formación teórica y práctica eran fundamentales durante sus estudios, primero como simples observadores realizando tareas menores, después formándose en diversas materias como aprendices y más tarde como ayudantes hasta conseguir ejercer su profesión.

Actualmente en la formación de arquitectos técnicos e ingenieros de edificación se imparten asignaturas teóricas reforzadas en sus clases prácticas y tutorizadas por los profesores pero de una manera general y alejada en ciertos casos por ser genérica, de la profesión a ejercer. Posteriormente a la formación universitaria en el proceso de aprendizaje cobra mayor importancia la parte práctica que generalmente se obtiene sin tutorización alguna por parte de profesionales experimentados.

En la siguiente tabla se resume de manera gráfica las etapas formativas en el caso de un maestro constructor y un jefe de obra.

Tabla 1. Comparación de Etapas de Formación Renacimiento y Actualidad. Fuente Elaboración propia.

RENACIMIENTO		ACTUALIDAD	
Formación de maestros constructores		Formación de ingenieros edificación para el oficio de jefe de obra	
Etapas	Tipo de formación	Etapas	Tipo de formación
Observador	Práctica	-	-
Aprendiz	Teórica - Práctica	Formación universitaria	Teórica - Práctica
Ayudante	Teórica - Práctica	Ayudante	Práctica
Maestro	Práctica - Teórica	Jefe de obra	Práctica - Teórica

Se observa en la tabla realizada en base a aspectos muy generales que en ambas épocas, tanto la formación teórica como la práctica, fueron y son desarrolladas.

Cabría un análisis más profundo donde se pudieran analizar las tareas realizadas por los ayudantes en ambas épocas y así comparar el nivel de práctica adquirida hasta entonces; los ayudantes del Renacimiento ya estaban preparados para su labor profesional gracias al largo proceso de aprendizaje práctico (Gracia, 2005), y tanto en responsabilidad como en experiencia, sería imposible de equiparar a las de un ayudante de jefe de obra actual.

4. Conclusiones

Pretendemos enfatizar en nuestra conclusión que los procesos de formación actuales en determinados oficios, como el de jefe de obra, se encuentran más acorde a tiempos de la Edad Media y del Renacimiento pero con el agravio de que actualmente no existen escuelas de aprendices donde un maestro enseñe a sus ayudantes tutorizándolos y enseñándoles de su experiencia durante años.

La inexistencia de un plan para la formación de profesionales que desarrollan oficios muy generalizados en el sector de la edificación, deja en manos del propio técnico su especialización y la ampliación de conocimientos, que adquieren de forma autónoma generalmente y en el mejor de los casos impulsados por las empresas a las que pertenecen.

En una sociedad moderna la demanda de técnicos experimentados y altamente cualificados en el sector de la construcción es ya un hecho y el aprendizaje pragmático es cada vez más necesario pero en etapas anteriores.

Debemos replantearnos si mejorar los planteamientos actuales fijándonos en las bases de la formación Renacentista.

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Formación en edificación para el mantenimiento de edificios. Herramientas tecnológicas

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Abstract

Building engineers have theoretical knowledge in all areas related to building construction, thus qualifying them in a notable way to become head maintenance supervisors. The real challenge in their work is to interrelate the large quantity of elements that configure a building while maintaining a traceability of all the tasks that have been carried out. This is necessary in order to have an integral knowledge thereof, so that taking decisions may be made with enough criteria for sustainable maintenance management. This article connects the technological tools utilized in building maintenance, alongwith the college education pertaining to this subject.

Keywords: *Building training; Building engineer; Maintenance of buildings; Asset Management; Technological tools.*

Resumen

El ingeniero de edificación posee conocimientos teóricos en todas las áreas relacionadas con la construcción de edificios y ello le capacita de una manera notable para realizar la dirección de mantenimiento de los mismos. El verdadero reto en esta labor es conseguir interrelacionar la gran cantidad de elementos que configuran un edificio con la obtención de la trazabilidad de todas las actuaciones llevadas a cabo para un conocimiento integral del mismo, de forma que la toma de decisiones pueda ser realizada con criterios suficientes para una gestión del mantenimiento sostenible. En este artículo se relacionan las herramientas tecnológicas utilizadas para el conocimiento de los edificios y la formación en este aspecto impartida.

Palabras clave: *Formación en edificación; Ingeniero edificación; Mantenimiento de edificios; Gestió de Activos; Herramientas tecnológicas.*

Introducción

La formación universitaria prepara a los alumnos para unas determinadas destrezas que deberán aplicar con eficacia en su vida profesional. En determinadas carreras técnicas, los alumnos, parecen estar predestinados hacia algunas áreas concretas, cuando la realidad y dado la continua evolución del mercado de trabajo, existen otras numerosas áreas de trabajo hacia donde pueden encarar su ámbito profesional. Este es el caso de los ingenieros de edificación o graduados en arquitectura técnica, donde los conocimientos adquiridos pueden enviarlos hacia áreas dedicadas al mantenimiento de edificios, donde tendrán que adaptarse hacia nuevas herramientas tecnológicas que deberán asimilar en su vida laboral.

El ingeniero de edificación durante su formación estudia en profundidad los aspectos técnicos, los de gestión y de construcción de edificios así como las diferentes etapas necesarias para su ejecución desde la fase de diseño y medición de proyectos hasta su construcción y puesta en servicio. Los conocimientos específicos en normativa, sistemas constructivos (Madureira, 2017), materiales e instalaciones y la interrelación de todos ellos, permiten al ingeniero de edificación tener una completa visión de los edificios y esto le capacita para desarrollar una profesión como la dirección de ejecución de obras, la rehabilitación y el mantenimiento de edificios.

El mantenimiento tradicionalmente se ha asociado a un ámbito industrial, desarrollándose modelos desde diferentes puntos de vista como la gestión del conocimiento (Cárcel, 2014), no en vano se estudia el mantenimiento como una rama más de la ingeniería industrial. Con la entrada en vigor del Código Técnico de la Edificación (CTE) aparecen las primeras reseñas acerca del mantenimiento en los estudios de ingeniería de edificación como por ejemplo en asignaturas de Construcción.

Acorde a las exigencias de la sociedad, la formación impartida al ingeniero de edificación debe ser ampliada y completada en materia de mantenimiento de edificios no industriales abordando este tema desde el enfoque de la sostenibilidad y de la sistematización del proceso, ayudándonos de las herramientas tecnológicas existentes, fundamentales para la mejora del ciclo de vida (García-Erviti, 2015) de los edificios ya construidos.

En este artículo se muestra la formación adecuada para los ingenieros de edificación, con el fin de adaptarse hacia este nuevo sector de trabajo estratégico, matizando la formación existente en edificación para mantenimiento de edificios y las nuevas herramientas tecnológicas que les podrían ser de utilidad para conseguir una alta capacitación en este sector en expansión.

1. Formación en edificación para mantenimiento de edificios

Sería objeto de una investigación mayor y un profundo análisis hablar del mantenimiento de edificios de manera general dado que existen múltiples tipologías y no hay dos edificios iguales. En este apartado nos centramos en revisar la formación existente para el mantenimiento de edificación residencial poniendo el foco en la formación universitaria reglada y en la formación impartida a través de los colegios profesionales, asociaciones, plataformas, etc. del sector del mantenimiento que existe para los técnicos que ejercen una profesión.

1.1. Formación universitaria en mantenimiento de edificios

Hemos observado los estudios de grado de arquitectura e ingeniería de edificación así como los de máster en la Universidad Politécnica de Madrid (UPM) y en la Universitat Politècnica de València (UPV) revisando las asignaturas y la formación impartida que hace referencia en los títulos de sus asignaturas al mantenimiento de edificios y que resumimos en la tabla siguiente.

Tabla 1. Formación universitaria en mantenimiento de edificios. Fuente: Elaboración Propia

GRADOS			
Universidad	Nombre de la titulación	Nº Asignaturas	Créditos
UPV	Arquitectura	0	0
UPV	Arquitectura Técnica	0	0
UPM	Fundamentos de la Arquitectura	0	0
UPM	Edificación y Administración y Dirección de Empresas	1	6
UPM	Edificación	1	3
MÁSTER			
Universidad	Nombre de la titulación	Nº Asignaturas	Créditos
UPV	Ingeniería del Mantenimiento	1	4,5
UPV	Edificación	1	3
UPM	Máster en Arquitectura	0	0
UPM	Máster en Gestión en Edificación	1	3
UPM	Máster en Innovación Tecnológica en Edificación	0	0

En los diferentes grados de arquitectura y edificación solamente una asignatura habla concretamente del mantenimiento de edificios y aunque sí encontramos el ejemplo de una formación específica en mantenimiento como el Máster de Ingeniería del Mantenimiento de la UPV, este mayoritariamente va dirigido a la industria y no a la edificación.

Por lo tanto una primera observación de la formación reglada en estas universidades para el mantenimiento de edificios de uso residencial nos indica que existe una carencia.

En otras universidades observadas como la de Alicante, se están llevando a cabo estudios de integración de asignaturas (Echarri, 2016) para poder afrontar los retos de los proyectos técnicos de edificios en materia sostenible en su conjunto.

1.2. Formación dirigida a profesionales en herramientas tecnológicas

Las asociaciones y los colegios relacionados con la edificación orientan su oferta formativa según las demandas de los profesionales que deben estar al día del uso de nuevas tecnologías y herramientas así como de las normativas y exigencias de la administración. Se observa que en los colegios profesionales de arquitectura técnica existe una formación específica entorno a la rehabilitación, reparación, conservación y eficiencia energética de edificios, y la oferta aumenta cuando se trata de nuevas tecnologías, metodologías y programas informáticos.

Como ejemplo, en el del Col·legi d'Aparelladors, Arquitectes Tècnics i Enginyers d'Edificació de Barcelona existen varios niveles para aprendizaje de building information modeling (BIM), cursos de especialización en materia energética, gestión de proyectos, acústica, criterios de sostenibilidad en intervenciones de rehabilitación, todos ellos relacionados con el conocimiento de un edificio que son clave para el futuro mantenimiento sostenible de los edificios.

La Asociación Española de Mantenimiento (AEM) a través de su órgano de difusión, la revista *Mantenimiento: ingeniería industrial y de edificios* dedica su último número a un especial de edificación desarrollando temas como la termografía infrarroja y el control solar dinámico en fachadas. Como vemos y a pesar de lo expuesto anteriormente, dentro del ámbito del mantenimiento se están realizando investigaciones en las áreas edificación y arquitectura técnica.

En el punto siguiente establecemos un listado de tecnologías que podrían ser claves en el futuro para desarrollar modelos avanzados eficientes ofreciendo un mayor conocimiento de las metodologías a aplicar.

2. Herramientas tecnológicas y mantenimiento de edificios

Las normativas actuales en materia de sostenibilidad y eficiencia energética para las ciudades y sus edificios y el impulso que la administración mediante ayudas (García-Erviti, 2015) está dando al sector de la rehabilitación de edificios residenciales, ha desencadenado una generalización del uso y estudio en las nuevas herramientas tecnológicas que permiten evaluar los edificios desde diferentes criterios como el de la eficiencia energética.

2.1. Metodologías

Existen numerosas tecnologías que deberían aplicarse para la formación en estas áreas de conocimiento aplicadas hacia el mantenimiento de edificios. Indudablemente, con el avance del tiempo y la aplicación de nuevas tecnologías, estos profesionales se deberán adaptar a adquirir los conocimientos y destrezas en el avance en la eficiencia de los procesos de mantenimiento en los edificios.

El mantenimiento de activos e infraestructuras, facility management y los sistemas de gestión integrados son metodologías que se desarrollan en el ámbito empresarial generalmente en

edificios no residenciales privados (Benloch, 2016) y se utilizan para la toma de decisiones de cara su mantenimiento y conservación.

No es nuestro objeto profundizar en cada una de las metodologías pero sí enumerar cuáles se pueden aplicar al mantenimiento de edificios residenciales para mejorar su eficiencia energética y su ciclo de vida. Precisamente estos estándares se aplican de manera general y no existe ninguno orientado exclusivamente a la conservación y mantenimiento del parque residencial existente en España. Los sistemas que podríamos utilizar para crear a partir de ellos un modelo de mantenimiento específico puede ser:

- British Standard Institute PAS 55:2008 Asset Management.
- UNE-EN ISO 50001:2011 Sistemas de gestión de la energía. Requisitos con orientación para su uso.
- UNE-EN 15221:2012 Gestión de inmuebles y servicios de soporte.
- UNE-ISO 21500:2013 Directrices para la dirección y gestión de proyectos .
- UNE-ISO 55000:2015 Gestión de activos. Aspectos generales, principios y terminología.
- UNE-EN 16646:2015 Mantenimiento. Mantenimiento en la gestión de activos físicos.
- UNE 178303:2015 Ciudades Inteligentes. Sistema de Gestión de activos de la ciudad. Especificaciones.

Como observamos son múltiples los enfoques con los que se podría abordar el mantenimiento de edificios y, si bien existen estudios de casos de rehabilitación de edificios de viviendas que analizan las condiciones de mantenimiento (Díaz et al., 2012), la conservación de edificios y su mantenimiento debe enfocarse de manera integral (Ludevid, 2015).

Las capacidades adquiridas en el ámbito universitario en estos aspectos son claves hoy en día para el desempeño de una profesión en el ámbito de la edificación más aún en el desarrollo de un modelo de mantenimiento que requiere de una metodología para su correcta aplicación..

2.2. Tecnologías para el conocimiento de los edificios existentes

Como complemento a una metodología necesaria para estandarizar el mantenimiento de los edificios residenciales no podemos olvidar la utilización de las tecnologías que actualmente nos permiten un mayor conocimiento de los edificios. Tales como la modelización de edificios, la temografía, geotermia, fotogrametría, el uso de TICS, drones y las herramientas de cálculo energético proporcionarían un mejor conocimiento y diagnóstico durante el ciclo de vida del edificio mejorando la toma de decisiones para su óptimo mantenimiento y conservación.

Una de las herramientas tecnológicas desarrolladas en la formación de los ingenieros de edificación es el building information modelling (BIM) o modelado de información de construcción (Nieto et al., 2017). Es escasa la literatura sobre la utilización del BIM para la

gestión de activos (Pärn et al., 2017) y es una herramienta fundamental tanto para una fase inicial de conocimiento del edificio y todos sus elementos como para realizar el posterior seguimiento de las intervenciones realizadas consiguiendo la trazabilidad e integración de las actuaciones en cada elemento.

Para la modelización se utilizan tecnologías complementarias al BIM; la fotogrametría y el uso de drones para el levantamiento, con mucha aplicación en intervención de edificios históricos (Denzer-Kemter, 2015), se utiliza para la toma de datos reales que es fundamental para el conocimiento del edificio y tiene amplias posibilidades si se orientan al mantenimiento de edificios.

La proliferación de herramientas verdes para la evaluación de la sostenibilidad de edificios (Macías et al., 2010) a lo largo de la presente década y su aplicación directa a la edificación residencial para la obtención de la certificación es clave para el planteamiento del mantenimiento sostenible y la mejora continua de resultados durante el ciclo de vida. Los programas reconocidos por el Ministerio de Energía, Turismo y Agenda Digital son la Herramienta Unificada LIDER-CALENER (HULC), CE3, CE3X o CERMA en sus versiones actualizadas correspondientes.

El conocimiento de los comportamientos térmicos de los elementos constructivos que componen un edificio construido y en uso tiene en la termografía una de sus técnicas no invasivas con amplio campo para su desarrollo y permite la obtención de datos de partida para un análisis pormenorizado del conjunto (Collados et al., 2015) y complementa las herramientas de cálculo energético de manera que se puedan realizar estos con datos reales tomados en el edificio a mantener y no con datos genéricos extraídos de las bases de datos de los barrios de las ciudades.

La realidad virtual ya es un hecho en el ámbito del patrimonio histórico y son muchos los ejemplos que encontramos sobre proyectos de actuación realizados mediante el apoyo de técnicas de la realidad virtual (Robles, 2015) en toda la geografía española. Sin embargo en construcción o rehabilitación de edificios residenciales esta información es escasa, y la utilización de esta tecnología permitiría obtener una simulación de los resultados de la aplicación de los criterios de mantenimiento previa a la intervención.

2.3. Tecnologías para el seguimiento del mantenimiento de edificios

Las utilización de tecnologías como la domótica (San José, 2013) para la monitorización de las instalaciones de los edificios deben ser parte del desarrollo del modelo integrado de mantenimiento ya que a lo largo de la vida del edificio permitirán la toma de decisiones en el ciclo de vida de un edificio.

La innovación cada día mayor en las tecnologías de la información, el almacenamiento de grandes bases de datos está produciendo un cambio de modelo de ciudades a través de las administraciones, hablamos de las Smartcities (Díaz et al., 2016) y por supuesto de los

edificios inteligentes pero también de los edificios existentes, que deberán adaptarse para cumplimiento de las exigencias medioambientales presentes.

3. Conclusiones

Es necesario fomentar la formación y entrenamiento en áreas de mantenimiento de edificios y las herramientas tecnológicas necesarias, hacia los titulados en ingeniería de la edificación o arquitectura técnica, dado que es un sector de trabajo en constante evolución y se necesitarán numerosos profesionales en un futuro próximo.

Nos encontramos actualmente en una amalgama de herramientas tecnológicas que facilitan el conocimiento de los edificios, la integración de su potencial en un todo y que en un momento de cambio coyuntural pueden fortalecer el desarrollo de nuevas funciones de los ingenieros de edificación y arquitectos como gestores de activos y por lo tanto su formación en estas herramientas, es clave en nuestro futuro.

Integrar el mantenimiento como un aspecto fundamental a igual escala que la evaluación energética en la rehabilitación de edificios residenciales, podría generar una mejora para adoptar decisiones de inversión en su rehabilitación a medio y largo plazo y por lo tanto en el ciclo de su vida útil.

Hemos enumerado desde la visión de la adecuada formación, las tecnologías básicas, acotando su función al mantenimiento de edificios, sin embargo son muchas las preguntas que quedan abiertas para un uso más dirigido y que se abordarán en futuros análisis. En este artículo simplemente se ha querido establecer un marco general básico en la situación actual del mantenimiento de edificios, pensamos que conectándolas todas ellas y fusionándolas en un todo se podría lograr un modelo de mantenimiento para el parque inmobiliario residencial.

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Lenguaje, socialización diferencial y conformación de identidades

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Abstract

Language, as social, concrete and historical practice, is the symbolic referent through which people build and rebuild up the world around, while they shape themselves. During its learning and apprehension, language makes possible the internalization of behaving, feeling and thinking forms which are typical of the culture around. Likewise, in this socialisation process people inoculate prejudices and stereotypes which, in the case we are dealing with here, are a reflection of gender inequalities proper of sexism and androcentricity. Through a comparative analysis of the development of terms referred to love and sexuality world in the different editions of the Royal Spanish Academy (Real Academia de la Lengua Española, RAE) and in opposition to differential perspective offered by Dictionary of Spanish Use “María Moliner” (Diccionario de uso del español, DUE), we extract a symbolic perspective of masculine and feminine universes as they are substantivized and represented by these different dictionaries. Our results bring to light that RAE, as institution which legislates and arbitrates language, reproduces, perpetuates certain mottos which support asymmetrical social relations among sexes; these last are strange to continuous changing to which society and language are subjected.

Keywords: *Linguistic sexism, dictionary, Gender stereotypes, discrimination*

Resumen

El lenguaje como práctica social, concreta e histórica es el referente simbólico a través del cual construimos y reconstruimos el mundo circundante, a la par que nos modelamos a nosotros mismos. En su aprendizaje y comprensión, el lenguaje hace posible la interiorización de las formas de obrar, sentir, pensar,... propias de la cultura que nos envuelve. En este proceso de socialización, asimismo, inoculamos prejuicios y estereotipos, que en el caso que nos ocupa, son reflejo de

las desigualdades de género del sexismo y androcentrismo. A través de un análisis comparativo de la evolución de vocablos referidos al mundo del amor y la sexualidad en las distintas ediciones de la Real Academia de la Lengua Española (DRAE) y, en contraposición a la perspectiva diferencial que ofrece el Diccionario de uso del español (DUE) de María Moliner, sacamos a flote toda una perspectiva simbólica de los universos masculino y femenino sustantivados y representados por estos diferentes diccionarios. Los resultados ponen de manifiesto que la RAE, como institución que legisla y arbitra el lenguaje, reproduce y perpetúa y, en algunos casos incrementa, ciertos lemas que sostienen unas relaciones sociales asimétricas entre sexos, impropias del cambio continuo al que están sometidos sociedad y lenguaje.

Palabras clave: *Sexismo lingüístico, diccionarios, estereotipos de género, discriminación.*

Introducción

Abordamos el lenguaje desde su incuestionable cualidad de realidad social (Berger & Luckman, 1967). Lenguaje y sociedad están indisolublemente vinculados. Es evidente que el mundo social está lingüísticamente intervenido y hay quien sostiene que, en buena medida, *es* lenguaje (Beltrán, 1990). El lenguaje por su condición simbolizadora está asociado a la estructura social: erige, refleja, reimprime y reinterpreta, mediante el uso consuetudinario de la cultura individual y referencial, relaciones asimétricas de poder, negociaciones sociales jerárquicas, vínculos de equilibrio e inestabilidad y, consecuentemente, contribuye de igual manera a la construcción de la sexualidad de mujeres y hombres en el contexto del patriarcado (Schultz, 1990). Las desigualdades sociales y las relaciones de poder entre ambos sexos están tan interiorizadas y naturalizadas que no somos conscientes de las asimetrías y discriminaciones implícitas, lo cual provoca que cada persona se identifique, reproduzca y perpetúe en su esfera individual y social las prácticas sexistas, concretadas simbólicamente en el uso del lenguaje.

Nuestra hipótesis parte de que el lenguaje es un patrimonio heredado consustancial a un sistema de pensamiento patriarcal, materializado en una lengua sexista. No obstante, gracias al mayor protagonismo de las posturas feministas de décadas recientes y a la progresiva presencia de la mujer en la esfera pública, la necesidad e idoneidad de utilizar un lenguaje inclusivo, cala en la conciencia social. En este sentido, la institucionalización y consagración de esta realidad debe recogerse –como imperativo legislativo– por la Academia, es decir, por la institución que reza como misión principal la de “velar por los cambios que experimenta

la lengua española en su constante adaptación a las necesidades de sus hablantes”¹. Es obvio que la labor lexicográfica no es neutral. En general, ningún campo está exento de ello: “No supone a estas alturas ningún descubrimiento señalar que los diccionarios no son obras neutrales, sino condicionadas por las ideas de sus autores” (Pascual y Olaguibel, 1991: 73). No obstante, el Diccionario de Uso del Español (DUE) de María Moliner –más conocido como *Diccionario de María Moliner*- representa otra visión de un hacer lexicográfico en la que los márgenes de operatividad y compromiso de los lemas vinculados al amor y la sexualidad reflejan el mundo desde la otra perspectiva femenina.

El objetivo es constatar cómo las mismas realidades objetivas son apropiadas y expresadas simbólicamente desde dos cosmovisiones diferenciales de género (RAE vs. DUE) en las que determinados lemas presentan e integran *significados* discriminantes o inclusivos. De aquí que siguiendo al pensamiento heideggeriano consideremos que, no somos nosotros y nosotras quienes hablamos a través de la lengua, si no que por el contrario es ella la que habla a través nuestra.

En el presente estudio abordamos en un primer momento la configuración del lenguaje como realidad conformadora de identidades sexuales y de género. Proseguimos con la metodología utilizada para efectuar la comparativa de los lemas relacionados con el amor y la sexualidad, para a continuación, presentar y desarrollar los resultados obtenidos. Y, en última instancia procedemos a las conclusiones.

1. Realidad social, lenguaje y géneros

El lenguaje, como universal mediador, es creación social y en sentido estricto es “una construcción social de la realidad” (Berger & Luckman, 1967). Es, por tanto, una institución social compleja que actúa como árbitro entre la realidad social y la persona. Dicha intermediación viene determinada por la presencia del lenguaje en la mayoría de las relaciones en las cuales la comunicación es fundamentalmente un medio de intercambio de información, además de una forma de mantener una relación o, el total de las interacciones sociales (Habermas, 1979). De hecho, el lenguaje es considerado como una de las principales guías para el desenvolvimiento de nuestra vida social (van Dijk, 2009; Kress, 2010; Teubert, 2010; Llamas & Watt, 2010). En efecto, el lenguaje es un recurso que sirve para estructurar las relaciones sociales y, en cierta medida, es refractario de la propia sociedad (Blackledge, 2009; Blommaert, 2010; O’ Halloran & Smith, 2011). Construye una visión de la realidad y con ello determina la forma de nuestra percepción y concepción de la misma, ”por tanto, en este sentido, el lenguaje *crea* nuestra imagen de la realidad” (Schaff, 1967:212). Obtenemos nuestra visión del mundo y de nosotros mismos a través de los *significados*. Las palabras, los vocablos o términos -configurados por la sociedad- son las piezas con las que se “piensa” y

¹ <http://www.rae.es/la-institucion>

se “ve” el mundo. Pero, además, ese mundo objetivo y exterior conforma los elementos referenciales sin los que no ha lugar las palabras.

La vida cotidiana es aprehendida como ordenada, objetivada y constituida por un orden de objetos antes de que un individuo concreto tenga acto de presencia en la vida social. “El lenguaje es el que marca las coordenadas de la vida en sociedad y llena esa vida de objetos significativos” (Fishman, 1982:255). Dicho de otro modo, el lenguaje es una creación social impuesta: está dado. Es un filtro de mi percepción. Con él se configura el conocimiento del mundo, pero, además, se construye el pensamiento. En este sentido, el lenguaje es realidad social que condiciona y limita al ser social, a la par que supone la mediación entre éste y la conciencia (Beltrán, 1990).

La construcción semántica está cromada por los vínculos ideológicos que actúan de marco. En efecto, el fenómeno de las ideologías está íntimamente relacionado con el lenguaje hasta el punto de que «cuando se habla de ideología se está hablando necesariamente de lenguaje, y viceversa» (Rossi-Landi, 1980: 236). El lingüista ruso Mijaíl Bajtín resumió esta relación considerando que “la palabra constituye el fenómeno ideológico por excelencia” (Bajtín, 1977: 31). En este sentido, los vocablos adquieren connotaciones conforme al uso que imponen los tiempos y, conforme al trascurrir de las sociedades patriarcales: “la mayoría de los lenguajes se han elaborado de conformidad con los géneros. La diferenciación en géneros constituye un fenómeno preeminente de la vida simbólica y de la comunicación en el seno de nuestra sociedad. [...] El concepto género ilustra el poder que tienen las categorías lingüísticas para determinar lo que conocemos acerca del mundo. (Hare-Mustin & Marecek, 1994: 47 y ss).

Si bien la adquisición de lenguaje es un hecho necesario, común y universal, cuando nos configuramos como seres individuales y sociales, nuestro proceso de aprendizaje y su forma de uso nos ubica en nuestra etnia, nuestra clase y nuestro género (Kaplan, 1990:59). En efecto, las diferencias sexuales consolidan social y culturalmente en los géneros, así como sus jerarquías relacionales, los valores construidos en torno a los mismos, los comportamientos y actitudes esperados en relación a esas características, etc.

El género, como construcción social, deviene tanto de una realidad objetiva como subjetiva, es decir, como un orden impuesto a los individuos. A la par, ellos y todos nosotros lo reconstruimos continuamente, sustentándose en los significados que proporcionan el lenguaje, la historia y la cultura (Berger/Luckmann, 1967; De Barbieri, 1996; Hare-Mustin & Marecek, 1994). De manera imperceptible e invisible el lenguaje talla nuestra identidad de género. En el campo del lenguaje juegan un papel axial la producción de significados asociados a las nociones de masculinidad y feminidad, la formulación de ideologías de género con rígidos contenidos sobre los roles adecuados a cada sexo y, el control de los significados socialmente relevantes (poder simbólico). A todo esto se añade no sólo el lenguaje verbal o escrito, sino el iconográfico, visual etc., así como el hecho de utilizar un determinado tipo de

ropa con el que la persona obtiene y recrea su identidad configurada con una carga simbólica para sí y para los demás.

López y Encabo afirman que "(...) en las estructuras lingüísticas no existe sexismo *per se* sino que este aparece en la utilización que realizamos del lenguaje" (2008:77) que transmite y mantiene el papel de superioridad del varón con herramientas tales como, el masculino genérico que invisibiliza a las mujeres.

La socialización de los géneros a través del lenguaje supone un proceso por el que niñas y niños llegan a identificarse a sí mismas como seres sexuales. Por medio de él, se internalizan imágenes del universo simbólico previamente construidas, diferenciadas y explicitadas como identidades distintas que se internalizan. De este modo, a través de la socialización sexista del lenguaje, se logra un alto grado de homogeneidad en cuanto a los comportamientos, inquietudes, sentimientos, formas de relacionarse, expectativas de futuro, etc.

Ahora bien, los significados, los contenidos ideológicos subyacentes en los lemas se transforman en su discurrir histórico. Es posible creer en una transformación, en los efectos del advenimiento de nuevas ideologías, pues ninguna palabra se relaciona con su objeto de manera singular entre un término cultural y su referente. En efecto, se da un ambiente elástico de otras "palabras ajenas sobre el mismo objeto, el mismo tema" (Bajtín, 1981: 276), de tal manera que en la medida en que mujeres y hombres seamos capaces de construir otra realidad simbólica, decir otras "términos"... , configuraremos otros significados para la palabra "mujer", otras imágenes igualitarias. Ese "ambiente elástico" mutará, y otros hablantes, aún si desean conservar viejos sentidos de las palabras, podrán toparse en su camino -entre su palabra y la realidad a la que se refieren- la refracción de estas nuevas posiciones.

2. Metodología

Desde la publicación, entre 1723 y 1739, del Diccionario de Autoridades, el Diccionario de la Real Academia Española –al que nos referiremos de ahora en adelante como el Diccionario académico o, simplemente, el DRAE ha mantenido buena parte del prestigio merecidamente adquirido a lo largo de las veintidós ediciones posteriores. Sin embargo, desde hace un tiempo la situación ha cambiado sustancialmente. Cada vez son más las voces que han venido poniendo en duda la autoridad de la Academia en cuestiones relacionadas con el sexismo y racismo (Calero, M.A; Forges, E y Lledó, E 2004), otrora incuestionable, a la par que han surgido nuevos referentes allí donde antes el DRAE ostentaba el monopolio lexicográfico, tales como el Diccionario de uso del español, de María Moliner.

Nuestro propósito es desvelar la carga ideológica y simbólica en la evolución de vocablos referidos al mundo del amor y la sexualidad que la Academia ha ido plasmando en las distintas ediciones, en comparación a la cosmovisión femenina del DUE de María Moliner. Para probar nuestra hipótesis optamos por un análisis cualitativo de carácter comparativo, abordando diacrónicamente lemas y acepciones relacionados con los vocablos antes mencionados, en las ediciones de la RAE 1780, 1817, 1884, 1925, 1992,2001 y 2014, así

como del primer diccionario de la RAE, denominado *Diccionario de Autoridades* (1726-39). Para ello se ha utilizado la aplicación de la RAE “Mapa de Diccionario”² que permite visualizar sus ediciones de los siglos XVIII, XIX, XX y XXI. Y, el DUE en versión 2.0³

3. Evolución de lemas en Diccionario de la Real Academia Española (DRAE) vs Diccionario de Usos del Español (DUE) de María Moliner

Respecto a la palabra Amor, el siguiente cuadro compendia su evolución temporal a través de las distintas ediciones del DRAE, así como su contraste con el DUE de Moliner.

Tabla 1. Evolución del lema Amor SigloXIX y M. Moliner. Fuente: DRAE y DUE. Elaboración propia.

AMOR 1884	1817	1780	DI.C.AUTO 1726-1739	M. MOLINER 1966-67
1.2 amor m. Afecto por el cual busca el ánimo el bien verdadero ó aprendido, y apetece gozarle. Uniendo á esta palabra la preposición de, indicamos el objeto á que se refiere; como AMOR de Dios, de los hijos, de la gloria; ó la persona que lo siente, como AMOR de padre.	1 10 amor s. m. Inclinación ó afecto á alguna persona ó cosa. Amor.	1 10 amor s. m. Inclinación ó afecto á alguna persona ó cosa. Amor.	AMOR. s. m. Afecto del alma racional, por el qual busca con deséo el bien verdadero, ó aprehendido, y apetece gozarle. Tómase en varios sentidos, segun son los objetos á que se endereza la voluntad; si al Padre, se llama paternál: si á la sensualidad, se llama carnál, y si á las riquezas [1,273] se llama codicia, y si es endereçado á buen fin se llama amor honesto. Es voz puramente Latina Amor. SAAV. Empr. 38. El amor y el respeto se pueden hallar juntos: el amor y el temór servíl no. BURG. Gatom. Sylv. 1.	1 («Dedicar. Profesar. Sentir. Tener. Tributar») m. Sentimiento experimentado por una persona hacia otra, que se manifiesta en desear su compañía, alegrarse con lo que es bueno para ella y sufrir con lo que es malo. «También se emplea corrientemente con aplicación a cosas tomadas en general: 'El amor a la música, al dinero, a las comodidades'. Como se ve por los ejemplos, la preposición aplicada al objeto del amor es generalmente «a»; pero es igualmente correcta su construcción con «de»: 'El amor de la patria'. □ Se aplica particularmente a la atracción entre dos personas. □ Puede también, por extensión, aplicarse a la atracción entre animales: 'El amor entre los pájaros'.

Tabla 2. Evolución del lema Amor S XX y XXI. Fuente: DRAE y DUE. Elaboración propia.

AMOR 2014	2001	1992	1925
Del lat. amor, -ōris. 1. m. Sentimiento intenso del ser humano que, partiendo de su propia insuficiencia, necesita y busca el encuentro y unión con otro ser.	1. m. Sentimiento intenso del ser humano que, partiendo de su propia insuficiencia, necesita y busca el encuentro y unión con otro ser.	1 2 amor m. Sentimiento que mueve a desear que la realidad amada, otra persona, un grupo humano o alguna cosa, alcance lo que se juzga su bien, a procurar que ese deseo se cumpla y a gozar como bien propio el hecho de saberlo cumplido. Uniendo a esta palabra la preposición de , indicamos el objeto a que se refiere: como AMOR de Dios, de los hijos, de la gloria; o la persona que lo siente: como AMOR de padre.	1 2 amor m. Afecto por el cual busca el ánimo el bien verdadero o imaginado, y apetece gozarlo. Uniendo a esta palabra la preposición de, indicamos el objeto a que se refiere; como AMOR de Dios, de los hijos, de la gloria; o la persona que lo siente; como AMOR de padre.

Tal como puede observarse en el cuadro compendio de la evolución del lema *amor* -utilizando exclusivamente su primera acepción-, es llamativo la evolución de la primera palabra empleada en su definición: “*afecto*”, presente en el Diccionario de Autoridades y que se ve modificada mínimamente en las ediciones de 1780 y 1817 respectivamente con el concepto previo de “*inclinación*”. Con posterioridad, vuelve a introducirse en primer lugar el término de “*afecto*” en el DRAE de 1884 y 1925. Sin embargo, nótese una importante diferencia en ambas y es que se ven ampliadas las definiciones. Ahora bien, mientras en 1884 se define el amor como “*Afecto por el cual busca el ánimo el bien verdadero o aprendido, y apetece gozarle*”, en la edición de 1925 se sustituye parte de la definición “*bien verdadero o aprendido*” por “*bien verdadero o imaginado*”. Este cambio podría interpretarse

²Instituto de Investigación RaFael Lapesa de la Real Academia Española *Mapa de diccionarios*, 2013. <http://web.frl.es/ntllet>.

³Diccionario de Uso del Español (CD-ROM) (1996)

como una concepción del amor más ámplia al sustituir lo “aprendido” por lo “imaginado” y, tal vez, solapadamente, dar cabida al “amor platónico”.

En la edición del 92 el lema amor, que vuelve a su concepto de sentimiento, ensancha su definición y queda explicitado como un “*sentimiento que mueve a desear que la realidad amada, otra persona o grupo humano o alguna cosa...*”. Sin embargo, en las dos siguientes ediciones del DRAE (2001 y 2014), aún manteniendo el lema de “sentimiento” concentran su definición con precisión, a “*sentimiento intenso del ser humano*”; expresión que, a nuestro juicio, consideramos -tal vez en exceso- concisa. Ahora bien, en la segunda parte de dicha definición, encontramos inexplicablemente una visión que podría interpretarse bajo el filtro y la influencia del llamado *mito de la media naranja*, al suscribir que dicho sentimiento humano intenso parte de su “*propia insuficiencia*”. Con lo que pudiera ofrecerse una cierta percepción de un sentimiento que expresa una carencia, una falta, un vacío... Por contra, el DUE, ya en 1967, definía el amor como “*sentimiento experimentado por una persona hacia otra que se manifiesta en desear su compañía...*” Además, en este diccionario aparecen en la cabecera, enunciados de verbos en infinitivo que amplían y enriquecen el significado del sentimiento del que estamos hablando: “*Dedicar, profesar, sentir, tener, tributar*”.

El vínculo que puede darse entre *amor* y *sexualidad* se recoge por primera vez en las ediciones del DRAE en 1884 y 1925, en sus segundas acepciones respectivamente, con la inclusión del término “pasión”, de tal manera que amor sería la “*pasión que atrae un sexo hacia el otro...*” No obstante, expresiones y marcas de uso más novedosas como “hacer el amor”, si bien son recogidas en la edición de 1925, como “*enamorar, galantear*”, no es vinculado al concepto sexual hasta 1992 (copular). Con esta última orientación, en la cuarta acepción en el DRAE de 2014, Amor se define como tendencia a la unión sexual. Por su parte, el DUE, en su versión electrónica, recoge la expresión “hacer el amor” que, en su segunda acepción, también significa *Realizar el acto sexual*.

Adentrándonos de lleno en el mundo de la sexualidad, hay que destacar que en las distintas ediciones del DRAE existen pocos lemas referidos a este temática. En concreto en la búsqueda del Mapa de Diccionario, aparece el término -por primera vez y con una sola acepción- en 1925 como: “*Conjunto de condiciones anatómicas y fisiológicas que caracterizan a cada sexo*”. Hay que esperar hasta 1992 para que la Academia explicita en su segunda acepción el carácter de “*apetito sexual, propensión al placer carnal*”, manteniéndose de forma idéntica en las siguientes ediciones (2001 y 2014). El DUE 2.0 de María Moliner, por su parte, recoge tres acepciones de sexualidad, de las que las dos primeras hacen referencia al dimorfismo sexual, frente a la tercera en la que ya aparece su relación con el acto sexual, siendo en su definición bastante más minuciosa y precisa: “*conjunto de fenómenos biológicos, psicológicos, sociales, etc., relativos al sexo: “la sexualidad del hombre*”. A pesar de que muchas de sus lemas se refieren a personas -sin identificar sexo-, en lugar de utilizar hombre como genérico masculino, en este caso específico, se puede

observar que el ejemplo de la sexualidad la vincula a hombre “genérico”y no hace alusión a la mujer.

Dentro del ámbito de la sexualidad, en 1967 el DUE contempla un neologismo como adaptación de la expresión angloamericana “sex-appel”, con el significado de “*atractivo sexual*”. Por su parte, la palabra *sexy* el DRAE no la recoge hasta 2001 y la mantiene en la edición del 2014 con la grafía de “i” latina en vez de “y” griega.

Respecto a las “disidencias” de identidades u orientaciones sexuales abordadas desde el lema *amor*, la expresión “*amor lesbiano, lésbico o lesbio*”, se recoge por primera vez en la edición de 1884 en su acepción masculina, limitando el significado del mismo a indicar el gentilicio. Es a partir del 92, cuando se explicita el femenino, es decir, lesbiana y, en su tercera acepción, como “*mujer homosexual*”. Sin embargo, en el DUE 2.0 de Moliner, el vocablo lesbiana viene recogido con la definición de mujer homosexual, incluyendo como sinónimos “bollera” y “tortillera”.

Tabla 3 . Evolución del lema tortillero, ra. Fuente: DRAE y DUE. Elaboración propia.

TORTILLERO,A 2014	2001	1992	1925	1884	M. MOLINER 2.0
1. adj. Méx. Perteneciente o relativo a la tortilla de maíz.	1. adj. Méx. Perteneciente o relativo a la tortilla de maíz.	m. y f. Guat. y Méj. Persona que por oficio hace o vende tortillas, principalmente de maíz.			Tortillero, -a (Hispan.) n. Persona que hace y vende tortillas.
2. m. y f. El Salv., Guat., Hond., Méx. y Nic. Persona que por oficio hace o vende tortillas, principalmente de maíz.	2. m. y f. El Salv., Guat., Hond., Méx. y Nic. Persona que por oficio hace o vende tortillas, principalmente de maíz.				
3. f. despect. vulg. lesbiana.	3. f. despect. vulg. lesbiana.				

Tabla 4 . Evolución del lema lesbiano, na. Fuente: DRAE y DUE. Elaboración propia.

LESBIANO,A 2014	2001	1992	1925	1884	1817	1780	M. MOLINER
De lesbio, por alus. a Safo, y -ano1; cf. safismo.	1. adj. lesbio.	adj. lesbio.	adj. Lesbio. Apl. a pers., ú. t. c. s.	adj. Lesbio. Apl. á pers., ú. t. c. s.			1 adj. y n. Lesbio.
1. adj. Dicho de una mujer: homosexual. U. t. c. s. f.	2 2 lesbiano, na	2 1 lesbiano,, na					2 f. Mujer homosexual. B Bollera, tortillera
2. adj. Perteneciente o relativo al lesbianismo o a las lesbianas.	2. f. Mujer homosexual.	adj.V. amor lesbiano.					
3. adj. p. us. lesbio (l natural de Lesbos). U. t. c. s.		3 2 lesbiano, na					
4. adj. p. us. lesbio (l perteneciente a Lesbos).		f. Mujer homosexual.					

En general, las diferencias de los vocablos que venimos marcando entre el DRAE y el DUE 2.0 referidas al mundo de la sexualidad, son reiterativas en palabras como: homosexual, heterosexual, travesti, transexual, tortillera, lesbiana etc., términos recogidos por la Academia en 1992, e incluidos, en el María Moliner en su versión electrónica en CD.

En referencia al lema homosexualidad, en las ediciones del DRAE, encontramos un cierto vacío a la hora de nombrar esta realidad. Dicho término es reflejado por la Academia en su edición de 1992, pese a ser un vocablo acuñado en el siglo XIX. Por el contrario, María Moliner en su Diccionario de 1967 recoge y define el término “homosexualidad” como “*persona que satisface su sensualidad sexual con las del mismo sexo (V. invertido)*”. Además, el lema se mantiene en la versión electrónica (1996), desplegando en su segunda acepción una eclosión literal de sinónimos tal y como puede advertirse en la imagen de la tabla 3.

Tabla 5 . Evolución del lema homosexual . Fuente: DRAE y DUE. Elaboración propia.

HOMOSEXUAL 2014	2001	1992	1925	1884	1817	1780	M.MOLINER
De homo- y sexual.	1. adj. Dicho de una persona: Con tendencia a la homosexualidad. U. t. c. s.	adj. Dícese del individuo afecto de homosexualidad. U. t. c. s.					homosexual (de «homo-» y «sexual»)
1. adj. Dicho de una persona: Inclínada sexualmente hacia individuos de su mismo sexo. U. t. c. s.	2. adj. Dicho de una relación erótica: Que tiene lugar entre individuos del mismo sexo.	2. adj. Dícese de la relación erótica entre individuos del mismo sexo.					Se aplica a las personas que satisfacen su sensualidad sexual con las de su mismo sexo. (V. "invertido")
2. adj. Dicho de una relación erótica: Que se produce entre individuos del mismo sexo.							Bardaja, bardaje, bollera, cacorro, garzón, gay, ivertido, jula [julandrón o julay], lesbiana, loca, marica, maricón, mariposa, mariposón, mariquita, nefandario, pederasta, puto, rosquete, sarasa, sodomita, somético, tortillera. Ó De la otra acera [o de la acera de enfrente], de la cáscara amarga Ó Homosexualidad, lesbianismo. Ó homofobia ó *Afeminado

4. Conclusiones

A través de la comparación ofrecida de vocablos referidos al amor y a la sexualidad en un proceso temporal recogido en las distintas ediciones del DRA y el DUE, hemos querido extraer dos visiones, dos cosmovisiones, a la hora de expresar y definir realidades. La Academia, a lo largo de sus trescientos años de historia, orienta su misión en “velar por que la lengua española, en su continua adaptación a las necesidades de los hablantes, no quiebre su esencial unidad”. Pues, bien, tal vez lo más llamativo a la hora de escudriñar los vocablos mencionados, aunque resulte paradójico en referencia a su definido propósito, sea la falta de “adaptación a las necesidades”, especialmente las derivadas de un lenguaje sexista que reproduce y encorseta ante una regenerada realidad social. Por el contrario, el DUE de María Moliner supone un impulso a la lengua española, modernizando términos e incorporando a su diccionario sugerencias que le mandaban. No cabe la menor duda de que fue una personalidad vanguardista que se adelanta, con mucho, a su época. Y, desde una perspectiva no muy cómoda, como mujer de su tiempo y constreñida por él. Moliner aparece retratada como mujer de mentalidad abierta y moderna con una profunda fe en el ser humano, como así lo demuestran las definiciones de los lemas elegidos y recogidos en su Diccionario del Uso del Español.

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El primer año en la Universidad: Como se refleja en la vida universitaria

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Abstract

The educational system proposed in Bologna, is based on the development of a unique degree system in all European Countries. Its objective is to improve the international transparency of the university study programs and facilitate the students and professors mobility through European Countries. The study system is based on the credits systems where the students are obligated to realize their studies individually. In the first year of the university degree on the basic subjects, the academic performances are very low, the development on the students feelings of uncertainty. The main factors that affect in the school failure in the first year are the time organization and the relaxation after the selectivity exams, the society, culture, etc.

Keywords: *university education, first year, difficulties, academic performance.*

Resumen

El sistema de educación según la declaración de Bolonia se basa en crear un sistema único de titulaciones dentro de la comunidad Europea que mejore la transparencia internacional de los programas de estudios superiores, así como facilitar la movilidad de los estudiantes y profesorado en el espacio europeo. El sistema de estudios se basa en el estudio de créditos, donde el alumno se ve obligado a estudiar un 50% de forma individual. Con respecto a los estudios de grado, en las asignaturas básicas del primer año de estudios, el fracaso escolar es bastante alto creando sentimientos de incertidumbre. Los principales factores que influyen en el fracaso escolar del primer año de vida son sobre todo la organización del tiempo y la relajación después de los exámenes de selectividad, etc.

Palabras clave: *educación universitaria, primer año, dificultades, rendimiento académico.*

Introducción

La educación universitaria es el pilar de base de una sociedad, que mantiene tanto el bienestar social como el bienestar económico del país. Es decir que el futuro de cualquier país sea europeo, un país emergente o sea un país desarrollado, se basa en su capacidad innovadora y la competitividad. El mundo se vuelve cada vez más selectivo y competitivo y la educación universitaria se transforma en un requisito fundamental para la empleabilidad.

En las últimas décadas las universidades españolas están muy comprometidas con la mejora de la calidad educativa, lo que conlleva estar involucrados en los tres campos más importantes del siglo XXI: económico, social y tecnológico. Por otro lado, la diversidad de titulaciones, mejor decir diversidad de nombres de las titulaciones con el mismo perfil y la competitividad con otros países han hecho que se crea la Comisión Europea de Educación Superior en 2010 (European Commission, 2002). El objetivo principal de la comisión era:

1. Mejorar la transparencia internacional de los programas y el reconocimiento de las cualificaciones a través de la convergencia gradual hacia un marco común de cualificaciones y ciclos de estudio;
2. Facilitar la movilidad de los estudiantes y los docentes en el espacio europeo y su integración en el mercado laboral europeo;
3. Elaborar un sistema común de titulaciones para los estudios universitarios.

Los tres requerimientos para mejorar la calidad y crear un sistema común de titulaciones se definió en 1998 en la Declaración de Sorbona. En 1999 en la Declaración de Bolonia la lista de imprescindibles para un espacio común educativo universitario se extiende a:

1. Establecer un sistema de evaluación común basado en un sistema de créditos ECTS
2. Apoyar la movilidad también de los investigadores y del personal administrativo
3. El desarrollo curricular y cooperación institucional
4. Definir el sistema de estudios universitarios basado en dos ciclos principales

Aparte de mejorar la calidad educativa universitaria, la Declaración de Bolonia tenía como objetivo promover la competitividad internacional del sistema europeo de educación superior que garantizaba la calidad. En 2007 en el Comunicado de Londres se creó el Registro Europeo de Garantía de Calidad de la Educación superior EQAR cuyo principal objetivo es valorar la calidad educativa mediante evaluaciones externas.

La rápida transición de los antiguos planes de estudio a los nuevos planes desde los colegios hasta la universidad, ha producido un cambio radical en la forma de pensar y actuar de los alumnos/estudiantes. A pesar de que la metodología docente actual está enfocada en mejorar la calidad educativa basada en los alumnos, hay un gran problema lo que respeta la tasa de rendimiento, la tasa de abandono en el primer año de universidad sigue siendo alto (Coromina, 2001).

El primer año de universidad influye significativamente en la evolución de los estudiantes, en lo que respeta los resultados académicos (Silva, 2011).

En el presente trabajo se hace un análisis de las características de la educación universitaria y los problemas más comunes de abandono en el primer año de universidad.

1. La educación universitaria

El objetivo principal de la educación universitaria es la formación científica y humana. La educación universitaria no consiste en el simple aprendizaje de determinados contenidos, sino en la formación de los estudiantes con el fin de ser capaces de ver, analizar y tomar decisiones por sí mismos. Con esto, la metodología docente aplicada en la universidad es diferente a la metodología docente de los institutos (Mantovani, 2011). El cambio entre las metodologías de enseñanza/aprendizaje es uno de los primeros factores que influye en los estudiantes de primer año.

- Enseñanza por grupos multitudinarios:

Si bien la enseñanza de los institutos está organizada en grupos pequeños de alumnos, donde el profesor durante las horas tiene la posibilidad de interactuar con cada uno de los alumnos, la enseñanza de los primeros dos años de universidad es más bien organizada en clases magistrales multitudinarias. Este factor de tener clases con alrededor de cien alumnos recién llegados, hace que una parte de los estudiantes desatiendan la clase, ya que el profesor no consigue trabajar con cada uno de los alumnos.

- Asignaturas básicas de carácter teórico:

La mayoría de las asignaturas del primer año de universidad son asignaturas troncales que ponen las bases de la formación de los futuros ingenieros. Dichas asignaturas tienen un formato muy teórico y la mayoría no tienen carácter práctico y divertido. Las asignaturas como matemática, física, expresión gráfica, etc, son asignaturas que requieren un esfuerzo de estudio. La importancia de las asignaturas básicas troncales consiste en la formación y dominación de la esencia de todas las materias ya que en una carrera universitaria técnica no hay materia alguna que no tenga su raíz y su demostración sin las tres materias anteriores mencionadas. Durante el aprendizaje en la universidad, los estudiantes no solo deben aprender el uso de materias de especialidad, sino comprender como se llega a desarrollar dicha materia. Por otro lado, las materias troncales básicas tienen como objetivo de desarrollar una serie de competencias así como el pensamiento crítico, el pensamiento abstracto, toma de decisiones, resolución de problemas, etc. Debido a que la mayoría de las asignaturas del primer año de carrera universitaria son asignaturas más bien abstractas, desarrollan en los estudiantes la visión abstracta.

Los estudiantes recién llegados a la universidad, tienen en mente el hecho de que ya se ha acabado con asignaturas básicas, que van a construir naves espaciales desde el primer día, un concepto erróneo. El choque de volver de nuevo a cursar estas asignaturas más complejas les hacen desmotivarse.

- Aprendizaje individual:

La enseñanza universitaria consiste en enseñar los conceptos básicos de las materias por parte del profesor en clases y el estudiante debe profundizar la materia de forma individual en casa, biblioteca, etc., consultando libros y trabajos tanto teóricos como prácticos más recientes. Este modelo de aprendizaje, tiene como objetivo desarrollar en los estudiantes la independencia. Por la independencia se entiende el desarrollo de las características de esfuerzo, organización de tareas, comportamiento, relaciones con las personas, toma de decisiones, etc.

Con todo esto, se definen los fines de la educación universitaria, una enseñanza que forma a los jóvenes estudiantes a ser especialistas en sus profesiones y al mismo tiempo se forman como personas. La universidad hace de puente de transición entre la vida dependiente de los padres a una vida independiente donde las tomas de decisiones no afecta solamente a los demás si no les afectan en primer lugar a los estudiantes mismos.

2. Características sociales y cognitivas

Uno de los factores más importantes en el primer año de vida universitaria es el choque cultural, social y cognitivo. En primer lugar hay que destacar el hecho de que todos los estudiantes en el primer año de universidad cambian de familia institucional después de años que rompe los vínculos con el mundo escolar conocido (De Garay, 2001). Los estudiantes cambian radicalmente de forma de aprendizaje y trabajo, se deben adaptar a nuevas caras (sus nuevos compañeros), nuevas relaciones con los profesores, forma de vida, etc. Los estudiantes vienen desinformados sobre la forma de enseñanza/aprendizaje universitaria, requiriendo más esfuerzo y recursos en superar dicha barrera. Obviamente la metodología de enseñanza universitaria, en el primer año de universidad tiene implementados métodos de transición del método de enseñanza de bachillerato y secundaria a los métodos de enseñanza superior. Sin embargo, la tasa de rendimiento en el primer año es un problema para las universidades con perfil técnico.

Si el tránsito a la vida universitaria supone un gran problema para los estudiantes del primer año en la universidad, las dificultades se perciben en aquellos que viven fuera de su casa. Los vínculos creados durante tanto tiempo se rompen de alguna forma y los jóvenes se ven obligados a convivir con otros jóvenes que para ellos son desconocidos por lo menos el primer cuatrimestre hasta adaptarse al entorno. Muchos de los estudiantes se despiertan lejos de la familia, viviendo en pisos de alquiler, residencias, etc., compartiéndolos con gente desconocida. Al vivir separados de sus familias se ven obligados a gestionar sus fondos económicos que no es una tarea fácil si no hay experiencia previa. Todos los problemas sociales a los que se ven implicados, afecta en gran medida al rendimiento académico de los alumnos en el primer año de universidad.

A todo ello se debe añadir el hecho de no estar seguros de la carrera o especialidad seleccionada. Un gran porcentaje de alumnos llegan a la universidad por la decisión de los padres y/o por la exigencia del mercado laboral. Los padres, en muchos casos, deciden la

carrera de sus hijos por sus deseos sin tener en cuenta las preferencias de los hijos ni de sus capacidades. Los padres eligen las carreras por motivos varios, así como la carrera que les hubiera gustado harer, las carreras que tienen más éxito laboral, las que son de moda, etc. (Sánchez García, 2001). Por lo tanto, los estudiantes en el primer año de universidad, se estresan y crean una visión errónea sobre los estudios superiores, ya que no se ajusta lo deseado con lo real (Blinde y Johnson, 1998). En estos casos, después del primer año, antes de abandonar las carreras, los estudiantes intenta cambiar de especialidad.

Debido a que vivimos en un siglo marcado por la competitividad donde el desarrollo y la innovación tecnológica marca la vida de la sociedad, los jóvenes se ven obligados a realizar estudios universitarios ya que la tasa de desempleo entre los titulados universitarios es más baja que para los jóvenes sin estudios.

Las capacidades de cada estudiante o la preparación previa influye mucho en el primer año (Latiesa, 1992). Es de vital importancia a que los alumnos antes de llegar a las carreras, tengan los conocimientos básicos, la nomenclatura o el lenguaje respectivo (García y San Segundo, 2001).

Tinto (1998) hace un estudio con el fin de identificar los problemas que se encuentran los estudiantes del primer año:

1. Dificultad de adaptación a la vida universitaria, entorno, modelo de enseñanza/aprendizaje.
2. Objetivos o visión sobre la carrera, no están seguros de la decisión de su elección.
3. Dificultades académicas o nivel bajo de preparación previa.
4. Aprendizaje que se refleja en la características o forma de estudiar.
5. Compromiso con la elección y los estudios. Por motivos distintos de carácter social, familiar o personal, los estudiantes no se comprometen con la elección de su carrera lo que no les permite motiva y concentrar en realizar los estudios.

3. Medidas adaptadas por las universidades

Para evitar la confusión y reducir el abandono de los estudiantes, las universidades aplican en el primer y segundo año de estudios, programas de apoyo a la carrera. Dichos programas están enfocados en investigar y analizar el problema del rendimiento académico de cada uno de los alumnos y buscar una solución (KHEAA). Durante el periodo del programa, cada alumno esta tutorizado por un profesor de la universidad. El profesor realiza encuentros en forma de tutorías tanto establecidas por la escuela como tutorías a la petición del alumno. En la primera reunione el profesor identifica el prroblema del alumno, ya que no es necesariamente que tenga todos los factores previamente mencionados. Seguidamente, el profesor se encarga de realizar un programa de trabajo personal para el alumno. El programa desarrollado por el profesor inicialmente es definir las pautas de trabajo de y con el alumno, establecer normas y horrarios de trabajo. Asimismo la labor del profesor tutor es buscar en el alumno la forma de comunicación y hacerle entender cual es el objetivo de la universidad,

de la carrera seleccionada, hacerle profundizar en sus propios objetivos de la vida etc. Durante el año previsto, el profesor va supervisando los éxitos de sus alumnos tutorizados, etc. El profesor puede entrar en contacto con los profesores para tener una visión del profesor sobre el alumno.

En ningún caso el profesor tutor pueda hacer tutorías sobre materias en las que los alumnos tienen problemas.

Los alumnos del programa superan no solamente las dificultades académicas con las que se encuentran en el primer año de estudios si no también se desarrollan más como personas mejorando sus actitudes.

4. Conclusiones

El presente trabajo trata de representar los principales problemas encontrados por los estudiantes durante el primer año de universidad. Según la declaración de Bolonia la enseñanza superior se basa en crear un sistema único de titulaciones dentro de la comunidad Europea, que mejoré la transparencia internacional de los programas de estudios superiores así como facilitar la movilidad de los estudiantes y profesorado en el espacio europeo. Durante el primer año, llegan los problemas en cursar las asignaturas básicas, creando sentimientos de incertidumbre sobre la carrera en si. Los principales factores que influyen en el fracaso escolar del primer año de vida son sobre todo, la organización del tiempo y la relajación después de los exámenes de selectividad, etc.

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Dando visibilidad a la interpretación infantil del entorno musical en los espacios masivos de comunicación

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Abstract

Educational activities aimed at children this age are oriented toward understanding the context, looking for a living school, with meaning and sense that is still only a desire in many countries and sectors. Our study is interested in the closest and everyday sonic and musical environment, film and television as large areas of social communication and globalization. The development work meet the observational made from a selection of preferred audiovisuals, questionnaires, application and quantitative and qualitative results obtained on audiovisual experience. The results obtained with SPSS and Atlas.ti show the significance and meaning of music in the selected audiovisual and its relation to history and image, preparing the groundwork for future educational interventions that can promote music education from understanding the sound habitat , their contexts and values.

Keywords: *education, communication, music, film, television, meaning childhood.*

Resumen

Palabras clave: *educación, comunicación, música, cine, televisión, significado, infancia.*

Introducción

Una de las preguntas más importantes que se hace el hombre a lo largo de su existencia es “quien soy yo”. Para contestarla se necesita del desarrollo vital y su recorrido en diálogo con la sociedad, la cultura y la educación. Este artículo plantea esta cuestión desde la música y busca su respuesta a partir de su relación con lo sonoro, la organización de las experiencias y el terreno discursivo por el que transcurre. Este itinerario tiene en el propio recorrido las claves para su comprensión, la cultura, la identidad y la educación, sus opciones y oportunidades. Comenzaremos por una breve introducción a los elementos configuradores de nuestro objeto de estudio, la identidad y la música, como piedras de toque que justificarán la elección metodológica, es decir la manera de acceder a sus indicadores utilizando sus dos grandes formas de aproximación, el análisis cuantitativo y el análisis cualitativo. Finalmente justificamos la elección final de un método mixto que comienza con los grandes clasificadores cuantitativos y termina buscando la diversidad, el caso único, lo privado y persona, sólo posible a través del análisis cualitativo. Y este recorrido y su cierre cualitativo es para nosotros necesario e imprescindible porque a partir del s. XX, tal como dice Walter Benjamin, la música se produce de forma masiva pero siempre se recibe de forma individual y privada (Benjamin, 1973).

Revisamos en las siguientes líneas los elementos configuradores de nuestro trabajo: la cultura, la educación y la identidad para entender la música y su presencia en espacios de alto impacto, lo audiovisual y su banda sonora.

1. Los audiovisuales y su relación con la identidad en la infancia

La identidad ha sido uno de los factores destacados en los estudios culturales del s. XX, su concepto es dinámico, y en su definición intervienen elementos sociales, culturales, educativos y discursivos que han ido configurándose junto al avance de las ciencias sociales. Cultura e identidad son dos conceptos muy relacionados pero no coincidentes para los que investigadores culturales proponen diferentes definiciones. Cuche dice que la cultura implica inmersión y absorción, siendo por lo tanto, poco elegida, mientras la identidad hace referencia a la diferencia, es consciente y por lo tanto, implica inclusión y exclusión (nosotros y ellos) y diferenciación cultural (Cuche 1999). Las formas, y de manera especial las manifestaciones sobre las que se construye la identidad a través de la música, son el objeto último de este trabajo, en el que nuestro interés es estudiar la música que escuchan los niños en sus entornos cotidianos como efectos de cultura y también de identidad. Desde posiciones post-estructuralistas, toma cada vez más fuerza el discurso como elemento no sólo narrador sino constructivo de la identidad. Bauman (2005) dice que la identidad, lejos de ser una representación interna, coherente y estable del sí mismo, es un producto narrativo, que a su vez se articula y sitúa en escenarios cambiantes e inestables propios de la modernidad tardía, construyéndose en las actuaciones con herramientas culturales (Bauman, 2005). Para González, la identidad es aquello que el sujeto dice o cuenta, es aquello que se hace

discursivamente (González 2010). Esta concepción múltiple y dialógica es cercana a la desarrollada por psicólogos actuales como Hermans (2004) y Davies y Harré (2007). Así considerada, la identidad es parte importante de la vida social en la que las personas expresan sus experiencias. Su construcción se produce mediante signos con los que vinculan los procesos sociales, culturales y psicológicos a los que da lugar. El discurso narrativo crea las identidades al organizar las experiencias vitales, las relaciones sociales, las interpretaciones del pasado y los planes para el futuro (González 2010). Así, pues, destacamos la conformación semiótica de la conciencia, y la emergencia de la persona desde los procesos de comunicación e interacción social (González 2010). Cultura, identidad y discurso constituyen entonces el sendero vital que recorre el ser humano para contestar a "quién soy yo". Y la sociedad y la educación no están ajenos ni a la pregunta ni a la respuesta, porque ambas forman parte del lugar donde se vive y experimenta, pero, sobretodo, se dice. En este espacio compartido el individuo emerge de los procesos de interacción social que se construye y reconstruye en las variadas prácticas discursivas en las cuales participa teniendo "el discurso" un rol similar al "esquema conceptual (Davies 2007). El desarrollo de nuestro propio ser y de cómo el mundo se interpreta desde la perspectiva de nuestra identidad implica: 1) El aprendizaje de las categorías que incluyen a algunas personas y excluyen a otras, 2) La participación en prácticas discursivas diferentes a través de las cuales los significados se asignan a esas categorías, 3) El posicionamiento de la identidad en términos de categorías y argumentos y 4) El reconocimiento de uno mismo como miembro y portador de varias subclases de categorías dicotómicas y no de otras (Davies y Harré, 2007). Y en todo ello, precisamente, es el hecho de experimentarse a sí mismo como contradictorio, lo que provee la dinámica para el entendimiento (Haug, 1987). Concluimos esta revisión sobre la construcción de la identidad con Vigotsky (1996) quien relaciona la conformación genética y semiótica del sujeto y de la identidad en términos discursivos. Así, pues, se necesita generar una explicación de las mediaciones que introduce el lenguaje, los objetos simbólicos y los otros en la conformación del sujeto humano (González 2010). Vigotsky consideró que los productos culturales como el lenguaje, los sistemas de notación y otros productos más elaborados como la literatura, los cuentos, las obras de arte, la música y expresión, median en la conformación de los procesos psicológicos superiores como el pensamiento, la formación de conceptos, la atención, etcétera. Teniendo el discurso un rol similar al esquema conceptual (Davies 2007). En esta multiplicidad de discursos, el etnólogo francés considera determinante la presencia de los media y dice que los estudios de la comunicación de masas no pueden limitarse a analizar discursos e imágenes (y nosotros añadimos músicas), sino que también deben preocuparse de cómo los consumidores se apropian de lo que consumen reinterpretándolo según sus propias lógicas (Cuche, 1999). Este es el caso de los audiovisuales y sus relaciones con la globalización (Carretero, 2007; Morley, 2004), así como latinidad y sus múltiples hibridaciones (Valdivia, 2004). En este espacio multimodal definido

por su mestizaje se produce el binomio audiovisual que, desde lo sonoro, contribuye a la construcción de la percepción de uno mismo y del otro, del nosotros y ellos.

2. La música y el desarrollo de la identidad

Desde este ángulo identitario surge nuestra pregunta es ¿Cuál es el lugar de la música en todo ello? Desde el punto de vista social y cultural la música encuentra su sentido en el diálogo con la escucha. Sus usos, muchas veces tienen carácter mediador y comunicativo siendo, en ocasiones, más potentes y certeros que las palabras (Porta, 2007). Entre muchos aspectos, la música se utiliza para comunicar emociones, pensamientos, declaraciones políticas, relaciones sociales y expresiones físicas (Hargreaves 2003; Campbell, 2010). Y, todo ello, tiene una profunda influencia en el desarrollo de nuestro sentido de la identidad, nuestros valores y creencias, ya sea mediante la música rock, clásica o jazz (Macdonald, 2002; Hormigos, 2004).

Nuestro interés es conocer el peso específico que ocupan estas músicas en la vida diaria de los niños. En torno a ello, McDonald dice que al igual que el lenguaje puede mediar en la construcción y negociación de identidades en desarrollo, la música también puede ser un medio de comunicación a través del cual se construye la identidad de las personas (Macdonald, 2002). Para ello es necesario conocer dónde se encuentra (medios y soportes) y cómo se produce la escucha (modos y gramáticas) (Porta, Vilar, & Navasquillo, 2013). El significado de cualquier tipo de música es inseparable de las condiciones bajo las cuales se genera y experimenta. Por ello, además del contexto institucional, estructuras y fines, es importante conocer las experiencias y los valores de la cultura y de la sociedad que requieren una exploración a través de las teorías sociológicas de la modernidad y las teorías del aprendizaje sociocultural (Bresler 2004). Y todo ello nos conduce a las formas de aproximación (Sloboda, O'Neill, Ivaldi, 2001).

Este trabajo forma parte de un proyecto sobre el entorno sonoro de la infancia, en este caso nos situamos en el desarrollo de la identidad y su relación con la música. Para ello hemos utilizado una muestra de niños de 11 años de España, Argentina y Chile, aplicando una metodología mixta triangulando el análisis musical, cuantitativo y de contenido (Porta, Herrera, 2017). Todo ello con la intención de mostrar su significado y sentido, así como la relación de la música con la historia y la imagen, así como sus efectos en la infancia como una parte determinante del hábitat sonoro actual y sus valores.

El trabajo ha tenido dos objetivos:

Objetivo 1. Conocer cuales son los audiovisuales favoritos .

Objetivo 2. Conocer qué significado y sentido tiene la música para ellos.

a. La importancia de la elección del método

Las aproximaciones al entorno de la expresión se han ido desarrollando con el hombre a lo largo de la historia. La música ha estado tradicionalmente unida al arte y también a la ciencia. Los estudios de los que tenemos una mejor constancia son los que proceden de la culturas grecolatinas. La Historia va perfilando sus grandes avances en materia de expresión y arte. Pero es en el siglo XIX cuando se produce un gran salto en el conocimiento e investigación sobre las obras de expresión humana, en el que el formalismo se impone dando lugar en el transito del S. XIX al XX a la iconografía. Fue durante este siglo cuando las corrientes se precipitan apareciendo la Sociología, la Psicología del Arte y el Estructuralismo. Este ultimo considera el arte como un tipo de lenguaje y desde este punto de vista las formas de expresión en las que se incluye la música se convierten en un medio y acto de comunicación mas. Este ámbito comunicativo tiene como línea de pensamiento destacada la Escuela de Frackfurt (1923), con autores interesados en desarrollar una reflexión interdisciplinar sobre la sociedad burguesa-capitalista desde una óptica marxista y a la que se añadió la reflexión psicoanalítica de Freud. Esta escuela ha contado con algunos de los pensadores más destacados del S. XX como Adorno y Erich Fromm y como colaboradores W. Benjamin o A. Hauser. El movimiento se basa en una reacción al malestar generado por las sociedades modernas, la presión de la publicidad, la degradación ambiental y la lucha de clases. Su eje se centra en la Teoría Crítica y en aunar teoría y práctica. Este espacio marca una gran distancia crítica al positivismo al que se han atribuido tradicionalmente a las formas de análisis cuantitativo. Las vanguardias del s. XX en el arte orientan también los principios de la educación musical, especialmente las de fuerte calado social como es el caso de Murray Shaffer quien dice que “Los sonidos dan a los habitantes un sentido del lugar, actividades y comportamientos” así como la idea de la importancia del objeto sonoro y la percepción auditiva como construcción cognitiva de Pierre Shaeffer o la construcción social de la conciencia de Vigostky (1981).

3. Método (Fig 1)



Figura 1. Método mixto que comienza con el análisis cuantitativo y termina con metodología cualitativa).
Fuente: Elaboración propia

a. Instrumentos

Para cubrir nuestros objetivos hemos hecho uso de tres instrumentos:

1. Un cuestionario de preguntas cerradas para conocer las preferencias infantiles sobre cine y televisión.
2. Una serie de secuencias editadas en versiones y grupos de tres audiovisuales
3. Un cuestionario asociado con preguntas abiertas y cerradas

b. Diseño de la investigación

Para estudiarlo se aplicó el cuestionario C1 sobre preferencias infantiles. Posteriormente los audiovisuales preferidos fueron analizados por expertos estudiando su banda sonora y eligiendo escenas significativas.

Nuestro diseño de investigación ha seguido el proceso necesario para contestar nuestras preguntas:

- Cuáles son sus preferencias audiovisuales,
- Cómo son sus músicas,
- Cuál es su significado

Cuales son sus efectos.

Se ha utilizado una metodología mixta:

El análisis musical (el estudio cuantitativo de 13 categorías musicales mediante la plantilla 3.0 y el análisis de la forma musical),

El análisis de contenido para dar visibilidad a los elementos internos de la escucha, siempre individual y privada (Benjamin, 1973)

El análisis semiótico para conocer los efectos, interpretación y sentido.

i. *Para conocer sus músicas: el análisis musical (Fig 2)*

Los títulos t El análisis musical

La plantilla 3.0 y sus categorías (Porta, A., Morant, R. & Ferrández, R. (2015)

La forma musical y las letras de las canciones

El análisis musical

La plantilla 3.0 y sus categorías (Porta, 2011, 2015)

The image shows a screenshot of a spreadsheet titled 'PLANTILLA 3.0'. It is divided into two main columns: 'CATEGORÍAS' and 'ANÁLISIS'. The 'CATEGORÍAS' column lists 13 categories for musical analysis, such as 'Sin sonido', 'Género y estilo', and 'Métrica y rítmica'. The 'ANÁLISIS' column contains a grid where each row corresponds to a category and each column represents a different piece of music, with cells for recording the analysis results.

La codificación en 13 categorías

- Sin sonido
- Sonido no musical
- Sonido musical
- Voz
- Métrica y rítmica
- Tipo de comienzo
- Dinámica
- Agógica
- Género y estilo
- Organización sonora
- Cadencias
- Modulación
- Textura sonora
- Plano sonoro

La forma musical y la letra de la canción

Compas	16	16	4	16	16	4	16	8
Forma	A	B	C	A	B	C	B	C
A: Estrofa B Estribillo								

Estrofa 1
 Ahora sabes que,
 yo no entiendo lo que pasa
 sin embargo se,
 nunca hay tiempo para nada
 pienso que no me doy cuenta
 y le doy mil y una vueltas
 mis dudas me cansaron
 ya no esperar

Estribillo
 y vuelvo a despertar
 en mi mundo
 siendo lo que soy
 y no voy a parar
 ni un segundo
 mi destino es hoy

1

Figura 2. (El análisis musical). Fuente: Elaboración Propia.

ii. *Para conocer el significado y sentido que tiene la música:*

El logro de este objetivo se ha realizado en dos etapas:

1ª etapa: formativa, aprender sobre técnicas observacionales.

Dando visibilidad a la interpretación infantil del entorno musical en los espacios masivos de comunicación

2ª etapa: preparación de series de tres clips favoritos en tres versiones

sólo sonido sólo imagen completo

Creación del cuestionario C2 sobre la experiencia audiovisual en versiones editadas.

iii. *Cómo conocer sus efectos (Fig 3)*

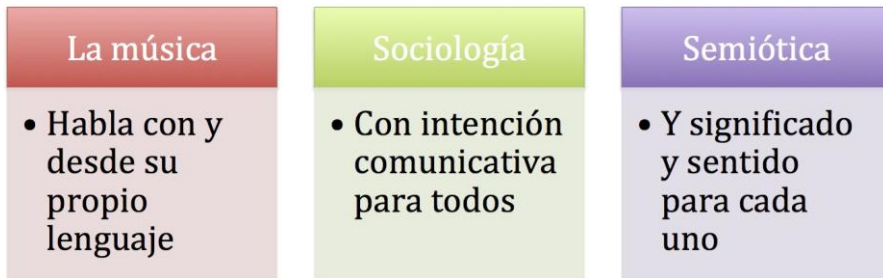


Figura 3. Conocer sus efectos. Fuente: Elaboración propia

iv. *Metodología específica para el objetivo 2: Análisis cualitativo*

Objetivo: Conocer el significado y sentido de la música para ellos, tiene carácter interpretativo y busca sus efectos (Fig 4)

Objetivo 2. Metodología cualitativa

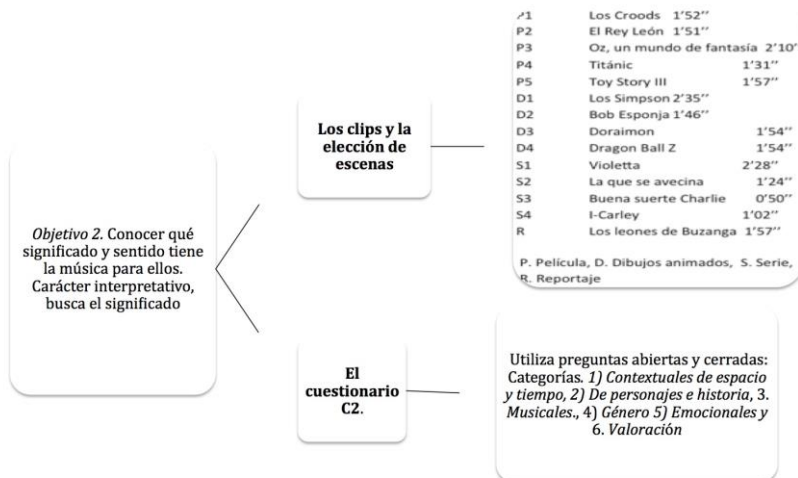


Figura 4. Metodología para objetivo 2. Análisis cualitativo. Fuente: Elaboración propia.

4. Resultados

4.1. Objetivo 1. Conocer sus audiovisuales favoritos

- Películas: Los Croods (6,1%), Oz un mundo de fantasía (3,5%), Lo imposible (5,2%), El Rey León, (4,3) Titanic (3,5%) Harry Potter (2,6), Toy Story 3 (2,6%)
- Series. Violetta (12,2%), La que se avecina (10,4%), Buena suerte Charlie (4,3%), Código Lyoko (4,3%), Austin y Alie (3,5%), Big time rush (3,5%), Carly (3,5%), Jessie (3,5%), Dragon Ball (2,6%), Física y Química (3,5%), Los Simpson (2,6%), y Shake it up (2,6%).
- Dibujos animados. Los Simpson (24,3%), Phineas y Ferb (20,9%), Bob Esponja (8,7%), Hora de aventuras (6,1%), Doraimon (5,2%), El asombroso Gumbali (4,3%), Dragon Ball Z (3,5%).
- Reportaje. Sin respuestas concretas, indicaron documentales sobre la naturaleza y los animales.

4.2 Objetivo 2. Estudiar el significado y sentido de la música en un estudio de caso?

Los estudios de caso se realizaron a partir de series de clips editadas en tres versiones: solo sonido, solo imagen y todo. El total de series fue de 24, mostramos aquí un estudio de caso realizado a partir de las series complementarias en sus versiones, las series 19 y 20:

Los resultados son estudiados caso por caso porque nuestra finalidad última es dar visibilidad a la escucha, siempre individual y privada. Series elegidas en el estudio de caso

Así, nosotros mostramos

Tabla 1. Las series 19 y 20

<i>SERIE 19</i> 6'03''	<i>SERIE 20</i> 6'36''
P3S Oz, un mundo de fantasía 2'10'	P3I Oz, un mundo de fantasía 2'10''
S1 Violetta	S1T Violetta
RT Ciénaga de Buzanga 1'57''	RS Ciénaga d Buzanga
<i>D Dibujos, R Reportaje, P Película, Se Serie S Sonido, I Imagen, T Todo</i>	

4.2.1. Los audiovisuales, su análisis musical y cualitativo de preguntas abiertas

Selección audiovisual: Oz, un mundo de fantasía. 2013, Walt Disney, 130'; *Violetta.* Disney Channel. 2012; *La Ciénaga de Buzanga.* National Geographic Channel

Oz, un mundo de fantasía. 2013, Walt Disney Pictures (USA), 130'. Director Am Raimi.

La escena (2'10'') Un terrible viaje en globo.

Análisis musical: En cuatro partes 1) sin música: con sonido ambiente, viento, golpes, gritos; 2) Habla el protagonista en peligro; 3) Cambio drástico, sonido cósmico, electrónico; 4) música de feria- música sinfónica (viento y cuerda) y 5) Final: aleteo, gong y orquesta.

Análisis cualitativo. Resultado preguntas abiertas en la versión “*Sólo sonido*”

¿*Cómo te imaginas el lugar?* Hablan de fenómenos naturales como tormenta, lluvia, viento o tornado; psicológicos como oscuro, peligro, sin alegría, y paisajes con agua como río, bosque, puerto, barco.

¿*Qué pasa en la historia que has escuchado?* Se hunde un barco, peligran, escalan una montaña, quieren matar a alguien.

Violetta. Disney Channel. 2012. Argentina

La escena (2'28") Ensayo de una actuación TV interpretando la canción *Si es que yo soy así*

Análisis musical: Música incidental que sostiene el diálogo con leitmotiv asociado a la palabra "beso" repitiéndose el motivo varias veces, terminando de forma súbita. Pasa de figura a fondo (pizzicato)

Análisis cualitativo. Resultado preguntas abiertas en la versión “*Sólo sonido*”

¿*Cómo te imaginas el lugar?* Describen el estudio, escenario. Se obtienen resultados similares en la versión de imagen, aunque más descriptivos de fenómenos atmosféricos y colores así como menos evocativos de situaciones y climas.

¿*Qué pasa en la historia que has escuchado?* Explican aspectos descriptivos del ensayo.

La Ciénaga de Buzanga. National Geographic Channel (NatGeo USA. 1888.

La escena (1:57"): Muestra una escena de caza de leones a gacelas.

Análisis musical: Música: la sabana, la caza, la voz del narrador. Utiliza tesituras graves y agudos, diseños sostenidos y arpegiados. Tímbrica orquestal de todas las familias con percusión destacada. No se mezclan los planos sonoros

Análisis cualitativo. Resultado preguntas abiertas en la versión “*Sólo sonido*”

¿*Cómo te imaginas el lugar?* Citan paisajes secos como sabana, desierto, África y ambientales como lugar cálido, mediodía, un descampado, con mucho calor, sin llover en semanas. Usan frases descriptivas como: *Un pequeño bosque al lado de una manada de ñus que una leona quiere cazar. Una selva al mediodía llena de animales (pájaros, leones, gacelas). Cuenta la vida de un animal. Una selva peligrosa de África donde los animales tenían muchos problemas.*

¿*Qué pasa en la historia que has escuchado?* Escriben: *Los animales cazan, Una manada de animales está en una selva peligrosa de África y corren peligro, Parecía un león*

persiguiendo a algún otro animal, Que un animal recorre la selva para cazar. No lo sé, pero ha estado interesante, Al principio parecía un ambiente de caza, iban a matar al león y cuando están a punto se van corriendo.

¿Para qué crees que servía la música? Las respuestas hablan de dramatismo, sentimientos, emociones e intriga.

5. Conclusiones y discusión

A partir de nuestras preguntas de investigación podemos indicar como conclusiones de este trabajo que las bandas sonoras utilizan músicas descriptivas e incidentales de carácter diegético o/o extradiegético, estructuras formales en simbiosis con la escena mezclando tímbricas, registros, tipos de sonidos y planos sonoros. Su presencia contribuye de manera convincente y efectiva al significado y sentido de la música. De igual modo el estudio constata la importancia de la música que mantiene el interés aun separada de la imagen. En las respuestas abiertas los niños explican las escenas que han escuchado, hablan de mezcla de música, ruidos y silencios con los que perciben la acción, intriga y atmósfera tanto física como psicológica.

Este trabajo ha utilizado un sistema metodológico mixto, comenzando con análisis cuantitativo de muestras que, de manera progresiva, ha dado lugar a diferentes estudios de caso que, finalmente han sido estudiados de manera separada por medio del análisis de contenido. Este estudio ha proporcionado visibilidad a la presencia y significado de la música para la infancia haciendo emerger aspectos que aparentemente parecen no tener relación con ella. Por ello consideramos que son necesarios estudios que profundicen sobre algunos aspectos invisibles de la música como son su relación con factores espaciales, temporales, emocionales y contextuales. El estudio revela que los mundos de ficción serían otras si utilizaran otras músicas, así como que la historia sin la banda sonora pierde significado. La música forma parte de los escenarios, personajes y valores actuando de manera persuasiva, económica y convincente. Por todo ello se hacen necesarias líneas investigadoras que estudien los efectos que la música en la infancia y sus consecuencias en la educación.

6. A modo de epílogo

¿Qué aporta el análisis cualitativo al estudio de la música audiovisual?

Aporta aspectos imposibles de detectar por medio del análisis cuantitativo, da visibilidad a los efectos de la escucha, se introduce en lo próximo y particular, muestra cómo la música construye mundos y, finalmente, evidencia la necesidad de su reconocimiento desde la Educación por su significado y sentido en la construcción de la cultura y la identidad. Y finalmente, constata la necesidad de buenas prácticas desde la producción audiovisual para una mejor inmersión en la cultura y una mayor conciencia de la identidad y su construcción, altamente sensible a factores exógenos

Todo ello hace necesario el análisis cualitativo porque: la música habla desde su propio lenguaje para todos pero es recibido de forma individual y privada.

7. Agradecimientos

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Propuesta de colaboración entre asignaturas para la evaluación de la competencia transversal “Diseño y proyecto” de la UPV

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Abstract

The UPV transversal competences project has as main objective to accredit UPV transversal competences to the students graduated in any of the official degrees taught at the Universitat Politècnica de València (UPV). These competences must be acquired in a multidisciplinary way, through different subjects that can achieve the common objective of each of the transversal competence. One of these transversal competences is the so-called "Design and Project", whereby students must learn to design and manage a project, that is, an effort that is carried out in a given time to achieve the Specific objective of designing and creating a unique service or product, by performing a series of tasks and an effective use of resources. This transversal competence also favors the student to learn by making and integrating knowledge and skills from different disciplinary fields, developing high-level intellectual skills, promoting autonomous learning and work, teamwork and self-evaluation.

In the specific case of the intensification of Information Systems and Knowledge Management of the Degree of Engineering in Industrial Organization, there are three subjects, two of which have the "Design and Project" competency as Control Point. Obviously, these two subjects are coordinated to get the students to reach the competition in question, but this article proposes to go a step further, not only be coordinated, but to collaborate, combining work and practices, so that both can get to "merge" part of its contents with a common goal.

Keywords: *Design and project, Transversal competence*

Resumen

El proyecto de competencias transversales de la Universitat Politècnica de València (UPV) tiene como objetivo principal acreditar las competencias transversales UPV a los estudiantes egresados en cualquiera de los títulos oficiales impartidos en la Universitat Politècnica de València. Estas competencias deben adquirirse de forma multidisciplinar, a través de diferentes asignaturas que, tratando materias diferentes, puedan lograr el objetivo común de cada una de las competencias transversales. Una de estas competencias transversales es

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la denominada “Diseño y Proyecto”, mediante la cual, los estudiantes deben aprender a diseñar y gestionar un proyecto, es decir, un esfuerzo que se lleva a cabo en un tiempo determinado para lograr el objetivo específico de diseñar y crear un servicio o producto único, mediante la realización de una serie de tareas y un uso efectivo de recursos. Esta competencia transversal favorece además que el estudiante aprenda haciendo e integrando conocimientos y habilidades de diferentes ámbitos disciplinares, desarrollando habilidades intelectuales de alto nivel, promoviendo el aprendizaje y trabajo autónomo, el trabajo en equipo y la autoevaluación.

En el caso concreto de la intensificación de Sistemas de Información y Gestión del Conocimiento del Grado de Ingeniería en Organización Industrial, hay tres asignaturas, dos de las cuales tiene la competencia “Diseño y Proyecto” como Punto de control. Evidentemente, estas dos asignaturas están coordinadas para conseguir que los alumnos alcancen la competencia en cuestión, pero en este artículo se propone que se vaya un paso más allá, y no sólo estén coordinadas, sino que colaboren, compaginando trabajos y prácticas, de forma que ambas puedan llegar a “fusionar” parte de sus contenidos con un objetivo común.

Palabras clave: Diseño y proyecto, Competencia transversal

Introducción

En el presente trabajo se investiga la posibilidad de aumentar la colaboración que existe entre algunas asignaturas del Grado de Ingeniería en Organización Industrial (GIOI), con el objetivo de conseguir que los alumnos alcancen una de las competencias transversales, en este caso “Diseño y Proyecto”. Se centra concretamente en dos asignaturas que pertenecen a la misma intensificación de dicho grado, y que comparten algunas características y objetivos comunes, por lo que puede darse una colaboración muy estrecha entre ellas. Una de estas características comunes, es que ambas son punto de control de la competencia transversal en cuestión, “Diseño y proyecto”, dentro del proyecto institucional en la Universitat Politècnica de València (UPV).

Evidentemente, esta colaboración entre asignaturas ya existe, y por supuesto las asignaturas están coordinadas en cuanto a su temario y plan de estudios. Pero se considera que podría haber una colaboración mayor en la parte práctica, y sobre todo en relación a las Competencias transversales que tienen estas asignaturas asignadas como punto de control. Por ello, se propone en este trabajo la colaboración entre las asignaturas.

Para facilitar la comprensión al lector de la propuesta, en el siguiente apartado se presenta brevemente el contexto del proyecto de competencias transversales de la UPV y dentro de él, en el tercer apartado se describe brevemente la competencia transversal “Diseño y Proyecto”. A continuación, se centra la atención en las asignaturas, para lo cual se describe brevemente el grado y la intensificación en los que se imparten, y los datos básicos de las asignaturas. De

esta manera, se puede entender el contexto existente, para posteriormente realizar la propuesta de colaboración.

1. Competencias Transversales en la UPV

Según diferentes autores, las competencias se estructuran en torno a dos grandes grupos (OECD, 2001; Rodríguez, 2007; Montero, 2010):

- a) Competencias genéricas o transversales: Se trata de competencias que de una u otra forma son necesarias y comunes a todos los grados, es decir, deberán desarrollarse potencialmente en todos los estudios, con el fin de dar el máximo de garantías de formación al egresado, bien para continuar su carrera universitaria o bien para incorporarse al mundo laboral.
- b) Competencias específicas: Son diferentes entre todas las titulaciones; hacen referencia al corpus de conocimientos de diversos tipos que configuran la especificidad temática de cada grado. Se trata, por tanto, de competencias que caracterizan a una profesión, son las que en último término llevan a la formación concreta para la que habilita cada grado y, con ello, son las que se exigirán para el desempeño específico de cada profesión.

Las competencias específicas se han venido trabajando de forma natural en las diversas titulaciones. Sin embargo, históricamente, las competencias genéricas o transversales no han recibido tanta atención como las específicas. Esto cambia en los últimos tiempos con la entrada del Espacio Europeo de Educación Superior (EEES), que les otorga una importancia acorde a la que reciben en el entorno laboral, donde son consideradas por los profesionales tan importantes como las específicas (si no más) (Fundación Everis, 2016).

En esa línea, el proyecto institucional de “Competencias Transversales” de la UPV tiene como objetivo principal certificar los niveles de los alumnos en “competencias transversales”, pero valorando estas a partir de actividades que las usen explícitamente. Es decir, mediante actividades dentro de las diversas asignaturas. Con esas actividades se trabajarán y desarrollarán las competencias específicas al mismo tiempo que las transversales, facilitándose así el proceso de aprendizaje de ambas competencias (UPV, 2012). El proyecto comenzó en 2013, con el objetivo de que el curso académico 2015/16 fuera ya el del comienzo de la implantación definitiva del proyecto, y actualmente se encuentra totalmente implantado. Para comprender este proyecto, y el trabajo que se presenta, ya que está relacionado con él, es necesario clarificar en qué consisten las “competencias transversales”, que podemos definir como *“aquellas competencias que son claves y transferibles en relación a una amplia variedad de contextos personales, sociales, académicos y laborales a lo largo de la vida. En este sentido, constituyen una parte fundamental del perfil profesional y del perfil formativo de todas o de la mayoría de las titulaciones. Se trata de competencias que incluyen un conjunto de habilidades cognitivas y metacognitivas, conocimientos instrumentales y actitudinales de gran valor para la sociedad del conocimiento”* (ICE, 2017). Se trata por tanto de un saber hacer muy complejo, por lo que es necesario concretarlo en resultados de aprendizaje más específicos. Por ello, será necesario recurrir a estrategias metodológicas que propicien

el cambio de roles. Ya no se puede utilizar una metodología “tradicional” basada en clases magistrales y problemas que el profesor resuelve en el aula. Incluso las prácticas de laboratorio deben cambiar su enfoque para conseguir nuevos objetivos, y lograr que los alumnos adquieran una serie de capacidades, que, por lo general, antes no se tenían en cuenta ni se evaluaban, como son la capacidad de trabajo en grupo, la capacidad de realizar exposiciones orales, etc. (Oltra-Badenes y Gil-Gómez, 2015). Por tanto, estas acciones formativas deben estar basadas en metodologías activas para la formación de competencias, en métodos con participación del alumno, que generan un aprendizaje más profundo, significativo y duradero (Fernández March, 2006).

En el proyecto de Competencias Transversales de la UPV, se han definido un total de 13 competencias transversales, habiendo tenido en cuenta para ello las normativas y directrices más importantes nacionales e internacionales, así como la numerosa literatura científica existente sobre las mismas (ICE, 2017). De este modo, se llega a la definición del siguiente listado de competencias transversales UPV:

- CT-01. Comprensión e integración
- CT-02. Aplicación y pensamiento práctico
- CT-03. Análisis y resolución de problemas
- CT-04. Innovación, creatividad y emprendimiento
- CT-05. Diseño y proyecto
- CT-06. Trabajo en equipo y liderazgo
- CT-07. Responsabilidad ética, medioambiental y profesional
- CT-08. Comunicación efectiva
- CT-09. Pensamiento crítico
- CT-10. Conocimiento de problemas contemporáneos
- CT-11. Aprendizaje permanente
- CT-12. Planificación y gestión del tiempo
- CT-13. Instrumental específica

2. Competencia Transversal “Diseño y Proyecto” en la UPV

Como se ha podido observar en la lista anterior, una de las competencias transversales definidas en la UPV es la CT-05 Diseño y Proyecto. Esta es una competencia mediante la cual, al ser desarrollada, se favorece que el estudiante aprenda haciendo e integrando conocimientos y habilidades de diferentes ámbitos disciplinares, desarrollando habilidades intelectuales de alto nivel, promoviendo el aprendizaje y trabajo autónomo, el trabajo en equipo y la autoevaluación.

Según se define en el proyecto institucional de las competencias transversales de la UPV (UPV, 2012), un proyecto es “*un esfuerzo que se lleva a cabo en un tiempo determinado para lograr el objetivo específico de diseñar y crear un servicio o producto único, mediante la realización de una serie de tareas y un uso efectivo de recursos*”. Esta competencia se centrará por tanto en el diseño y desarrollo de este tipo de “esfuerzo”.

Para desarrollar la competencia en cuestión, la UPV propone realizar algunas de las siguientes actividades formativas:

- Actividades grupales
- Exposiciones orales
- Lección magistral
- Lecturas
- Proyectos
- Redacción de informes
- Tutorías planificadas

De igual forma, se proponen una serie de procedimientos de evaluación, de entre los que destaca, como técnica de evaluación más utilizada, el análisis del proyecto elaborado y reflejado en el informe. Este es un informe que se puede acompañar de un portafolio de proceso, en el que se recojan evidencias del trabajo que se ha ido realizando y también de una presentación oral del mismo. En este caso, hay que tener en cuenta también que la complejidad de la tarea que requiere un proyecto exige una evaluación formativa al menos de ciertos productos parciales o entregables, para asegurar que el proyecto avanza en una dirección adecuada. Además, la participación de los alumnos en el proceso de evaluación (autoevaluación y evaluación entre iguales), facilitará la comprensión y asunción de los elementos esenciales del proyecto (ICE, 2017).

Siguiendo con la propuesta de evaluación, entre los procedimientos de evaluación, destacan (UPV, 2012):

- Redacción de informe escrito individual o grupal
- Observación
- Autoevaluación
- Evaluación entre iguales
- Exposición oral
- Portafolio

En cuanto a los instrumentos de evaluación se recomiendan (UPV, 2012):

- Rúbricas (de proceso para cada una de las fases del proyecto, del informe escrito, de la presentación oral, de la calidad del trabajo en equipo si el proyecto se ha realizado de este modo, etc..).
- Entrevistas con guiones elaborados para poder evaluar y calificar.

En esta línea, para poder evaluar la competencia transversal Diseño y Proyecto, en la UPV se ha desarrollado una rúbrica, que tiene 3 niveles de dominio, correspondiendo el nivel 1 a los dos primeros cursos del grado, el nivel 2 a los cursos 3º y 4º del grado, y el nivel 3 al Máster. Cada nivel de dominio tiene asociados además una serie de indicadores, que pueden servir para saber si el alumno ha alcanzado el nivel de dominio de la competencia adecuado.

3. El Grado en Ingeniería de Organización Industrial

La mejora docente que se propone, se encuadra en el Grado en Ingeniería de Organización Industrial. Este grado forma a titulados con una sólida base científica y tecnológica que les permite asesorar, hacer funcionar o mejorar las organizaciones, los sistemas de producción, los procesos, servicios o sistemas de información para favorecer la ventaja competitiva de las empresas, teniendo en cuenta los aspectos humanos y la viabilidad económica de las propuestas diseñadas.

El plan de estudios que se presenta en este grado está diseñado con una estructura de módulos. En concreto, la planificación de las enseñanzas comprende 5 módulos, con la distribución que se muestra a continuación:

Tabla 1. Distribución de módulos del Grado en Ingeniería de Organización Industrial

Modulo	Créditos
Formación Básica	60
Común a la Rama Industrial	60
Tecnologías de Organización Industrial	61.5
Optatividad General	10.5
Optatividad Específica	36
Trabajo Fin de Grado	12
TOTAL	240

Cada módulo se estructura por materias, y cada materia puede constar de una o varias asignaturas.

3.1. Módulo de optatividad específica: La vía de Organización Industrial

El Módulo de Optatividad Específica, de 36 ECTS, se desarrolla en 4º curso. Se ha estructurado en tres vías o itinerarios, debiendo el estudiante elegir uno de ellos para cursar la optatividad. Una de estas tres vías es la “Vía de Organización Industrial”. En esa vía, en el primer semestre del curso se imparte la Materia Común Vía Organización Industrial (18 ECTS, 4 asignaturas.) con el objeto de ampliar los conocimientos en las tecnologías de organización industrial. Posteriormente, en el segundo semestre, con el objeto de que el estudiante elija una de ellas e intensifique en un campo específico de las tecnologías de organización industrial, se imparte la Materia de Intensificación. La oferta de materias de intensificación que en estos momentos se realiza es la siguiente:

- Intensificación en Producción y Logística (18 ECTS, 3 asignaturas.)
- Intensificación en Innovación y Creación de Empresas (18 ECTS, 3 asignaturas.)
- Intensificación en Sistemas Integrados de Información y Gestión del Conocimiento (18 ECTS, 3 asignaturas)
- Intensificación en Diseño de Plantas Industriales (18 ECTS, 3 asignaturas.)

- Intensificación en Ingeniería de Fabricación (18 ECTS, 3 asignaturas.).

Dentro de esta materia es donde se encuadran las asignaturas objeto de este trabajo, y concretamente, en la Intensificación en Sistemas Integrados de Información y Gestión del Conocimiento. En ella se imparten las tres asignaturas siguientes

- Gestión por Procesos de negocio. Implantación, Desarrollo y Simulación
- Sistemas de Información y Gestión del Conocimiento
- Sistemas Integrados de Información en Empresas industriales

Las tres asignaturas son impartidas por el Departamento de Organización de Empresas. Por ello ya existe una coordinación y colaboración entre ellas bastante estrecha, pero que, como todo, es susceptible de entrar en un proceso de mejora continua, y por ello se propone una línea de colaboración adicional entre ellas.

4. Datos básicos de las asignaturas

Las tres asignaturas se imparten en el segundo semestre del 4º curso, teniendo 6 créditos cada una de ellas, divididos en 3 créditos de teoría y 3 créditos de prácticas.

Es importante destacar que las asignaturas se imparten de forma intensiva, durante dos meses (febrero y marzo), lo cual hace que los alumnos tengan una carga importante de clases, prácticas y trabajos, ya que la docencia se encuentra muy concentrada.

Tabla 2. Datos básicos de las asignaturas de la intensificación en Sistemas Integrados y Gestión del Conocimiento

MATERIA : Sistemas Integrados de Información y Gestión del Conocimiento

Créditos Mínimos : 18 Caracter: Optativo

Código	Asignatura	Tipo	Curso	Sem.	C.T	C.P	ECTS	Ofe.
11515	Gestión por Procesos de negocio. Implantación, Desarrollo y Simulación	Optativo	4	B	3	3	6	✓
11516	Sistemas de Información y Gestión del Conocimiento	Optativo	4	B	3	3	6	✓
11517	Sistemas Integrados de Información en Empresas industriales	Optativo	4	B	3	3	6	✓

En cuanto a las competencias a adquirir, evidentemente, al ser asignaturas de una intensificación común, están muy relacionadas. En la tabla siguiente se observan las competencias específicas y transversales de las que son punto de control las diferentes asignaturas

Tabla 3. Competencias específicas y transversales en las que son punto de control las asignaturas

Código asignatura	Competencias Específicas	Competencias Transversales
11515	15(E) Diseñar, proyectar y planificar procesos, sistemas de producción y operaciones, plantas industriales y dispositivos con finalidades prácticas, económicas y financieras. 18(E) Seleccionar y calcular los indicadores adecuados para la gestión interna de las diferentes áreas de la empresa industrial u organización.	(04) Innovación, creatividad y emprendimiento (05) Diseño y proyecto (09) Pensamiento crítico
11516	18(E) Seleccionar y calcular los indicadores adecuados para la gestión interna de las diferentes áreas de la empresa industrial u organización. 19(E) Diseñar, proyectar, planificar y gestionar la información de una empresa industrial u organización usando la tecnología y los sistemas adecuados.	(03) Análisis y resolución de problemas (06) Trabajo en equipo y liderazgo (09) Pensamiento crítico
11517	19(E) Diseñar, proyectar, planificar y gestionar la información de una empresa industrial u organización usando la tecnología y los sistemas adecuados.	(05) Diseño y proyecto (10) Conocimiento de problemas contemporáneos

5. Conclusiones

Como conclusión de este trabajo, se presenta una propuesta de colaboración entre asignaturas. La propuesta de colaboración que se plantea como mejora docente se centra en la posibilidad de integrar la parte más práctica de las asignaturas, y, sobre todo, las actividades para desarrollar la competencia transversal “Diseño y Proyecto”, en la que dos de las asignaturas son punto de control.

Por ello, ambas asignaturas (11515 y 11517) proponen en su guía docente el uso del proyecto como metodología docente y como medio de evaluación

Así, en la asignatura 11515, se puede observar que la descripción de actividades y criterios de evaluación para la competencia transversal “Diseño y Proyecto”, es:

- Descripción detallada de las actividades:
 - El alumno debe desarrollar, mediante actividades en grupo, un proyecto de mejora de procesos de negocio. El proyecto deberá redactarse en un informe que se entregará al profesor y deberá exponerse oralmente.
- Criterios de evaluación
 - La evaluación se realizará a partir del proyecto entregado y de su presentación oral.

Por otra parte, en la guía docente de la asignatura 11517, se puede ver que la competencia Diseño y Proyecto se aborda mediante las siguientes actividades y criterios de evaluación:

- Descripción detallada de las actividades:

- Se plantea un proyecto en relación con la temática de la asignatura para que se realice en grupo.
El proyecto se expone por parte del grupo al resto de la clase
- Criterios de evaluación
 - Observación
 - Proyecto entregado
 - Exposición Oral

Por tanto, se propone que los proyectos que se plantean en ambas asignaturas, sean de una temática común. Esto es totalmente razonable, ya que ambas asignaturas son de la misma intensificación, y abordan el mismo tipo de problemática a resolver en un proyecto. De este modo, tal y como propone la competencia en su definición desde el ICE (ICE 2017) *“se favorece que el estudiante aprenda haciendo e integrando conocimientos y habilidades de diferentes ámbitos disciplinares, desarrollando habilidades intelectuales de alto nivel, promoviendo el aprendizaje y trabajo autónomo, el trabajo en equipo y la autoevaluación.”*

En esta misma línea, también se plantea que las exposiciones orales sean comunes a ambas asignaturas, de forma que se presente un proyecto integral, donde puedan observarse las problemáticas resueltas desde las perspectivas de los diferentes ámbitos de las asignaturas, pero visto como un único trabajo, en línea con lo que debe ser un proyecto.

Se propone además que haya una autoevaluación y también evaluación entre iguales del proyecto, y por tanto de parte de la Competencia transversal por parte de los alumnos. Para ello, debe desarrollarse una rúbrica adecuada, que sirva para el proyecto común, basada en la propuesta de rúbrica de la UPV, pero adaptada a las necesidades del contexto que se ha presentado.

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Educar en valores desde la universidad. La crisis de refugiados desde el aula

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Abstract

The current university education seeks a comprehensive training of students that includes not only the learning of specific contents of the subjects taught, but also the acquisition of skills, abilities and cross-sectional values.

In this context, teaching innovation groups such as CTALENT have emerged whose objective is to integrate values of solidarity together with other Sustainable Development Goals (SDG), associating them with the development of different transversal and specific competences, and making partners external to the University, both public and private organizations.

One of the actions carried out by CTALENT has revolved around the refugee crisis in Europe today. To this end, with funding from the Center for Development Cooperation of the UPV in the Glocal call, support from the Culture area of the same and in collaboration with the Associació Professional d'Il·lustradors de València (APIV), has been brought during March And April of 2017 to the Campus of Valencia of the UPV the exhibition "Refugio Ilustrado: between the casket and the suitcase". This exhibition is an open graphic campaign in support of migrants, victims of the so-called "refugee crisis" and the failure of European countries.

Since then, a number of teaching activities have been carried out, as well as a survey that has allowed us to study the positioning of the university community in the face of the phenomenon of the refugee crisis and whose full results are offered in the paper

Keywords: *Refugees, values, learning, CTALENT, Universitat Politècnica de València, APIV, education for Sustainable Development, key competences*

Resumen

La formación universitaria actual busca una formación integral de los estudiantes que abarque no solo el aprendizaje de contenidos específicos de las materias impartidas, sino también la adquisición de destrezas, habilidades y valores transversales.

En ese contexto, han surgido grupos de innovación docente como CTALENT cuyo objetivo es integrar valores de solidaridad junto con otros Objetivos de Desarrollo Sostenible (ODS) asociándolos al desarrollo de distintas competencias transversales y específicas, y haciendo copartícipes a actores externos a la Universidad, tanto organizaciones públicas como privadas.

Una de las acciones llevada a cabo por CTALENT ha girado alrededor de la crisis de refugiados que padece Europa actualmente. Para ello, con financiación del Centro de Cooperación al Desarrollo de la UPV en la convocatoria Glocal, apoyo del área de Cultura de la misma y en colaboración con la Associació Professional d'Il·lustradors de València (APIV), se ha traído durante marzo y abril de 2017 al Campus de Valencia de la UPV la exposición “Refugio Ilustrado: entre el ataúd y la maleta”. Esta exposición es una campaña gráfica abierta en apoyo a las personas migrantes, víctimas de la llamada “crisis de los refugiados” y de la inoperancia de los países europeos.

A partir de la misma se han desarrollado diversas acciones docentes, así como una encuesta que ha permitido estudiar el posicionamiento de la comunidad universitaria ante el fenómeno de la crisis de refugiados y cuyos resultados completos se ofrecen en este trabajo.

Palabras clave: *Refugiados, valores, aprendizaje, CTALENT, Universitat Politècnica de València, APIV, educación para el desarrollo sostenible, competencias transversales*

Introducción

Según la Comisión Económica de las Naciones Unidas para Europa (UNECE), el objetivo de la estrategia de Educación para el Desarrollo Sostenible es alentar a los Estados miembros a desarrollar e incorporar la Educación para el Desarrollo Sostenible en sus sistemas de educación formal, a través de todas las asignaturas pertinentes, en la educación no formal y en la educación informal. Esta educación proporcionará a las personas los conocimientos y habilidades en el desarrollo sostenible, haciéndolos más competentes y seguros y aumentando sus oportunidades para actuar conforme a una vida saludable y productiva en armonía con la naturaleza y con respeto por los valores sociales, la equidad de género y la diversidad cultural.

En 2012, desde la Coordinadora de ONG para el Desarrollo de España (CONGDE), entiende que la Educación para el Desarrollo (EpD) debe abordar la globalización y por ello define la Educación para la Ciudadanía Global como un proceso para generar conciencias críticas, hacer a cada persona responsable y activa (comprometida), a fin de construir una nueva sociedad civil, tanto en el Norte como en el Sur, comprometida con la solidaridad, entendida ésta como corresponsabilidad en el desarrollo, participativa, cuyas demandas, necesidades,

preocupaciones y análisis, se tengan en cuenta a la hora de la toma de decisiones políticas, económicas y sociales.

En septiembre de 2015, la Asamblea General de Naciones Unidas aprueba el documento “Transformar nuestro mundo: la Agenda 2030 para el Desarrollo Sostenible”. Este documento es el resultado de un proceso de negociaciones a nivel mundial en el que se condensan más de seis décadas de debate sobre el desarrollo.

La Agenda 2030 presenta un planteamiento del mundo para el año 2030 del que derivan 17 Objetivos de Desarrollo Sostenible con sus 169 metas e indicadores, unos medios de implementación y un marco para el seguimiento.

Los 17 Objetivos de Desarrollo Sostenible (ODS) entraron en vigor oficialmente el 1 de enero de 2016 y vienen a reemplazar con más fuerza a los Objetivos del Milenio. Con estos nuevos Objetivos de aplicación universal, en los próximos 15 años los países deben intensificar los esfuerzos para poner fin a la pobreza en todas sus formas, reducir la desigualdad y luchar contra el cambio climático garantizando, al mismo tiempo, que nadie se quede atrás. Reconocen que las iniciativas para poner fin a la pobreza deben ir de la mano de estrategias que favorezcan el crecimiento económico y aborden una serie de necesidades sociales, entre las que cabe señalar la educación, la salud, la protección social y las oportunidades de empleo, a la vez que luchan contra el cambio climático y promueven la protección del medio ambiente. Ahora bien, la consecución de estos objetivos no es solo obligación de los Estados. Naciones Unidas ha instado a la sociedad civil de todo el mundo a que organicen eventos y actividades para aumentar la sensibilización sobre la importancia del desarrollo sostenible.

En 2016, la Dirección General de Cooperación y Solidaridad de la Conselleria de Transparencia, Responsabilidad Social, Participación y Cooperación encarga el desarrollo de la estrategia para la EpD en la Comunidad Valenciana para el ámbito formal al Instituto de gestión de la innovación y del conocimiento (INGENIO). Dicha estrategia está ya en marcha y su plan abarca el periodo 2017-2021.

Por su parte, la Universidad busca una formación integral de los estudiantes que abarque no solo el aprendizaje de contenidos específicos de las materias impartidas, sino también la adquisición de destrezas, habilidades y valores transversales. Esto se ve reflejado en el Plan Estratégico 2015-2020 de la Universitat Politècnica de València (UPV) y en el Proyecto Institucional de Competencias Transversales. La UPV pretende que sus alumnos y egresados desarrollen tanto competencias específicas de su título como competencias transversales, competencias que utilizarán tanto a lo largo de su vida profesional como en su vida personal. Es en ese contexto, en el que han surgido grupos de innovación docente como CTALENT, *Crear talento en colaboración con Organizaciones Públicas y Privadas. Aprendizaje de competencias para el Desarrollo Sostenible*, cuyo objetivo es integrar valores de solidaridad junto con los Objetivos de Desarrollo Sostenible (ODS) asociándolos al desarrollo de distintas competencias transversales y específicas, y haciendo copartícipes a actores externos a la Universidad, como organizaciones públicas, privadas y ONGD (organizaciones no

gubernamentales para el desarrollo), en definitiva enfocar la educación hacia el desarrollo sostenible desde las aulas universitarias.

El objetivo de este trabajo es introducir en las aulas universitarias acciones de sensibilización frente a la Crisis de refugiados que favorezcan el desarrollo de competencias específicas y transversales a las que contribuyen las asignaturas de los profesores del equipo CTALENT en el grado o máster al que pertenecen dichas asignaturas.

Una de las acciones llevadas a cabo en 2017 por CTALENT ha girado alrededor de la crisis de refugiados que padece Europa actualmente. Según datos de ACNUR, más de 5.000 personas murieron durante 2016 en el mar en su intento de alcanzar las costas europeas. En ese contexto, es muy importante sensibilizar a la sociedad frente a este problema, incluyendo a las futuras generaciones, y por ello es vital hacerlo desde los ámbitos universitarios y desde las propias aulas universitarias.

Para ello, con financiación del Centro de Cooperación al Desarrollo de la UPV en la convocatoria Glocal con el proyecto *Educación para la ciudadanía Glob-UPV*, apoyo del área de Cultura de la UPV y en colaboración con la Associació Professional d'Il·lustradors de València (APIV), se ha expuesto durante marzo y abril de 2017 en el Campus de Valencia de la UPV la exposición “Refugio Ilustrado: entre el ataúd y la maleta”. Esta exposición es una campaña gráfica abierta en apoyo a las personas migrantes, víctimas de la llamada “crisis de los refugiados” y de la inoperancia de los países europeos en la que han participado cerca de 200 ilustradores que han reflejado mediante el arte de la viñeta este grave problema.

El grupo de profesores también a través del proyecto de innovación y mejora educativa (PIME) *De la Universidad a las Organizaciones Públicas y Privadas: experiencias de aprendizaje desde las asignaturas* financiado por el vicerrectorado de Estudios, Calidad y Acreditación realiza actividades en las que los alumnos establecen contacto con la realidad a través de organizaciones públicas, privadas y ONGD.

Hemos de destacar la colaboración activa y relevante del Área de Cultura de la UPV que ha colaborado en la búsqueda de espacios para la exposición, en el montaje de la exposición tanto en la Casa de Cultura como en el Hall Solidari, en el diseño y elaboración de todos los carteles de las diferentes actividades, así como en la difusión de todas las actividades.

1. Metodología

Con la finalidad de introducir la Educación para el Desarrollo (EpD) en las asignaturas de segundo cuatrimestre vinculadas a los profesores del equipo de innovación y calidad educativa (EICE) CTALENT, se han diseñado varias acciones vinculadas a la Crisis de Refugiados que tienen como punto de partida la exposición del APIV Refugio ilustrado: entre el ataúd y la maleta. En la figura 1 se muestra el cartel de la exposición.

En primer lugar, se realizó una visita conjunta con los estudiantes a la exposición gráfica. La exposición estuvo primero en la Casa del Alumno, figura 2 y después en el Hall Solidari, figura 3. Previamente, se les había indicado que deberían formar equipos de 3-4 personas

para elaborar un pequeño video ó documento gráfico. Cada uno de los equipos tenía que elegir una ilustración de la exposición (la que más les gustase, llamase la atención o les pareciera más representativa del problema) y realizar una grabación de unos 3 minutos, indicando los motivos por los que elegían esa ilustración concreta, que destacarían de la misma y lo que más les había impactado, así como un comentario de la exposición en general y su opinión acerca de la crisis de refugiados. El enlace del video debían adjuntarlo a la tarea de la plataforma PoliformaT de su asignatura. Adicionalmente, de forma individual cada



Figura 1. Cartel exposición Refugio Ilustrado: Entre el ataúd y la maleta. Fuente: Area Cultura UPV a partir de la ilustración de Diego Flisfisch para el APIV

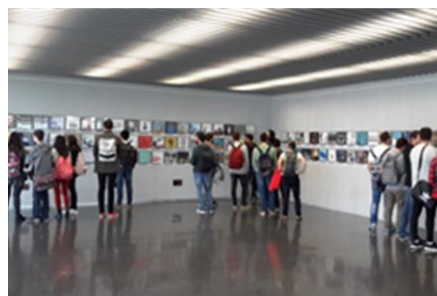


Figura 2. Visita exposición en la Casa del alumno UPV. Fuente: Profesores CTALent-UPV



Figura 3. Visita exposición en el Hall Solidari UPV. Fuente: Profesores CTALent-UPV

estudiante debía responder a la encuesta sobre su posicionamiento y opinión ante la crisis de refugiados. Esta encuesta estaba disponible en el QR del cartel de la exposición, y también podían responderla a través del blog de Ctalent. La exposición era de acceso libre y se publicitó en la propia universidad a través del Área de Cultura, del Centro de Cooperación al Desarrollo, de la Facultad de Administración y Dirección de Empresas, de la Escuela Técnica Superior de Ingeniería Industrial y de la Casa del Alumno de la UPV. También en el blog de CTALent así como en redes sociales. Otra de las actividades que se organizaron fue una Mesa Redonda: *Crisis de Regugiados: Acciones desde el aula*, figura 4, a la que se invitó a

ponentes relevantes por su compromiso con los valores de solidaridad, que pudiesen aportar su visión y valoraciones, tanto desde dentro de la Universidad como desde otros ámbitos fuera de la universidad. La Mesa Redonda tuvo lugar el 12 de abril en el Salón de Actos de Rectorado y estuvo centrada en el apoyo que las instituciones públicas prestan a los profesores para llevar a cabo acciones de sensibilización desde el aula en temas como la Crisis de Refugiados y la Agenda 2030 de Naciones Unidas con sus 17 ODS. También en mostrar acciones organizadas desde la sociedad civil para poner de manifiesto la inoperancia de las administraciones, principalmente en la Crisis de Refugiados, y como es posible encontrar sinergias desde las aulas con la sociedad civil, es el caso del APIV y de la ONGD InteRed. Por último, se difundieron las actividades que el grupo CTALMENT estaba llevando a cabo en estos temas.

Participaron como ponentes: Rosa Puchades Pla, vicerrectora de Responsabilidad Social, Cooperación y Deporte de la UPV; Federico Buyolo García, Director General de Cooperación y Solidaridad de la Generalitat Valenciana; Roberto Jaramillo Martínez, Concejal de Cooperación al Desarrollo y Migrantes, Transparencia, Gobierno Abierto y Auditoría Ciudadana del Ajuntament València; Miguel Ángel Giner Bou, Presidente de l'Associació Professional d'Il·lustradors de València; Eduardo García Ribera, Responsable Nacional de Voluntariado de la ONGD InteRed y como moderadora Nuria Portillo Poblador, coordinadora de CTALMENT. A esta mesa redonda, dirigida al público en general, estaban invitados de forma específica los estudiantes de las asignaturas implicadas. A priori no se conocía el nivel de participación, pero finalmente, el Salón de Actos estuvo lleno. Además de los alumnos expresamente invitados, hubo presencia de otros profesores y alumnos no vinculados a las asignaturas de los profesores del grupo y también de otras personas sin vinculación a la UPV.

El debate final de esta mesa redonda fue muy enriquecedor para todas las participantes, tanto ponentes como asistentes, y debido a la intervención de un par de voluntarias que habían estado recientemente realizando trabajos de voluntariado en campos de refugiados de Grecia, se consideró interesante realizar otra Mesa Redonda en la que estas voluntarias contasen sus experiencias recientes, principalmente a los estudiantes, pero también al público en general. Es por ello que la primera semana de mayo, bajo el título Experiencia compartida: la vida en un campo de refugiados, figura 5, se organizó una mesa redonda en la que participaron Inma Sánchez Lluch (Voluntaria Campo de Efigiados Idomeni, Grecia) y Ana Bayona Lluesa (Enfermera voluntaria del Campo de refugiados Elpida y Sinatex, Grecia). En esta mesa redonda participaron activamente un grupo de profesores del Proyecto de innovación y mejora educativa Pensamiento Crítico junto con sus alumnos. Esta mesa se grabó con el sistema de grabación de la UPV y está disponible para los alumnos de las distintas asignaturas.

En esta mesa se abordó el tema de la Crisis de los refugiados conjuntamente con la competencias transversales *Conocimiento de problemas contemporáneos* para los alumnos

de los profesores de CTALENT y *Pensamiento Crítico* para los profesores del PIME Pensamiento Crítico. Con una misma actividad se abordarán explícitamente dos competencias transversales con una fuerte vinculación entre ellas. Es necesario pensar críticamente para conocer, abordar y dar solución a los problemas contemporáneos que nos rodean y frente a los que no podemos quedarnos en una burbuja como si no nos afectaran. Esto está también estrechamente ligado con la Educación para la ciudadanía global y por supuesto con el nuevo paradigma de Gobierno Abierto en las administraciones públicas. Aunque se han detallado algunas de las actividades que se hicieron a partir de la exposición Regugio Ilustrado, en concreto, los resultados más detallados que se muestran en este trabajo son los del cuestionario sobre posicionamiento y opinión ante la crisis de refugiados. Este cuestionario se diseñó con la tecnología de los Formularios de Google. El acceso al mismo podía hacerse a través del código QR de los carteles de la exposición y de las dos mesas redondas, a partir del enlace disponible en el blog de CTALENT (<https://ctalent.blogs.upv.es/>), en los correos electrónicos donde se difundían las actividades y también en la plataforma PoliformaT para los alumnos de las asignaturas vinculadas a los profesores del equipo.

El acceso al cuestionario se activó el 10 de marzo de 2017, el primer día de la exposición en la Casa del alumno de la UPV. En total se han recogido 495 respuestas, 285 hasta el día 15 de marzo y el resto hasta el 16 de mayo de 2017. Se dividen las respuestas en dos periodos pues como se verá en el apartado de Resultados, las respuestas de ambos periodos son distintas, en concreto, existen diferencias estadísticamente significativas que se constatan a partir de la aplicación de los contrastes estadísticos más adecuados en cada caso.



Figura 4. Cartel Mesa redonda Crisis de Refugiados: Acciones desde el aula. Fuente: Area Cultura UPV a partir de la ilustración de Diego Flisfish para el APIV



Figura 5. Cartel Experiencia Compartida: La vida en un campo de refugiados. Fuente: Area Cultura UPV a partir de la ilustración de Miguel Angel Giner Bou para el APIV

2. Resultados

El cuestionario estuvo activo desde el 10 de marzo y se recogieron en total 495 respuestas. En la figura 6 se muestra el encabezado del cuestionario al que se hace referencia.



The image shows a survey form titled "Crisis de los refugiados" overlaid on a background of a chalkboard with handwritten notes. The chalkboard text includes: "Programas de reciclaje y agua", "Facilitar puntos de trabajo para los refugiados", "Participación de los refugiados en los ODS", "Crosby", and "los Campesinos refugiados". The survey form contains the following text: "Esta exposición se enmarca en el proyecto Educación para la Ciudadanía global-UPV en el que se aborda la Crisis de los Refugiados y los Objetivos de Desarrollo Sostenible 2030 en las asignaturas de los profesores del grupo CTALENT. Con el propósito de conocer su posicionamiento con la crisis de los refugiados, le agradecemos que responda a las siguientes cuestiones." Below this text are logos for "UNIVERSITAT POLITÈCNICA DE VALÈNCIA", "Àrea d'Iniciativa Cultural", "Centre de Cooperació al Desenvolupament", "Apiv", and "Talent". The main question is "¿Dónde has visitado la exposición 'Entre el ataúd y la maleta'?" with four radio button options: "Casa del Alumno", "Hall Solidari", "En la web ctalent.blogspot.com", and "En otra web".

Figura 6. Encabezado del cuestionario sobre la Crisis de Refugiados

Como ya se ha hecho referencia, hasta el día 15 de marzo incluido, se recogieron 285 cuestionarios que se han descartado del estudio puesto que existen respuestas no válidas.

Únicamente se podía escribir texto en los dos respuestas. En una, se ofrecen diferentes lugares donde se ha podido ver la exposición y se deja una respuesta libre para que se pueda escribir si es otro. En el lugar donde se afirma haber visto la exposición, nunca estuvo la exposición. La otra pregunta era el nombre del alumno. Solamente se llegaba a esta pregunta si se había marcado en la pregunta anterior la opción soy alumno de una asignatura de los profesores del equipo CTALENT. Aquí respondían nombres falsos u otras cosas no pertinentes. Se preguntaba el nombre a los alumnos pues responder al cuestionario formaba parte de una de las evaluaciones de la asignatura.

Otro de los motivos era el tiempo empleado en responder y el espacio temporal entre respuestas, menos de 2 minutos, una respuesta a continuación de otra y en un intervalos de aproximadamente 2 horas en diferentes tramos horarios incluso entre las 2 y 4 de la madrugada de varios días.

En este contexto se decidió estudiar que estaba pasando con las respuestas y si había diferencias estadísticamente significativas en ambos periodos de tiempo, hasta el 15 de marzo y posteriores a esta fecha. Tanto a nivel descriptivo, Gráfico 1, como a nivel poblacional, contraste de comparación de medianas con un p-valor de 0, las respuestas hasta el 15 de marzo y las respuestas después del 15 de marzo presentan diferencias estadísticamente significativas. El resultado del análisis para la variable catalogada como

Sociedad que responde a la pregunta: *Pienso que la sociedad debe intervenir proactivamente para resolver el problema de los refugiados* se muestra en el Gráfico 1.

Los cuestionarios hasta el 15 de marzo los hemos codificado como Troll con valor 0. Activamente, estuvieron respondiendo el cuestionario personas que no tenían el más mínimo interés en que se solucionara la crisis de refugiados como puede verse en el gráfico 1. Similar análisis se obtiene para cualquier otra pregunta del cuestionario. Si este fenómeno no se hubiera detectado, en los análisis posteriores habríamos concluido que en general, alrededor del 50% de la población no tiene ningún interés en resolver este problema, ni es sensible a él, ni le interesa lo más mínimo. Deducción que sería errónea.

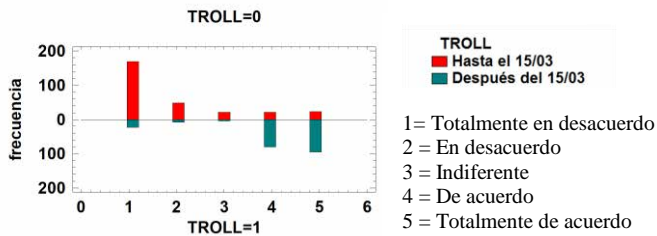


Gráfico 1 Comparación descriptiva sobre las respuestas antes y después del 15 de marzo para la variable Sociedad. Fuente: Elaboración propia

A partir de este punto se muestran los resultados del análisis de las respuestas posteriores al 15 de marzo.

La edad de los encuestados oscila entre 57 y 11 años situando el 50% de las edades entre 19 y 24 años, tal y como cabría esperar, puesto que el 95.67% de las respuestas son de alumnos de la UPV, siendo el 76.88% alumnos de asignaturas vinculadas con los profesores del equipo y el 18.79% de otros alumnos de la UPV.

En la Tabla 1 se muestran los resultados de los cuestionarios respecto a las preguntas de posicionamiento. La valoración va desde 1, totalmente en desacuerdo, hasta 5, totalmente de acuerdo. Se considera que la valoración es buena para las valoraciones 4 y 5. Las afirmaciones que se plantean en la encuesta se muestran en la Figura 7.

En otro bloque de afirmaciones, se pregunta el grado de acuerdo en organizar en la universidad actividades relacionadas con problemas o temas contemporáneos y en particular con la crisis de refugiados. Más del 70% de las respuestas están de acuerdo o muy de acuerdo con estas propuestas. En la figura 8 podemos ver las afirmaciones planteadas y en la tabla 2 los resultados del análisis.



Fig. 7 Posicionamiento frente a la Crisis de Refugiados

Fuente: Elaboración propia

Tabla 1. Resultado preguntas sobre Posicionamiento .Fuente: Elaboración propia

POSICIÓN	Sociedad		AAPP		Ciudadano		Ciudadano colabora	
	MEDIA	MEDIANA	MEDIA	MEDIANA	MEDIA	MEDIANA	MEDIA	MEDIANA
	4.03	4.0	3.88	4.0	3.77	4.00	3.66	4.00
% BUENA VALORACIÓN	83.34		75.21		74.65		70	
NIVEL VALORACIÓN								

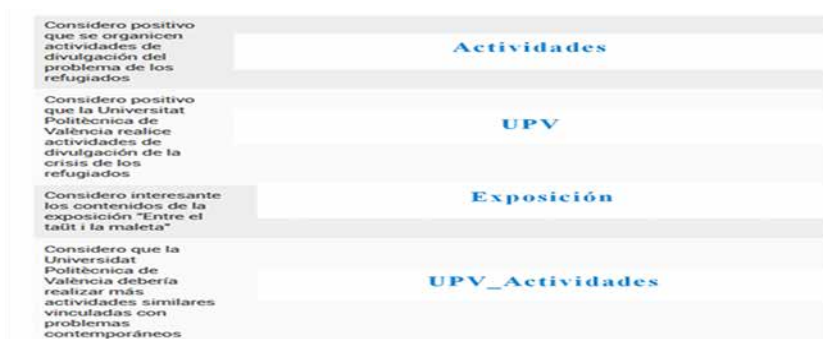
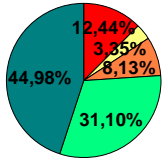
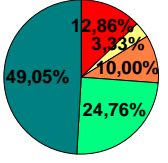
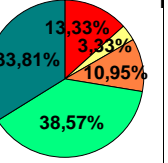
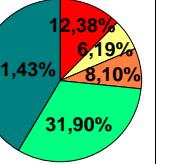


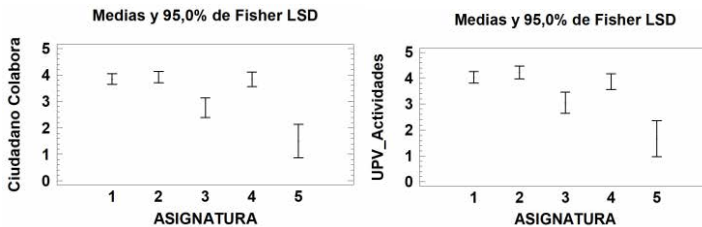
Fig.8. Organización actividades relativas a la Crisis de Refugiados

Fuente: Elaboración propia

Tabla 2. Resultado preguntas sobre la organización de Actividades. Fuente: Elaboración propia

POSICIÓN	Actividades		UPV		Exposición		UPV_Actividades	
	MEDIA	MEDIANA	MEDIA	MEDIANA	MEDIA	MEDIANA	MEDIA	MEDIANA
	3.93	4.0	3.94	3.93	4.0	3.94	3.84	4.00
% BUENA VALORACIÓN	76.08		76.81		72.38		76.08	
NIVEL VALORACIÓN								

En prácticamente todas las preguntas del cuestionario se ha estudiado si existen diferencias estadísticamente significativas en el grado de acuerdo respecto a la asignatura que cursan los alumnos vinculados a los profesores de este equipo. Se observa que si existen diferencias estadísticamente significativas, principalmente son los alumnos del Máster Universitario en Planificación y Gestión en Ingeniería civil los que puntúan más bajo con diferencia, y en



Indica la asignatura que cursas

- 1 Economía y empresa. Grado de Ingeniero de Organización Industrial
- 2 Estadística Aplicada a la Administración Pública. Grado de Gestión y Administración Pública
- 3 Gestión de Calidad. Grado de Gestión y Administración Pública
- 4 Gestión de la Calidad y Ambiental. Máster en Ingeniería Química
- 5 Habilidades Directivas. Master Universitario en Planificación y Gestión en Ingeniería Civil

Gráfico 2 Grado de acuerdo según asignatura . Fuente: Elaboración propia

algunos casos, los alumnos de la asignatura de Gestión de Calidad del Grado de Gestión y Administración Pública. Los resultados para la variable Ciudadano Colabora y para la variable UPV-Actividades se muestran en el gráfico 2.

También se ha estudiado si existen diferencias respecto a la edad, el país de origen, el vínculo con la UPV y el sexo pero no se han encontrado diferencias estadísticamente significativas.

Por último, con la intención de saber si los encuestados conocen los ODS, se preguntó explícitamente por ello y solamente el 37.56% conocía los ODS.

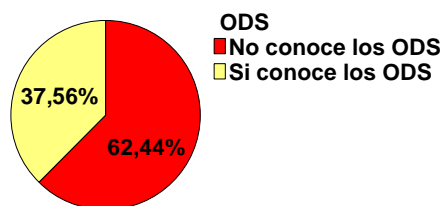


Gráfico 3 Conocimiento ODS. Fuente: Elaboración propia

3. Conclusiones

Respecto al cuestionario sobre el posicionamiento y la organización de actividades en torno a la Crisis de refugiados, en general, podemos indicar que la mayor parte de los encuestados, alrededor del 75%, están de acuerdo o muy de acuerdo en que la sociedad, las AAPP y ellos mismos como individuos deben colaborar en la resolución de la Crisis de los Refugiados, aunque en la última afirmación el porcentaje desciende al 70%. Por otro lado, en cuanto a organizar actividades de sensibilización respecto a la Crisis de Refugiados o similares, más del 72% están de acuerdo o muy de acuerdo en que deben organizarse. En general no se encuentran diferencias en torno a la edad, sexo, vínculo con la universidad ni país de origen para las afirmaciones planteadas.

Sobre el conocimiento de los ODS, aproximadamente el 37% los conocen. Resulta evidente la importancia de comenzar a trabajarlos en las aulas, y no solamente a nivel de conocerlos, es necesario ir más allá. El próximo proyecto de este equipo está centrado en incorporar explícitamente los ODS en nuestras asignaturas. Alguna pequeña experiencia ya se ha hecho durante el curso 2016-2017 pero es necesario seguir trabajando en ello.

Es importante destacar el fenómeno detectado en los primeros 6 días de la puesta en marcha del cuestionario coincidiendo con la inauguración de la exposición, y es que pocos ciudadanos muy activos pueden cambiar los resultados de un estudio. Se plantea la hipótesis de que son pocos ciudadanos puesto que la forma de responder cuestionarios aproximadamente cada 2 minutos en periodos de varias horas, incluso de madrugada, nos lleva a pensar que es la misma persona o un grupo reducido de personas respondiendo un cuestionario tras otro. Es relevante poner de manifiesto nuestra posición frente a la Crisis de

refugiados y también frente a otros problemas contemporáneos con la finalidad de que aquellos que más ruido hacen, aunque sean pocos, no ocupen todo el espacio.

En cuanto a la transferencia de este tipo de acciones, comentar que otros grupos de profesores se interesaron por este tipo de actividades y que finalmente, se organizó conjuntamente la segunda mesa redonda. Esto es muy positivo puesto que pone de manifiesto que este tipo de acciones son transferibles a otras asignaturas por otros profesores que también quieran emprender acciones de sensibilización en sus aulas.

Remarcar que estas acciones tienen necesariamente que ser únicamente de sensibilización, es posible vincularlas al aprendizaje de competencias transversales, tal y como se ha indicado en este trabajo, pero también a competencias específicas de los grados o másteres. En efecto, en algunas asignaturas de los profesores del equipo, los alumnos han realizado actividades vinculadas al aprendizaje de competencias específicas del título a las que contribuye la asignatura. Así por ejemplo, en la asignatura Estadística Aplicada a la Administración Pública del grado de Gestión y Administración Pública, los alumnos han realizado análisis estadísticos de conjuntos de datos vinculados a la Crisis de Refugiados que les han permitido comprobar de primera mano lo que habitualmente escuchan, leen o ven en diferentes fuentes de información como noticias, documentales o redes sociales entre otros, es real y al mismo tiempo han desarrollado competencias relacionadas con la estadística.

Las acciones emprendidas en este proyecto conectan directamente con la estrategia para la EpD de la Comunidad Valenciana que lidera la Dirección General de Cooperación y Solidaridad de la Conselleria de Transparencia, Responsabilidad Social, Participación y Cooperación. Incide directamente con la Agenda 2030 de Naciones Unidas y en los ODS con los que vamos a seguir trabajando en futuros proyectos. Permite incorporar a las asignaturas organizaciones externas a la UPV como en este caso el APIV e InteRed de manera que el mundo universitario se hace permeable a la sociedad. Es también un camino para fomentar conciencias críticas para la ciudadanía global y fomenta la participación en el nuevo paradigma de Gobierno abierto. Es por tanto una oportunidad que la universidad no puede desaprovechar y que desde las aulas universitarias es factible emprender.

4. Agradecimientos

Se agradece explícitamente la participación y colaboración de las distintas personas y organizaciones que han prestado todo su apoyo para que este proyecto fuera adelante y que han ido apareciendo en el trabajo.

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Diseño de una rúbrica para la evaluación de los Trabajos Final de Grado de la Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural

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Resumen

En este trabajo se presentan los resultados obtenidos en el desarrollo del proyecto de innovación docente “Herramientas para la planificación, realización y valoración de los Trabajo Fin de Grado (TFGs)”. Se ha elaborado un instrumento de evaluación, una rúbrica, especialmente diseñada para valorar los TFGs de la Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural (ETSIAMN). Con ella se pretende resolver la problemática a la que se enfrentan alumnos, tutores y miembros de tribunales respecto a la valoración de los TFGs, ya que no existen unos criterios claros y objetivos de evaluación, quedando su calificación sometida a consideraciones subjetivas. Actualmente es más detallado el documento para la evaluación de las competencias transversales desarrolladas por el alumno en la realización del TFG, que el utilizado para evaluar el propio TFG, y no existe ninguna guía de referencia. Los documentos disponibles se centran en aspectos formales y de contenidos mínimos. Por todo ello, se hace necesario desarrollar un documento “Guía del Trabajo Fin de Grado”, que proporcione instrumentos para una adecuada y óptima planificación y evaluación de los TFGs. Uno de los puntos clave ha sido la elaboración de una rúbrica con indicadores medibles que objetiven la calificación de los TFGs.

Palabras clave: evaluación, valoración, criterios, rúbrica-TGF.

Introducción

Los Trabajos Fin de Grado, en adelante TFGs, constituyen un trabajo de naturaleza profesional original en el que quedan de manifiesto los conocimientos, habilidades y competencias adquiridas por el estudiante a lo largo de sus estudios de Grado. Los tutores del TFG determinarán cuáles son los contenidos específicos del TFG, de acuerdo con las temáticas recogidas en la normativa correspondiente:

(http://www.upv.es/entidades/ETSIAMN/info/Normativa_Trabajo_Final1.pdf).

Actualmente existe cierta dificultad a la hora de planificar, realizar el seguimiento, y evaluar los TFGs, ya que no existe ninguna guía de referencia que regule estos aspectos. Este problema es común en numerosas Universidades (Monferrer *et al.*, 2012; Sayós *et al.*, 2016). Los documentos disponibles sobre los TFGs hasta el momento en la ETSIAMN se han centrado en aspectos formales y de contenidos mínimos.

Además, en muchos trabajos no se estima adecuadamente la dedicación del alumno, que frecuentemente invierte para la realización del TFG muchas más horas de trabajo que las reflejadas en los créditos correspondientes (12 ECTS). Los profesores tutores de los TFGs tienen que verificar durante la realización de los mismos que el alumno está llevando a cabo un desarrollo adecuado de las tareas correspondientes para alcanzar sus objetivos, de acuerdo con las competencias profesionales que debe trabajar durante su realización. No obstante, no se dispone de un documento donde se puedan recoger los progresos del alumno durante la realización del TFG y que permita al tutor verificar que se está llevando a cabo de forma adecuada.

Entre las estrategias habitualmente utilizadas para analizar las diferentes dimensiones y/o aspectos objeto de preocupación en torno a los principales agentes implicados en los procesos de elaboración, tutorización, presentación y/o defensa y evaluación de los TFGs, se encuentran las encuestas de opinión y las entrevistas al alumnado y a los tutores (Webster, *et al.*, 2000).

Uno de los aspectos críticos es la evaluación de los TFGs, cada vez más azarosa, pues al no disponer de unos criterios objetivos claros y establecidos, el alumnado puede percibir que se le está evaluando de manera subjetiva.

En el desarrollo del proyecto de innovación docente “Herramientas para la planificación, realización y valoración de los Trabajos Fin de Grado (TFGs)” uno de los primeros resultados ha sido la elaboración de un instrumento de evaluación, una rúbrica, especialmente diseñada para valorar los TFGs de la Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural (ETSIAMN) (Figura 1). Con ella se pretende facilitar, clarificar y objetivar la valoración de los TFGs.

Rúbrica para la evaluación del documento TFG y de la defensa

INDICADOR	NIVEL 1	NIVEL 2	NIVEL 3	NIVEL 4
Adecuación a objetivos formativos y competencias de la titulación	No se adecúa a los objetivos formativos	Se adecúa de forma parcial	Se adecúa en gran medida a los objetivos formativos	Se adecúa de forma completa a los objetivos formativos
Introducción y Objetivos	No aparecen los objetivos o se confunden con plan de trabajo o metodología.	Los objetivos no están claros y no se justifica el TFG. El problema a resolver no está definido.	No se especifican todos los objetivos o no quedan muy claros. La temática y contribución se justifica	Justifica la temática, especifica todos los objetivos y evidencia la contribución original.
Antecedentes y reconocimiento de trabajos previos ajenos.	No cita	Cita otros trabajos sin sistematización	Cita otros trabajos de forma sistemática	Cita el trabajo ajeno sistemáticamente y diferencia su aportación
Resultados	No se ha resuelto el problema planteado o la solución es errónea.	Muestra errores y omisiones y no se ajustan a la metodología.	Algunos errores u omisiones que no comprometen las conclusiones.	Adecuados al objetivo y coherentes con la metodología.
Evaluación de la solución aportada para alcanzar los objetivos del trabajo	No valora el resultado	Analiza el resultado sin valorarlo	Analiza el resultado y lo valora sin validarlo	Analiza el resultado, lo valora y lo valida
Organización de la información presentada durante la defensa	La presentación está desordenada y sin estructura lógica	La presentación está estructurada de forma confusa	La presentación está estructurada de forma clara, con algunos fallos menores	La presentación está estructurada de forma clara, lógica y bien cohesionada
Estilo, lenguaje corporal y registro ajustado a la defensa ante un tribunal académico	El nivel y registro no se ajusta al destinatario	Con frecuencia no se tiene en cuenta el destinatario	En general el estilo es adecuado	El estilo es adecuado
Recursos gráficos y medios para comunicar de forma efectiva.	No utiliza recursos gráficos ni ayudas visuales	Utiliza medios de apoyo que no ayudan	Utiliza medios de apoyo y recursos gráficos que ayudan pero no mejoran la efectividad	Diseño y utilización de recursos gráficos excelente y equilibrada.
Gestión del tiempo de la presentación.	Se excede el tiempo y el tribunal interrumpe	Se corta sin el cierre adecuado-	Demasiado deprisa o demasiado lento	Se ajusta al tiempo previsto
Interacción con los miembros del tribunal	No contesta o responde algo que no se corresponde con lo preguntado.	No es capaz de contestar a las preguntas	Responde pero en algunos casos, parece no entender la pregunta.	Responde de manera clara y concisa a las preguntas.
Resumen Indicador - Nivel				
Calificación	0-4.9	5 - 6.9	7-8.9	9 - 10

Figura 1. Versión inicial de la rúbrica para la evaluación de los TFGs.

El equipo de trabajo del proyecto de innovación ha querido trabajar de la mano de la Dirección de la Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural. Por ello, está formado por la Jefa de Estudios de la Escuela, la Subdirectora de la Comisión Académica del Título Grado en Ingeniería Agroalimentaria y del Medio Rural, el Subdirector de la Comisión Académica del Título Grado en Ingeniería Forestal y del Medio Natural, y por cinco profesores de las áreas de química, biología, botánica y tecnología de alimentos, que imparten docencia tanto en el Grado como en los Masteres, entre ellos una Directora de Departamento.

Las rúbricas se han propuesto y utilizado como elementos para la tutorización y evaluación del aprendizaje de los alumnos en enseñanzas universitarias (Torres y Perea, 2010; García-Ros, 2011; Raposo y Martínez, 2011), pero es imprescindible elaborar rúbricas que cumplan con criterios de fiabilidad y validez (Berrocoso, 2014). Existe una experiencia previa en cuanto al uso de rúbricas para el seguimiento y evaluación de los Proyectos Fin de Carrera, llevada a cabo en la Escuela Superior Politécnica de la Universitat Pompeu Fabra (Moreno *et al.*, 2012), cuyos primeros resultados, basados en informaciones provenientes tanto de directores, miembros de tribunal como de los propios estudiantes, muestran que, de manera global, el uso de rúbricas permite sistematizar tanto el seguimiento como la evaluación de los trabajos realizados, a la vez que facilita la homogenización de criterios (en clave de rigurosidad y transparencia). Otras Universidades, como la Universitat de les Illes Balears,

también están desarrollando proyectos de innovación docente para elaborar rúbricas para la evaluación de TFGs y TFMs (Jaume-i-Capó *et al.*, 2012).

Para elaborar la rúbrica se recopiló la información disponible y se analizó la situación de los TFGs en diferentes Escuelas de la Universitat Politècnica de València, revisando las rúbricas e instrumentos de evaluación disponibles para la valoración de los TFGs. En una primera aproximación, se elaboró una primera versión de la rúbrica que fue mostrada en Comisiones Académicas para recoger los comentarios de los miembros de las mismas.

Se ha conseguido elaborar una rúbrica con diferentes criterios para la valoración de los TFGs, que lleva asociada un intervalo de calificaciones para cada indicador, lo que permite realizar una evaluación más objetiva. Los indicadores se han seleccionado de manera que es posible evaluar tanto el documento-memoria de TFG como la exposición, parte presencial, realizada por el alumno durante la defensa pública del mismo.

Se han establecido cinco indicadores para evaluar el documento y otros cinco indicadores para evaluar la exposición del mismo. Asimismo, para cada indicador se han definido cuatro niveles de desarrollo, y cada nivel lleva asociada una puntuación numérica, para que la valoración del TFG se ciña a criterios objetivos y medibles.

Con el fin de dar difusión a la rúbrica para poder realizar las mejoras y correcciones oportunas, se preparó una encuesta (Figura 2) que, en primer lugar, se puso en disposición de las Comisiones Académicas de Título del Grado en Ingeniería Agroalimentaria y del Medio Rural, y del Grado en Ingeniería Forestal y del Medio Natural, donde se discutió y se realizaron algunos cambios a la misma. Allí se acordó su distribución, a través de correo electrónico, entre los diferentes grupos de interés (estudiantes de 4º curso de las Ingenierías anteriormente mencionadas, así como en el colectivo profesorado que imparte docencia en dichos grados y que pueden actuar como Tutores y/o como evaluadores (miembros de tribunales de evaluación), con el fin de que mostraran su conformidad (Sí) o disconformidad (No) con cada uno de los indicadores propuestos al tiempo que pudieron realizar las observaciones que consideren necesarias.

MEMORIA						
INDICADOR	NIVEL1	NIVEL2	NIVEL3	NIVEL4	ESTOY DE ACUERDO	OBSERVACIONES/SUGERENCIAS
Adecuación a objetivos formativos y competencias de la titulación	No se adecúa a los objetivos formativos.	Se adecúa de forma parcial.	Se adecúa en gran medida a los objetivos formativos.	Se adecúa de forma completa a los objetivos formativos.	<input type="radio"/> SI <input type="radio"/> NO	
Introducción (antecedentes) y Objetivos	No cita o lo hace exclusivamente con fuentes meramente divulgativas. No aparecen de manera explícita los objetivos o se confunden con plan de trabajo o metodología. No se plantea el problema que da sentido al TFG.	Cita otros trabajos, pero obviando aspectos importantes del tema tratado. Los objetivos están enumerados pero el problema al que responde el TFG no está planteado.	Cita otros trabajos, abarcando los distintos aspectos del tema tratado. Los objetivos son definidos y enumerados, aunque de forma incompleta.	Cita el trabajo ajeno sistemáticamente relacionándolos con los contenidos del TFG. Los objetivos están claramente definidos y enumerados. Responden a problemas claramente definidos.	<input type="radio"/> SI <input type="radio"/> NO	
Resultados	La expresión de los resultados es claramente inadecuada o existen errores metodológicos que afectan a su validez. No dan respuesta a los objetivos planteados.	Muestran errores y omisiones en la expresión de los resultados (gráficos, unidades, etc.) o no se ajustan a la metodología.	La expresión de los resultados es formalmente correcta. Se aprecian errores u omisiones que no afectan sustancialmente a las conclusiones.	Los resultados están correctamente expresados, están bien relacionados con los objetivos del TFG y son coherentes con su metodología.	<input type="radio"/> SI <input type="radio"/> NO	
Evaluación de la solución aportada para alcanzar los objetivos del trabajo	No valora el resultado.	Analiza el resultado sin valorarlo.	Analiza los resultados y los valora.	Analiza los resultados, los valora, valida y los contrasta con los objetivos planteados.	<input type="radio"/> SI <input type="radio"/> NO	
Adecuación del documento a la normativa en cuanto a estructura y aspectos formales	Ausencia injustificada de alguna de las secciones del documento y/o errores importantes en cuestiones formales: tablas, pies de figuras, etc.	Aparecen todas las secciones del documento pero se observan errores sistemáticos en cuestiones formales: tablas, pies de figuras, etc.	Aparecen todas las secciones del documento pero se observan fallos puntuales en cuestiones formales: tablas, pies de figuras, etc.	Aparecen todas las secciones del documento y no se observan errores significativos en cuestiones formales: tablas, pies de figuras, etc.	<input type="radio"/> SI <input type="radio"/> NO	
PRESENTACIÓN						
Organización de la información presentada durante la defensa	La presentación está desordenada y sin estructura lógica.	La presentación está estructurada de forma confusa.	La presentación está estructurada de forma clara, con algunos fallos menores.	La presentación está estructurada de forma clara, lógica y bien cohesionada.	<input type="radio"/> SI <input type="radio"/> NO	

Expresión oral, lenguaje corporal y registro de voz ajustado a la defensa ante un tribunal académico	El nivel y registro no se ajusta al destinatario: vocabulario no ajustado a los estándares académicos. Presencia y lenguaje corporal claramente inadecuados.	El registro no se ajusta en ocasiones al estándar académico. El ritmo de la presentación es inadecuado y abusa de la lectura directa del texto.	Registro adecuado con algunas carencias en cuanto al lenguaje corporal y la exposición oral.	Registro adecuado. Lenguaje corporal y expresión oral contribuyen eficazmente al seguimiento y comprensión del TFG.	<input type="radio"/> SÍ <input type="radio"/> NO	
Recursos gráficos y medios para comunicar de forma efectiva	No utiliza recursos gráficos ni ayudas visuales o bien son irrelevantes o inadecuados.	Utiliza ilustraciones que no aportan información relevante y recursos gráficos que no contribuyen a organizarla y estructurarla.	Utiliza ilustraciones que aportan cierta información y recursos gráficos que mejoran la organización y estructuración de la información.	Los recursos gráficos contribuyen de forma excelente a organizar y estructurar la información.	<input type="radio"/> SÍ <input type="radio"/> NO	
Gestión del tiempo de la presentación	Se excede el tiempo y el tribunal interrumpe.	El tiempo de presentación es adecuado pero el ritmo es demasiado lento o demasiado rápido.	El tiempo y ritmo de presentación son adecuados pero no se reparte el tiempo entre las partes del trabajo de forma apropiada.	Se ajusta al tiempo previsto.	<input type="radio"/> SÍ <input type="radio"/> NO	
Interacción con los miembros del tribunal	No contesta o responde algo que no se corresponde con lo preguntado.	No es capaz de contestar a todas las preguntas.	Responde a todas las preguntas, pero en algunos casos lo hace con argumentos ajenos a la finalidad y contenido de la pregunta.	Responde de manera clara y concisa a las preguntas.	<input type="radio"/> SÍ <input type="radio"/> NO	
CALIFICACIÓN	3-4.9	5-6.9	7-8.5	8.6-10	<input type="radio"/> SÍ <input type="radio"/> NO	

Figura 2. Encuesta sobre la rúbrica elaborada para evaluar los TFGs.

2. Objetivos

El objetivo de este trabajo es validar la rúbrica elaborada para la evaluación de los TFGs en la ETSIAMN, por los diferentes grupos de interés implicados (profesores y alumnos), con el fin de que pueda ser utilizada en las próximas convocatorias de defensa de TFGs.

Para ello, se ha pasado una encuesta por e-mail a los diferentes grupos de interés (estudiantes de 4º curso y profesorado, miembros de tribunales de evaluación), para que muestren su conformidad (Sí) o disconformidad (No) con cada indicador y añadan las observaciones que consideren oportunas.

3. Resultados

En la Tabla 1 se muestran los resultados de las encuestas pasadas a los grupos interesados (profesores, posibles Tutores o Cotutores de TFGs o miembros de tribunal, y alumnos matriculados en el TFG).

La encuesta preparada para la mejora y la validación de la rúbrica de evaluación de los TFGs de las Ingenierías Agroalimentaria y del Medio Rural, y de la Ingeniería Forestal y del Medio Natural fue contestada por 84 personas en total, 37 profesores, el 30% de los encuestados, y 47 alumnos, 50% de los encuestados.

En general, se puede destacar que la Encuesta sobre la Rúbrica tuvo una buena acogida y que los 10 indicadores fueron bien valorados por la mayoría de encuestados. La conformidad con los ítems propuestos osciló entre el 84 y el 94%, siendo una minoría los interesados que mostraron disconformidad con algunos de ellos. En concreto, los porcentajes de conformidad fueron los siguientes para cada uno de los ítems que figuran en la encuesta sobre la Rubrica Tabla 1): 86% (R1), 89% (R2), 88% (R3 y R4), 91,6% (R5), 94% (R6), 90,5% (R7), 94% (R8), 89% (R9) y 88% (R10). Entre los propuestos, los ítems mejor valorados fueron el 6 “*Organización de la información presentada durante la Defensa*“, y el 8 “*Recursos gráficos y medios para comunicar de forma efectiva*“, mostrándose de acuerdo 79 de las 84 personas que respondieron, lo que representa el 94% de respuestas favorables, seguido de los ítems 7, 2 y 9 con 90,5% y 89% de respuestas favorables. El ítem peor valorado fue el 1 que hace referencia a “*Adecuación de objetivos formativos y competencias de la Titulación*” con un 86% de respuestas favorables, que aún así es un valor nada despreciable. Entre el colectivo de los estudiantes destacar que los ítems en los que mostraron menor nivel de acuerdo fueron el 9 y el 10 que hacen referencia a “*Gestión del tiempo de la presentación*” e “*Interacción con los miembros del Tribunal*”, con 39 y 38 respuestas favorables de un total de 47 estudiantes encuestados, lo que representa 83 y 81% de conformidad.

Entre los encuestados, el profesorado realizó más observaciones a la redacción de los ítems que el colectivo de los estudiantes. Fundamentalmente, los comentarios y observaciones se centraron en algunos aspectos de la rúbrica. Por ejemplo, algunos sugerían incluir otros criterios de evaluación, así como ampliar los niveles de valoración, creando niveles intermedios, o bien todo lo contrario, es decir, reducir los intervalos de valoración a un único valor para cada ítem consiguiendo de esta manera menor dispersión en la nota final entre los miembros de tribunal.

Tabla 1. Resultados obtenidos en las encuestas pasadas a los colectivos implicados en la valoración de la rúbrica para cada indicador.

TOTALES	84	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
S	72	75	74	74	77	79	76	79	75	74	
N	12	9	10	10	7	5	8	5	9	10	
OBS	8	8	8	8	3	1	4	2	4	5	
PROFESORES	37	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
S	32	33	32	33	35	36	36	36	36	36	
N	5	4	5	4	2	1	1	1	1	1	
OBS	6	7	7	6	2	0	1	1	1	2	
ALUMNOS	47	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
	40	42	42	41	42	43	40	43	39	38	
	7	5	5	6	5	4	7	4	8	9	
OBS	2	1	1	2	1	1	3	1	3	3	

4. Conclusiones

Se ha conseguido elaborar una encuesta rúbrica para valorar los TFGs en la ETSIAMN con criterios de evaluación medibles y puntuables numéricamente. La rúbrica ha sido distribuida y valorada por los diferentes grupos de interés, que han podido expresar sus opiniones y revisar los indicadores con el fin de validar la rúbrica. La mayoría de los actores implicados han mostrado su conformidad con la rúbrica, por lo que se podría empezar a utilizar en las próximas convocatorias de defensa de TFGs.

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El plan de acción tutorial universitario: experiencia en 1º curso del Grado en Ingeniería Civil de la Universitat Politècnica de València

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Abstract

The main objective of the work is to know the strengths and weaknesses of the Program of Tutorial Action (PATU) from the point of view of first year students. For this purpose, the present text describes the way in which PATU has been organized at the UPV's School of Civil Engineering. Based on experience as a mentor, a survey and a questionnaire have been designed so that the students participating in the program can express their opinion and evaluate PATU at present, assess the relationship with the teacher-tutor and student-tutor and they can propose aspects in the program to be improved. Student performance has also been assessed.

Keywords: PATU, Tutorial action, teacher-tutor, student-tutor, mentoring.

Resumen

El objetivo principal del trabajo es conocer las fortalezas y debilidades del Programa de Acción Tutorial (PATU) desde el punto de vista de los alumnos de primer curso. Para ello en el presente texto se describe el modo en que se ha organizado el PATU en la Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos de la UPV. A partir de la experiencia como profesor-tutor, se ha diseñado una encuesta y un cuestionario para que los alumnos que participan en el programa puedan expresar su opinión y valorar el PATU en la actualidad, valorar la relación con el profesor-tutor y alumno-tutor y puedan proponer aspectos a mejorar en el programa. Se ha valorado el rendimiento del alumnado.

Palabras clave: PATU, Acción tutorial, profesor tutor, alumno tutor, tutorización.

Introducción

La figura del profesor tutor lleva varios años presente en la mayoría de las titulaciones impartidas en la Universitat Politècnica de València (UPV). En el año 2000 el Vicerrectorado de Coordinación Académica y Alumnado pone en marcha el PROYECTO EUROPA, (Una Enseñanza Orientada al Aprendizaje) integrado por cinco programas que perseguían adaptarse a los cambios producidos en las enseñanzas universitarias y facilitar y mejorar el proceso enseñanza-aprendizaje entre docentes y estudiantes. Uno de los programas de este proyecto era el AMA (programa de Ayuda a la Mejora en el Aprendizaje) cuyo objetivo era la “Ayuda a la mejora en el aprendizaje del alumno suministrándole instrumentos y métodos docentes alternativos que favorezcan el autoaprendizaje” (VCAA, 2000). El subprograma AMA3 era el dedicado a las tutorías profesores-tutores y su finalidad era “favorecer la orientación del alumno en sus estudios” ya que se había detectado la conveniencia de que los alumnos de nuevo ingreso en la universidad contaran con una figura de referencia que representara a la institución, le asesorara en materias de técnicas de estudio y le atendiera desde el punto de vista humano y del aprendizaje.

En el año 2004 el nuevo Vicerrectorado de Alumnado y Extensión Universitaria, pone en marcha el programa INTEGRAL, cuyo objetivo principal es “ayudar al alumno en su integración en la vida académica y social universitaria”, (VAEU, 2004) y que consta de tres acciones: las Jornadas de Acogida, diversos cursos de nivelación y el Plan de Acción Tutorial (PATU), (ver Cáceres y García, 2000 y Barrachina et al., 2011). Este tipo de iniciativa es común en muchas universidades de todo el mundo y su utilidad ha demostrado suavizar el comienzo de los estudiantes de primer año en la universidad (ver Pendleton, 2005 y Husband and Jacobs 2009).

En la Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos (en adelante ETSICCP) de la UPV se realiza el programa INTEGRAL desde hace más de una década. En el presente texto se va a detallar el modo en que se ha organizado el PATU en las últimas convocatorias y se van a presentar los resultados de una encuesta de opinión elaborada por los autores y contestada por los alumnos de nuevo ingreso que han participado en el programa.

1. Objetivos

El objetivo de la presente comunicación es describir el modo en que se aplica el programa PATU en la ETSICCP de Valencia, así como presentar una encuesta y cuestionario que se ha diseñado para conocer la opinión de los alumnos de nuevo ingreso del Grado en Ingeniería Civil (GIC) sobre el programa.

A partir de trabajos previos (Giménez-Carbó, Soriano y Gómez-Martín, 2011), y con la experiencia docente en la impartición de los nuevos Grados, los autores de la comunicación han confeccionado un cuestionario, que los alumnos participantes en el programa contestan anónimamente en el segundo cuatrimestre del primer curso. Además, se realizan entrevistas

personales a los participantes en el programa y a partir de toda la información se evalúa el resultado del programa y se establecen los aspectos a mejorar y las fortalezas del trabajo desarrollado.

Con los resultados obtenidos se pretende conocer las fortalezas y debilidades del PATU desde el punto de vista del alumno de primer curso. Con esta información se podrá retroalimentar la experiencia de la implantación del programa en la Escuela y se podrán introducir mejoras en los próximos cursos.

2. Métodos y materiales

Todos los alumnos que se matriculan por primera vez en la ETSICCP reciben información sobre las Jornadas de Acogida que se celebran en el mes de septiembre (fig. 1), justo antes del inicio de las clases. Además cada uno de los nuevos estudiantes tienen asignado un alumno tutor y un profesor tutor, aunque la participación en el programa es voluntaria.

En el curso 2016-17, cada profesor tutor de la Escuela tenía asignado un alumno tutor e inicialmente un grupo de 15 alumnos de primer curso. Estos datos varían cada curso al modificarse la matrícula y los profesores y alumnos que participan como tutores.



Figura 1. Tríptico informativo de las Jornadas de Acogida en la ETSICCP. Curso 2016-17. Fuente: ETSICCP-UPV.

Para incentivar la participación en el programa, la Escuela asigna 1 crédito ECTS de reconocimiento por actividades (equivalente a 30 horas de trabajo) a cada uno de los estudiantes que asiste a las jornadas de acogida y que completa el programa PATU. Esto conlleva participar activamente en al menos 6 reuniones (tanto grupales como individuales), asistir a las sesión formativa organizada por el Instituto de Ciencias de la Educación (ICE), y evaluar el programa.

Si por algún motivo el alumno de nuevo ingreso no ha participado en las jornadas de acogida, es labor del profesor tutor ponerse en contacto con ellos para convocarlos a las reuniones

grupales y que en cualquier momento se pueda integrar en el programa. La subdirección de Alumnado de la Escuela propone un calendario de reuniones mínimas que los participantes pueden ajustar a sus necesidades. En el curso 2016-17 la propuesta es la que aparece en la tabla 1.

Tabla 1. Propuesta de reuniones mínimas en el PATU en la ETSICCP (2016-2017). Fuente: Elaboración propia.

Sesión	Día	Horario	Mes	Organizada por	Lugar
Sesión 1: Asignación Planificación	1 de septiembre	11:30 a 12:30h	SEPTIEMBRE	Responsable INTEGRA	Salón de actos
Sesión 2: Información ETSICCP/UPV	15 de septiembre	12:15 a 14:15h	SEPTIEMBRE	Alumno Tutor	Aula informática
Sesión 3: Estrategias de aprendizaje	22 de septiembre	12:15 a 14:15h	SEPTIEMBRE	Grupo Tutorial	A decidir por el grupo
Sesión 4: Tutoría Individual	6 de octubre	12:15 a 14:15h	OCTUBRE	Profesor Tutor	A decidir por el tutor
Sesión 5: Identificar y RESOLVER problemas	27 de octubre	12:15 a 14:15h	OCTUBRE	Grupo Tutorial	A decidir por el grupo
Sesión 6: Seguimiento Fin	2 de febrero	12:15 a 14:15h	FEBRERO	Grupo Tutorial	A decidir por el grupo

Para culminar la participación en el programa que tiene establecida la duración de un curso, se pensó en el diseño de una encuesta y un cuestionario que junto con los resultados obtenidos en la evaluación académica del primer semestre de los estudiantes servirá para conocer su opinión y para que puedan proponer mejoras, tanto de la encuesta como del programa, a establecer en las siguientes convocatorias del PATU.

La encuesta desarrollada tiene un total de 20 preguntas elaboradas con la técnica de Likert (1932), con cinco niveles de respuesta. Las 20 preguntas están agrupadas en 4 grupos de 5 relacionadas con los siguientes aspectos: valoración general del programa PATU, valoración de la relación con el alumno-tutor, valoración de la relación con el profesor-tutor y aspectos a mejorar en el PATU. En la figura 2 se presenta la encuesta elaborada en el curso 2016-2017.


		Muy de acuerdo	De acuerdo	Indiferente	En desacuerdo	Muy en desacuerdo
1	Ha sido interesante participar en el PATU					
2	Se lo recomendaría a todos los alumnos nuevos de la UPV					
3	Se lo recomendaría a todos los alumnos nuevos de la ETSICCyP (aunque no sea su primer año en la UPV)					
4	PATU solo es interesante el primer año en la UPV					
5	Toda la información que me ha proporcionado el PATU, se me podría haber dado en una charla en una única sesión					
6	La relación con nuestro alumno-tutor ha sido fluida					
7	Ha sido interesante poder hablar con estudiantes de cursos superiores					
8	La relación con nuestro alumno-tutor ha facilitado mi integración en la Escuela					
9	La relación con nuestro alumno tutor nos ha servido para preparar mejor los exámenes					
10	Creo que no es necesaria la existencia de un alumno-tutor					
11	La relación con nuestro profesor-tutor ha sido fluida					
12	Ha sido interesante poder hablar con un profesor de temas no académicos					
13	La relación con nuestro profesor-tutor ha facilitado mi integración en la Escuela					
14	La relación con nuestro profesor tutor nos ha servido para tener confianza y sentirnos cómodos en la Escuela					
15	Creo que no es necesaria la existencia de un profesor-tutor					
16	Me gustaría que el programa PATU siguiera en los cursos posteriores					
17	Todos los aspectos que se han tratado en las reuniones me parecen interesantes					
18	El programa PATU solo sirve para canalizar las quejas y los problemas que nos surgen en el aula					
19	Me gustaría que la frecuencia de las reuniones fuera mayor					
20	Si en el futuro me surgen dudas o problemas, recurriré a mi profesor tutor					

Figura 2. Encuesta diseñada para conocer la opinión de los alumnos sobre el PATU. Fuente: Elaboración propia.

Además se completó la información recogida en la encuesta con un cuestionario (figura 3) donde los alumnos podían expresar de manera más abierta su opinión sobre el programa y dónde de manera anónima indicaban las calificaciones obtenidas en el primer semestre.

CAMINOS UPV ESCUELA TÉCNICA SUPERIOR DE INGENIEROS DE CAMINOS, CANALES Y PUERTOS

Por favor, contesta a las siguientes preguntas en esta hoja:

1. Indica los aspectos que más te han gustado del PATU.
2. Indica los aspectos que menos te han gustado del PATU.
3. Comenta los temas que te gustaría que se trataran en las reuniones.
4. ¿Te gustaría añadir algo más? (cosas que incluirías o no tendrías en cuenta en el programa, necesidades futuras que piensas podrías tener, aspectos a mejorar por parte de los profesores tutores o de los alumnos tutores, etc.)
5. ¿Te gustaría ser alumno tutor? ¿Por qué?
6. Indica las calificaciones obtenidas en las asignaturas del primer cuatrimestre:
Dibujo= Economía= Física= Matemáticas= Química=

Figura 3. Cuestionario diseñado para conocer la opinión de los alumnos sobre el PATU. Fuente: Elaboración propia.

3. Resultados

En el presente apartado se muestran los resultados obtenidos con el pase de encuestas y del cuestionario a los alumnos de primer curso.

3.1. Resultados de la encuesta

En las siguientes gráficas (fig. 4 a 11) se presentan los resultados de la encuesta realizada a un grupo piloto de 19 alumnos tutelados por 3 profesores-tutores distintos, del total de 74 alumnos del GIC que siguieron el PATU. Uno de los objetivos fijados para el próximo curso es pasar la encuesta a un número mayor de alumnos, con objeto de tener una muestra más representativa y poder obtener resultados estadísticamente significativos. En cualquier caso, se considera importante analizar los resultados obtenidos, ya que sirven como experiencia piloto de partida para desarrollar y mejorar tanto la encuesta como el programa en el próximo curso.

Aunque la escala Likert (1-5) permite operar con sus valores directamente (obtener estadísticos como media, desviación típica, etc.), en esta ocasión se ha decidido normalizarlos entre 0-10, de modo que para cuantificar los resultados se ha dado a la opción Muy De Acuerdo (MDA) un valor de 10, a la opción De Acuerdo (DA) un valor de 7.5, a la opción Indiferente (Ind) un valor de 5, a la opción En Desacuerdo (ED) un valor de 3.5 y finalmente a la opción Muy En Desacuerdo (MED) un valor de 0.

En el primer bloque de preguntas se hacía referencia al programa PATU en general. Resulta sorprendente que los estudiantes han puntuado más positivamente la cuestión 2 (Recomendarías el PATU a todos los alumnos nuevos de la UPV, figura 4) que la cuestión 1 (Ha sido interesante participar en el PATU). Esto puede ser debido a que si bien se valora

positivamente la participación en el programa, hay aspectos a mejorar que producen un ligero rechazo (como la excesiva dedicación durante los 2 primeros meses de inicio de los estudios universitarios). Sin embargo, la mayoría de los alumnos recomendaría participar en el programa, así que se puede considerar que lo valoran positivamente para su integración en la universidad. En la figura 5 se muestran los resultados obtenidos en las cuestiones 1, 3, 4 y 5.

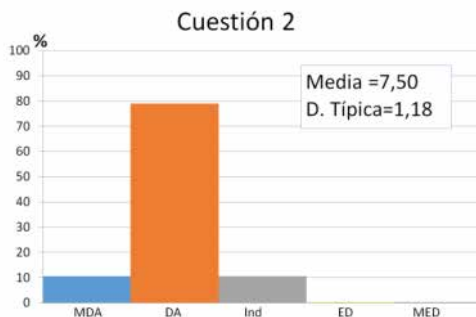


Figura 4. Resultados a la afirmación “Se lo recomendaría a todos los alumnos nuevos de la UPV”. Fuente: Elaboración propia.

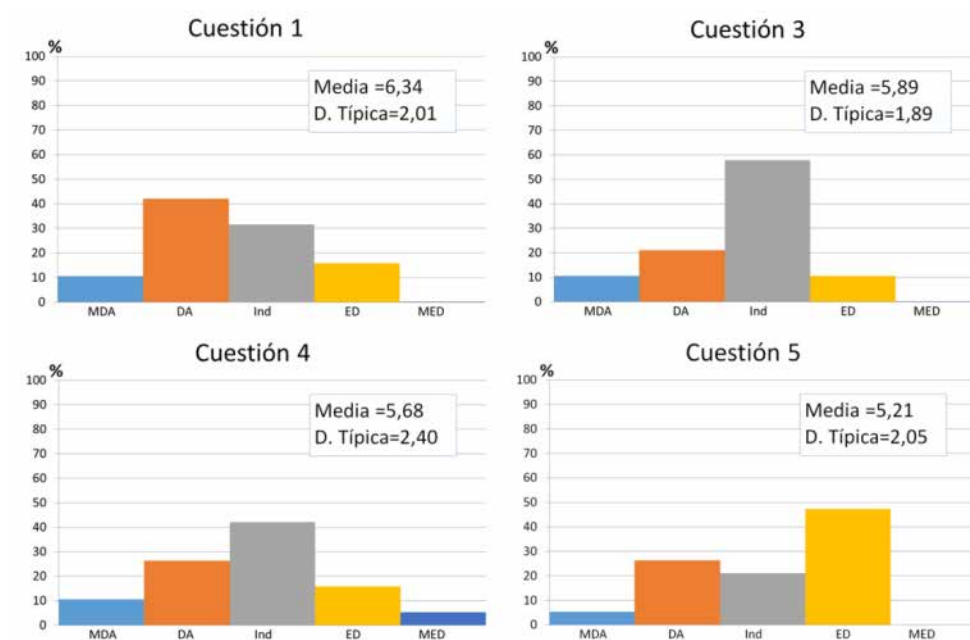


Figura 5. Resultados de las cuestiones 1, 3, 4 y 5 del primer bloque. Fuente: elaboración propia.

En el segundo bloque de cuestiones destinadas a conocer la opinión respecto al alumno tutor, el aspecto que más positivamente han valorado ha sido la oportunidad de poder hablar con estudiantes de su propia titulación de cursos superiores, que corresponde con la cuestión 7

(figura 6). También destaca en este bloque la valoración positiva que se realiza de la relación entre los nuevos alumnos y los alumnos-tutores (cuestión 6, figura 7).

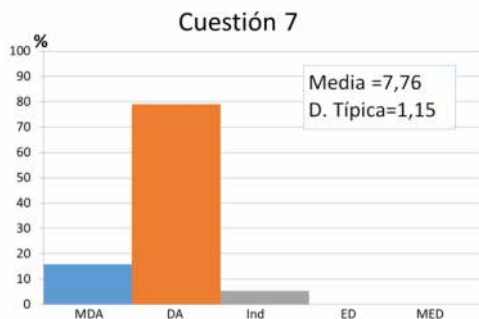


Figura 6. Resultados a la afirmación “Ha sido interesante poder hablar con estudiantes de cursos superiores”. Fuente: Elaboración propia.

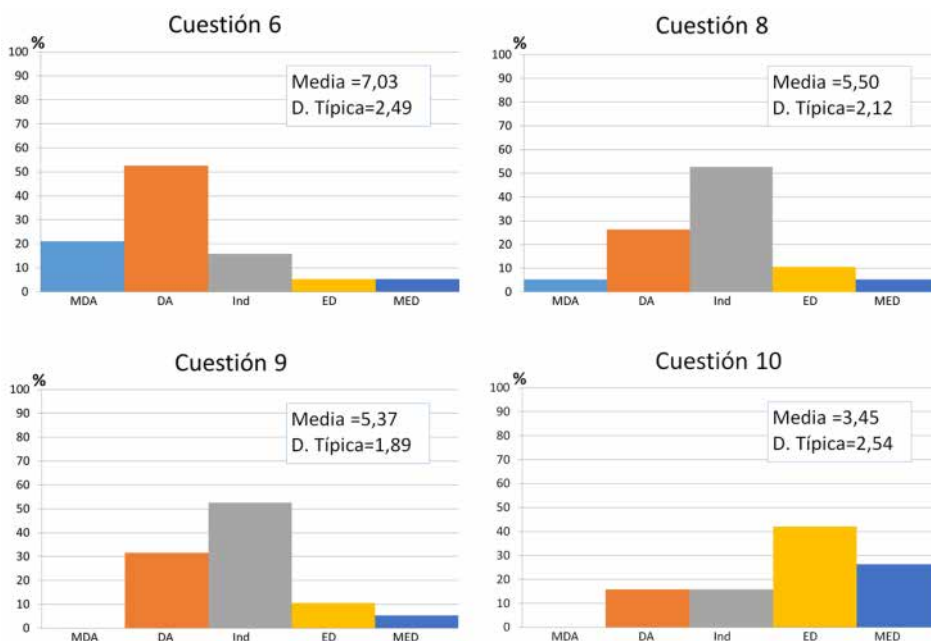


Figura 7. Resultados de las cuestiones 6, 8, 9 y 10 del segundo bloque. Fuente: Elaboración propia.

Hay que señalar que en este bloque y en el siguiente la formulación de la cuestión 10 y 15 en modo negativo, ha condicionado el tipo de respuesta que los alumnos han realizado. Este sería un aspecto a mejorar en los próximos años, ya que después de analizar las respuestas obtenidas, la cuantificación realizada para analizar los datos no es adecuada para este tipo de formulación. Las cuestiones 10 y 15 deberán plantearse para que su interpretación sea "the-

higher-the-better" (los mejores resultados corresponden a mayores valores), como el resultado de cuestiones para favorecer su interpretación y comparación.

El tercer bloque de cuestiones, dedicadas a conocer la opinión sobre el profesor-tutor, ha sido el mejor valorado. Los estudiantes dan una calificación superior a 7 en todas las cuestiones (excepto en la número 15, formulada de manera negativa, por los mismo motivos que se han explicado en el apartado anterior).

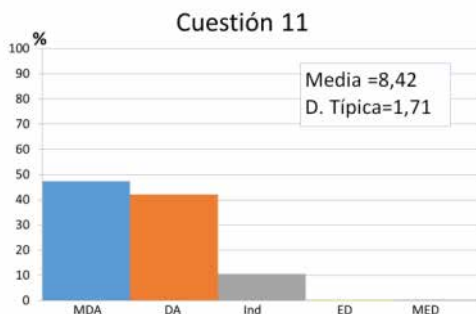


Figura 8. Resultados a la afirmación “La relación con nuestro profesor tutor ha sido fluida”. Fuente: Elaboración propia.

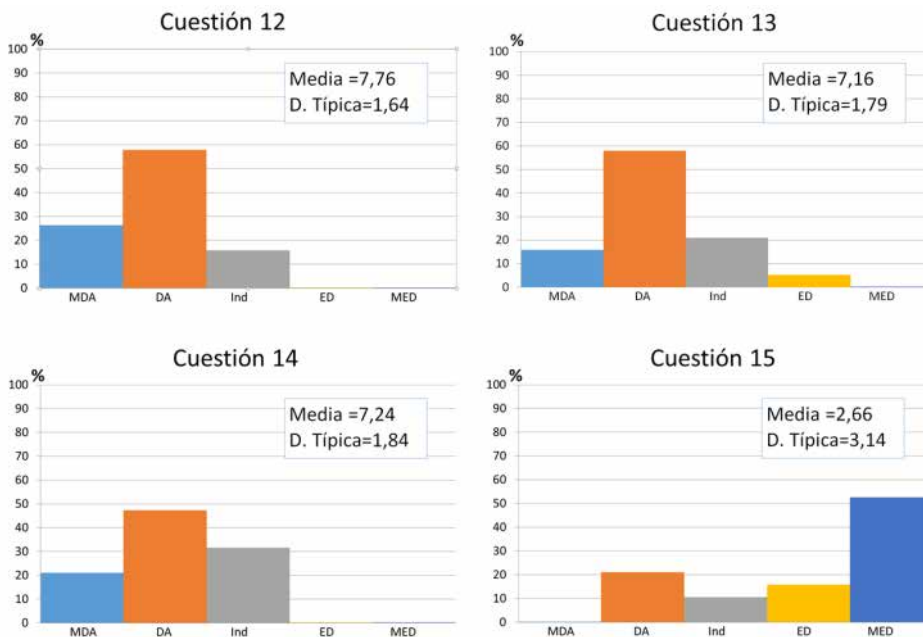


Figura 9. Resultados de las cuestiones 12, 13, 14 y 15 del tercer bloque. Fuente: elaboración propia.

La cuestión 11 “La relación con nuestro profesor tutor ha sido fluida” ha sido la que ha obtenido la mayor calificación (figura 8). Pero, como demuestran todas las respuestas de este

bloque (figura 9), la formación que reciben los profesores tutores, así como el carácter y la motivación de los docentes que deciden participar en el PATU hace que su intervención en el programa sea exitosa.

En el cuarto bloque (figuras 10 y 11), se han obtenido resultados interesantes respecto a las cuestiones sobre la continuidad del programa en cursos posteriores. Cabe destacar que a la mayoría de los alumnos les gustaría que el programa PATU siguiera en los próximos cursos.

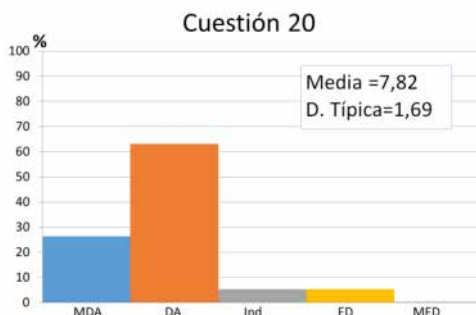


Figura 10. Resultados a la afirmación “Si en el futuro me surgen dudas o problemas, recurriré a mi profesor tutor”. Fuente: Elaboración propia.

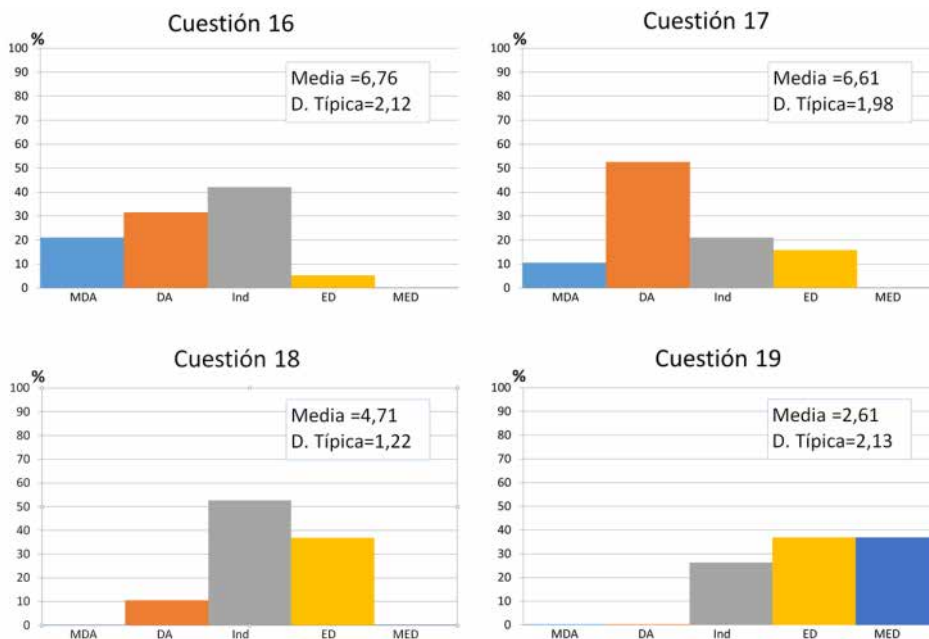


Figura 11. Resultados de las cuestiones 16, 17, 18 y, 19 del cuarto bloque. Fuente: Elaboración propia.

Por último, al aplicar el programa en la Escuela, se ha conseguido que los alumnos de primer curso tengan una persona de referencia durante la realización de sus estudios. Y de manera

mayoritaria recurrirán al profesor tutor si en el futuro les surgen dudas o problemas, tal y como queda recogido en la respuesta a la cuestión 20 (figura 10).

3.2. Resultados del cuestionario

En cuanto a los resultados obtenidos del cuestionario se puede decir que, en general, el grado de satisfacción de los alumnos noveles del grado en Ingeniería Civil con el programa PATU es muy elevado. Los estudiantes valoran la tarea de acompañamiento llevada a cabo por profesores y alumnos tutores y valoran muy positivamente tener personas de referencia a las que preguntar cualquier duda o cuestión relacionada con sus nuevos estudios.

Respecto a los aspectos negativos del programa, una queja generalizada, y que ya se ha comentado anteriormente, es el elevado número de reuniones a las que tienen que asistir durante los dos primeros meses del curso, además de a las jornadas de acogida y a las sesiones formativas organizadas por el ICE. Este es un punto que se debe revisar en la organización del PATU de cursos posteriores; deberán analizarse las ventajas de dar la máxima información posible en las primeras semanas de contacto con el nuevo escenario de estudio, con la posibilidad de dar esta información de manera más pausada a lo largo de un periodo de tiempo más largo o incluso dejar que el ritmo de suministrar información lo indiquen los estudiantes.

La mayoría de los alumnos de primer curso que han participado en el PATU manifiestan que se formarán para poder actuar como alumnos-tutores en cursos posteriores. Aunque esta disponibilidad no es solo altruista, sino que al hacerlo podrán conseguir los créditos por reconocimiento de actividades que las Escuelas proporcionan por participar en el programa. Todos los estudiantes que han sido encuestados han superado el primer semestre de la titulación con todas las asignaturas aprobadas y/o con una asignatura compensable, pero no podemos establecer la relación entre los resultados académicos y la participación en el programa PATU, ya que la nota media de acceso a la universidad de los alumnos participantes en la encuesta es de 10,20 sobre 14,00 (D. Típica = 1,50), mientras que la nota de corte en el GIC en el curso 2016-2017 ha sido 7,64. En general, se puede afirmar que existe una correlación entre los alumnos con mejores notas de ingreso y su participación voluntaria en este tipo de actividades, es decir que son los buenos alumnos los que se involucran en este tipo de actividades, por lo que hay un sesgo inicial en la población, de hecho, se suelen implicar más en este tipo de actividades quienes en realidad necesitan en menor medida la tutela porque iban a aprobar sin problemas igualmente y, probablemente con buenas notas.

4. Conclusiones

Tras el análisis detallado de todas las preguntas encuestadas se pueden extraer las siguientes conclusiones:

El aspecto del PATU mejor valorado por los alumnos de nuevo ingreso es la asignación de un profesor tutor. En todos los casos han valorado positivamente la relación establecida entre ambos.

Respecto a la relación con los alumnos tutores, se puede decir que la relación es buena y los alumnos de nuevo ingreso del grado en Ingeniería Civil se muestran satisfechos con la posibilidad de establecer una relación con estudiantes de su misma titulación de cursos superiores. Sin embargo se muestran indiferentes ante afirmaciones como “la relación con nuestro alumno-tutor ha facilitado mi integración en la Escuela” o “La relación con nuestro alumno-tutor nos ha servido para preparar mejor los exámenes”.

Cabe destacar que en la pregunta “si en el futuro me surgen dudas o problemas, recurriré a mi profesor tutor” sólo un estudiante ha mostrado sus reservas a hacerlo, y que a la mayoría de los nuevos alumnos les gustaría que el programa siguiera en cursos posteriores. Además, todos los alumnos que han realizado la encuesta se han mostrado de acuerdo en que recomendarían el programa PATU a todos los alumnos de nuevo ingreso en la UPV.

En cuanto a los aspectos a mejorar del programa, se puede decir que en general todos los estudiantes piensan que la frecuencia de las reuniones, junto con las jornadas de acogida y los distintos cursos que deben realizar en el ICE es demasiado elevada, especialmente en las primeras semanas del curso. Se podría analizar la posibilidad de espaciar en el tiempo estas tareas.

Finalmente, en cuanto a los aspectos a mejorar de la encuesta, cabe destacar que debe ser pasada a una muestra de alumnos mayor y deben reformularse las cuestiones 10 y 15.

En general, se puede afirmar que el trabajo desarrollado en el PATU tiene un impacto positivo tanto en los estudiantes de primer curso como en todos los participantes en el programa. Sin embargo, hay que seguir trabajando para potenciar su utilidad, valorar la posibilidad de implantarlo durante toda la duración de los estudios universitarios y así conseguir unos objetivos más ambiciosos y lograr que un mayor porcentaje de la comunidad universitaria se implique en su desarrollo.

5. Agradecimientos

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Códigos de Simulación de sistemas energéticos en el máster universitario de Ingeniería Industrial de la Universitat Politècnica de València

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Abstract

The use of simulation tools in subjects related to energy at the Polytechnic University of Valencia has been accelerated in recent years in order to improve acquired skills the students. This work describes the computer practical classes (complementary to theoretical classical classes) taught at the Chemical and Nuclear Engineering Department for the engineering master subject "Advance Energy and Thermal Machines". These experimental classes are focused on the study and management of heating and thermal simulation tools. It has been observed that simulation based training have increased students motivation towards two-phase fluid dynamics topics, since it reflects the broad career possibilities offered by these acquired competences.

Keywords: *Innovation, technology, simulation based training, TRACE*

Resumen

El uso de herramientas informáticas de simulación en la impartición de asignaturas relacionadas con la energía en la Universitat Politècnica de València se ha acelerado en los últimos años con objeto de mejorar las habilidades adquiridas por los estudiantes. Este trabajo describe las prácticas informáticas impartidas (complementarias a las clases teóricas clásicas) en el Departamento de Ingeniería Química y Nuclear para la asignatura de master de Ingeniería Industrial "Ampliación de Energía y Máquinas Térmicas". Estas clases prácticas se centran en el estudio y manejo de herramientas informáticas de simulación termohidráulica. Se ha comprobado cómo estas prácticas de simulación han incrementado la motivación de los estudiantes hacia los temas de dinámica de fluidos bifásicos, puesto que, entre otras, reflejan las amplias posibilidades profesionales que estas competencias adquiridas les ofrece.

Palabras clave: *Prácticas de simulación; Innovación; Sistemas energéticos; TRACE.*

Introducción

Tras el proceso de Bolonia [1], acuerdo que en 1999 firmaron los ministros de Educación de diversos países de Europa, se adoptó un sistema basado en dos ciclos y en base a esa nueva convergencia europea educativa en la Universitat Politècnica de València (UPV) se crearon nuevas licenciaturas y masteres [2]. Así, en la UPV, los estudiantes que terminan grado en ingeniería deben superar también el master en ingeniería industrial para poder firmar proyectos industriales como ingeniero.

El máster en ingeniería industrial se inició en el curso 2014-2015 y tiene 120 ECTS repartidos en dos años académicos. Desde su comienzo hasta ahora, el número de alumnos matriculados ha pasado de 169 a 304 en el presente curso 2016-2017.

Algunas de las asignaturas que en el master se imparten son reajustes de las asignaturas que estaban incluidas en la anterior carrera de ingeniería industrial, y otras son asignaturas completamente nuevas. Una de estas nuevas asignaturas es “Ampliación de energía y máquinas térmicas (AEMT)” que se imparte en el segundo semestre del primer año de master.

La enseñanza de la asignatura AEMT es compartida por dos departamentos. La primera parte del temario corre a cargo del departamento de Ingeniería Nuclear y la segunda parte es responsabilidad del departamento de Máquinas y Motores térmicos.

El trabajo que aquí se presenta corresponde a la parte docente del departamento de Ingeniería Nuclear, es decir, la primera mitad de la asignatura, cuyo temario se distribuye en 7 temas y se centra en el estudio del transporte del flujo bifásico, tal y como puede comprobarse en la tabla 1 donde se presenta el índice del temario de la asignatura.

Tabla 1. Temario de la primera parte de la asignatura AEMT (Dep. Ingeniería Nuclear, UPV)

TEMA	Título
TEMA 1	INTRODUCCIÓN
TEMA 2	PROPIEDADES DEL CAUDAL BIFÁSICO
TEMA 3	ECUACIONES DE TRANSPORTE PARA CAUDAL BIFÁSICO
TEMA 4	ECUACIONES DE TRANSPORTE PARA CAUDAL BIFÁSICO 1D
TEMA 5	REGÍMENES Y CORRELACIONES
TEMA 6	EBULLICIÓN. MODELOS DE FLUJO DE CALOR CRÍTICO (CHF)
TEMA 7	CONDENSACIÓN

La selección del temario, así como la preparación de las prácticas, se ha realizado procurando instaurar nuevas metodologías docentes, en detrimento de las tradicionales clases magistrales. Concretamente, la asignatura incluye una evaluación continua, así como una

enseñanza práctica con intervención activa del alumno a través de ejercicios, trabajo en grupo y clases prácticas.

Para esto último, la asignatura incluye prácticas basadas en la simulación de procesos de cambio de fase de un fluido con código termohidráulico. La simulación es una forma de enseñanza-aprendizaje donde los estudiantes están en contacto directo con lo que van a aprender en lugar de simplemente pensar en ello o de considerar la posibilidad de llegar a hacer algo con los conocimientos adquiridos.

Las herramientas de simulación de procesos físicos, procesos industriales o puramente numéricos presentan ciertas ventajas para la enseñanza tales como:

- son alternativas viables a la experimentación en laboratorios o instalaciones dadas la confiabilidad y la capacidad de la simulación para reproducir situaciones reales o hipotéticas, es decir, situaciones de riesgo industrial
- el coste económico de las simulaciones puede ser insignificante en comparación con las instalaciones de un laboratorio industrial o proceso que pretende ser estudiados o diseñados
- estimula la experimentación de los estudiantes con la modificación de las condiciones de simulación (inicial, contorno, etc.) para obtener rápidamente resultados en nuevas situaciones que deben ser analizados para extraer conclusiones del sistema;

Para estas prácticas, los estudiantes se agrupan en 18 grupos de prácticas de alrededor de 15 alumnos cada grupo, lo que permite que cada alumno pueda trabajar de manera independiente con un ordenador.

Las dos clases prácticas que incluye esta parte de la asignatura AEMT se basan en diseñar un modelo termodinámico basado en un sistema real y realizar experimentos con este modelo, a fin de comprender el comportamiento del sistema y evaluar los resultados obtenidos. En este trabajo se presenta la metodología de clases prácticas instaurada en la asignatura.

1. Objetivos y metodologías de las prácticas de simulación

Existen a día de hoy amplias alternativas de software termohidráulico, tanto de software libre como comercial. El software elegido para la realización de las prácticas es el código termodinámico TRACE [3] junto con la herramienta de entorno visual SNAP [4]. El programa AptPlot se utiliza para la representación de las variables de salida.

El código TRAC/RELAP Advanced Computational Engine (TRACE) es un código de simulación termodinámico de sistemas de reactores avanzados, desarrollado por la Comisión Nuclear Reguladora de Estados Unidos (NCR) para analizar el comportamiento neutrónico y térmico transitorio y estacionario de reactores de agua ligera. Por otro lado, el SNAP (Symbolic Nuclear Analysis Package) es una interfaz gráfica para ayudar a los usuarios a desarrollar los modelos y ejecutar el código (Figura 1).

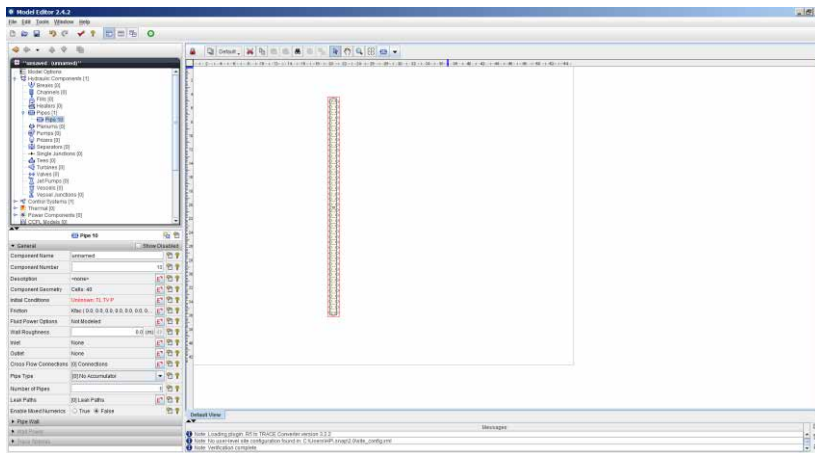


Figura 1. Interfaz gráfica del SNAP.

Para optar por el TRACE, ha sido necesario hacer un análisis detallado de alternativas de modelos físicos y matemáticos para poner en ejecución, destacando las ventajas y desventajas de cada uno de los códigos de acuerdo a las necesidades didácticas que estas prácticas presentan.

Las dos clases prácticas de la primera parte de la asignatura, se centran en introducir el funcionamiento de los códigos computacionales de flujo bifásico y la interpretación y manejo de los datos de entrada y salida. De esta manera se refuerzan los conceptos de teoría sobre los procesos de ebullición y condensación, dando la oportunidad a los alumnos de aplicar lo aprendido o bien de comprenderlo mejor.

El uso de programas de simulación permite incrementar el interés de los estudiantes al “aprender haciendo”. Se busca que los estudiantes recuperen la satisfacción respecto de sus aprendizajes utilizando estos complementos virtuales, que les abren nuevas opciones y les permiten aprender ciencia con motivación.

Las prácticas se centran en el análisis de los dos procesos del clásico ciclo termodinámico de vapor (Figura 2) en los que tiene lugar un cambio de fase. El ciclo de potencia a analizar es un ciclo representativo del proceso termodinámico que tiene lugar en una central térmica de vapor. Utiliza un fluido de trabajo que alternativamente evapora y condensa el agua.

La práctica 1 se centra en la caldera donde hay un cambio de fase de líquido a vapor (proceso 2-3), y la práctica 2 se centra en el condensador (proceso 4-1) donde hay un cambio de fase de vapor a líquido.

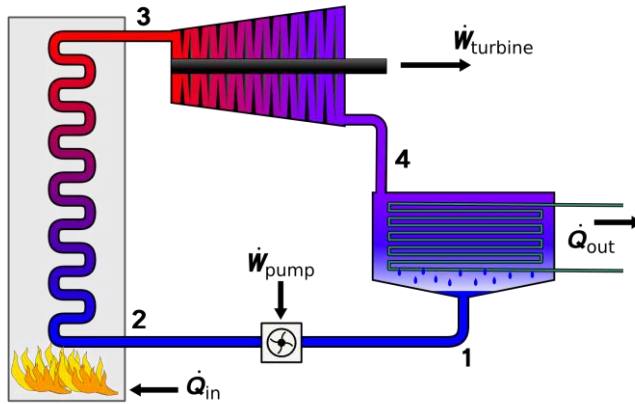


Figura 2. Ciclo de vapor

La tabla 2 recoge las diversas etapas que implican las clases de simulación descritas:

Tabla 2. Etapas de las prácticas de simulación con código termohidráulico

<i>Definición del problema</i>	Se fijan los objetivos y las preguntas a resolver.
<i>Planificación del proyecto</i>	Se analiza el software disponible y los pasos a seguir para llegar a los objetivos fijados. Se entiende el sistema de carpetas y ejecutables que el código a utilizar comprende.
<i>Definición del sistema</i>	Se estudian los límites y restricciones del problema. Se explican los diferentes códigos existentes (ventajas e inconvenientes de cada uno de ellos) y su fuente de distribución.
<i>Formulación conceptual del modelo</i>	Se realiza un diagrama de bloque inicial con la secuencia de pasos a llevar a cabo. Se explica cómo funciona el código y qué ecuaciones debe resolver (<i>six model equation</i>).
<i>Diseño experimental preliminar</i>	Se listan los tipos de datos que se necesitan y las bases de datos donde se pueden encontrar.
<i>Definición de los datos de entrada</i>	Se recolectan los datos de entrada necesarios para la simulación.
<i>Traducción del modelo</i>	Se traduce el modelo en el lenguaje computacional y se lanza la simulación
<i>Verificación y validez del modelo</i>	Se comprueba el funcionamiento del modelo, la convergencia de los resultados y su coherencia con datos reales
<i>Análisis de los resultados</i>	Se infieren los resultados y las conclusiones

1.1. Práctica 1

El objeto de estudio de la práctica 1 es la caldera. Se estudia la transmisión de calor hacia el fluido de trabajo (agua) a presión constante en la caldera. En un primer tramo del proceso el fluido de trabajo se calienta hasta la temperatura de saturación, luego tiene lugar el cambio de fase líquido-vapor y finalmente se obtiene vapor sobrecalentado.

El objetivo principal es analizar la variación de los regímenes de caudal bifásico (variando la potencia) en un modelo de una tubería vertical. Los datos de entrada necesarios para la simulación son dato del enunciado, y los alumnos se centran en generar el modelo de un tubo de la caldera introduciendo las variables de entrada y contorno (Figura 3).

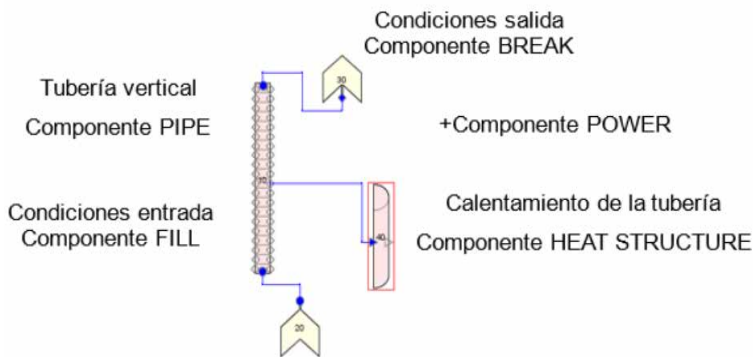


Figura 3. Modelo de un tubo de la caldera con SNAP

Tras la ejecución del modelo los alumnos analizan los resultados y estudian los diferentes regímenes de caudal bifásico (Figura 4) obtenidos para así entender los rangos de operación y validez e interpretar los resultados de los códigos termohidráulicos.

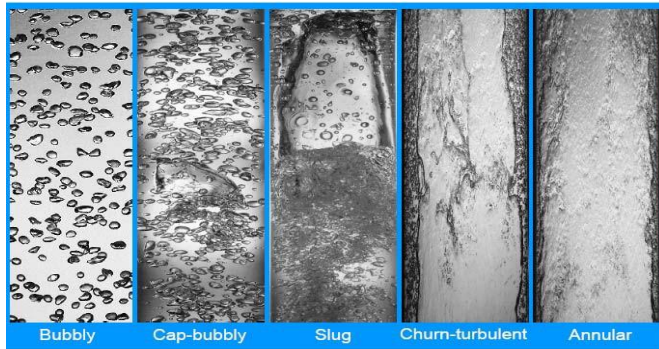


Figura 4. Regímenes de caudal bifásico.

1.2. Práctica 2

En este caso se estudia la transmisión de calor a presión constante desde el agua hacia el circuito de refrigeración, de forma que el fluido de trabajo alcanza el estado de líquido saturado. Se realiza en un condensador (intercambiador de calor), idealmente sin pérdidas de carga. En la práctica se modela un condensador para entender el proceso de ajuste de un modelo realizando sucesivas simulaciones en estacionario y transitorio hasta obtener la convergencia de los resultados.

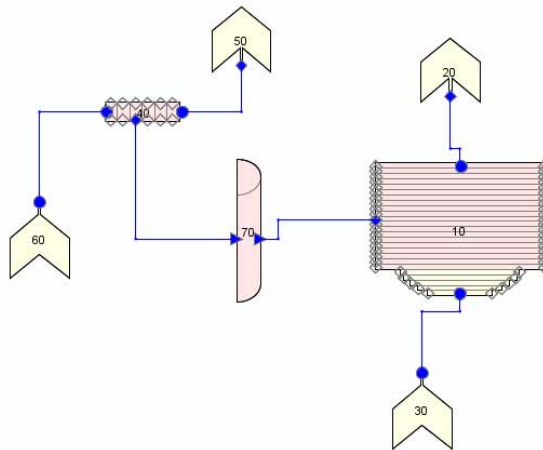


Figura 5. Esquema del condensador y el circuito secundario.

2. Evaluación

El trabajo autónomo y continuado del alumno es una parte muy importante del proceso de aprendizaje. Todo el trabajo realizado en casa, o durante las prácticas, es necesario para alcanzar los objetivos fijados en la asignatura.

Los sistemas de evaluación, se conocen antes de empezar el curso y consisten en que el alumno desarrollará un portafolio docente con las actividades y guiones de las prácticas, que supondrá un total del 10% de la nota (5% del primer parcial y 5% del segundo).

En la realización de las prácticas, los alumnos emplean un código informático de tipo profesional para el análisis de partes de una instalación industrial. Además, los alumnos desarrollan hojas de cálculo de apoyo para el análisis de resultados. Estos objetivos de aprendizaje permiten evaluar las siguientes competencias transversales:

- **Aplicación y pensamiento práctico.** Con la simulación se consigue que los alumnos apliquen los conocimientos a la práctica, atendiendo a la información disponible, y estableciendo el proceso a seguir para alcanzar los objetivos con eficacia y eficiencia. Durante las sesiones prácticas, el estudiante hace frente a situaciones en las que no basta aplicar recetas o fórmulas y en las que las soluciones deben estar argumentadas y acomodarse a los recursos disponibles.
- **Instrumental específica.** Las prácticas de simulación diseñadas hacen uso de las técnicas y las herramientas actualizadas necesarias para la práctica de la profesión asociada a la ingeniería industrial.
- **Análisis y resolución de problemas.** Durante las prácticas los alumnos deben analizar y resolver problemas de forma efectiva, identificando y definiendo los elementos significativos que los constituyen, lo que promueve así su capacidad de aprender, comprender y aplicar conocimientos de forma autónoma.
- **Comprensión e integración.** Con los informes a entregar con los resultados, los alumnos demuestran la comprensión e integración del conocimiento tanto de la propia especialización como en otros contextos más amplios.

3. Conclusiones

Con el uso de las computadoras han aparecido nuevas formas de aprendizaje para la enseñanza de las ciencias que posibilitan su acercamiento a alumnos. Las tecnologías de la información (TICs) aparecen como recursos didácticos a través de entornos virtuales tales como laboratorios virtuales y simuladores que brindan la posibilidad de trabajar en un ambiente de enseñanza e investigación de tipo “protegido”, con prácticas de muy bajo costo a las que no se tendrían acceso de otro modo, que además se pueden reproducir las veces que fueran necesarias hasta apropiarse de los conceptos [5].

En la asignatura AEMT, del master en ingeniería industrial en la UPV, se ha establecido un plan con el fin de transformar la manera de enseñar a través del uso de códigos computacionales para resolver problemas.

Los estudiantes adquieren conciencia en el transcurso de las clases de que la simulación es una de las herramientas más poderosas disponibles actualmente para el diseño y operación de máquinas térmicas complejas y se han convertido en una herramienta indispensable para los ingenieros que permite el estudio, análisis y evaluación de situaciones que de otro modo no sería posible analizar.

La simulación como herramienta de apoyo al estudio presenta numerosas ventajas, si bien es cierto que, como instrumento que es, debe ser bien utilizado. En nuestro caso, esta estrategia de aprendizaje ha permitido:

- a) La creación de un ambiente cautivador para los alumnos, fomentando su creatividad
- b) Utilizar el aprendizaje por descubrimiento y la combinación de experiencias de aprendizaje visuales e interactivas para ayudar a los estudiantes a afianzar los conceptos teóricos

Dado que en el nuevo sistema educativo el protagonista en el proceso de aprendizaje es el alumno y no el profesor, se ha orientado la asignatura a que estos adquieran no sólo conocimientos teóricos, sino también habilidades y capacidades generales y específicas que les permitan un mejor acceso al mercado laboral.

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Diseño de un modelo teórico conceptual de estrategias para motivación como apoyo al aprendizaje de las matemáticas

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Abstract

The paper describes process carried out to elaborate a proposal of a model of motivation strategies to improve learning of mathematics in students of Industrial Engineering and Civil Engineering. The aim was to generate a theoretical conceptual model of motivation strategies that mathematics teachers can apply to help students to lead and energize their behavior toward improve own academic achievement. The research has theoretical-descriptive approach and methodology used to design the model is qualitative, based on content analysis of articles that deal with motivation models for learning, review of motivation theories with cognitive approach and use of Soft Systems Thinking (synthesis and induction).

Keywords: *Motivation, Learning, Motivational Models, Theoretical Model.*

Resumen

En este trabajo se describe el proceso realizado para elaborar una propuesta de modelo de estrategias de motivación para mejorar el aprendizaje de las matemáticas en alumnos de Ingeniería Industrial e Ingeniería Civil. El objetivo es generar un modelo teórico conceptual de estrategias de motivación que puedan aplicar los docentes de matemáticas para ayudar a los estudiantes a dirigir y energizar su conducta hacia la mejora de su propio rendimiento académico. La investigación es de naturaleza teórica-descriptiva y la metodología utilizada para diseñar el modelo es de corte cualitativo, basada en análisis de contenido de documentos que tratan sobre modelos de motivación para el aprendizaje, revisión de teorías de motivación de enfoque cognitivo y uso del Pensamiento de Sistemas Suaves (síntesis-inducción).

Palabras clave: *Motivación, Aprendizaje, Modelos de motivación, Modelo Teórico.*

Introducción

La época actual que enfrentan los estudiantes universitarios de nuevo ingreso en carreras como ingeniería industrial o ingeniería civil, se caracteriza por un cambio del modelo tradicional de enseñanza a un modelo centrado en el aprendizaje y la incorporación de las tecnologías de la información y comunicación como herramienta de apoyo, lo que supone un mayor protagonismo de los estudiantes. Ante este escenario, vale la pena retomar lo expuesto por Villa (2006), quien plantea cinco críticas ante la nueva realidad social que impacta a las nuevas generaciones de estudiantes y que representan a su vez retos para los profesores universitarios: a) Descenso de la capacidad de concentración, b) Exceso de información, c) Saturación de la superficialidad, d) Pasividad y pérdida del espíritu crítico y e) Pérdida de la capacidad de razonamiento. Los cinco aspectos señalados por Villa también hacen notar la necesidad del cambio en el papel que debe desempeñar el profesor universitario dentro del aula y en los espacios virtuales, gracias a las posibilidades que brindan las tecnologías de información y comunicación para distribuir socialmente el conocimiento, lo que exige también mayores capacidades.

Los cambios en el rol docente son influenciados por el proceso de entrecruzamiento de las generaciones humanas que coexisten en la actualidad en las aulas universitarias. Actualmente, en las universidades convergen profesores que pertenecen a las generaciones de Baby Boomers (nacidos entre 1940 y 1964), en una menor proporción, y los de la Generación X (nacidos entre 1965 y 1979), con estudiantes que son de la Generación Y o también denominada “Millennials” (nacidos entre 1980 y 2000), que se caracterizan por ser nativos digitales (International Education Advisory Board, 2008). Las características sociales, económicas, culturales y tecnológicas de cada generación humana tienen muchas variantes en función del país o región de origen, lo que da lugar también a variantes en los objetivos, valores, formas de pensar, sentir, preferencias y motivaciones entre cada generación en relación a los procesos de aprendizaje.

La dinámica educativa en las aulas universitarias ha cambiado más drásticamente desde que los “Millennials” comenzaron a incorporarse a los sistemas escolares de educación superior. En el proceso de formación académica a nivel superior, el profesor universitario debe incorporar dimensiones importantes en su rol docente como motivador, facilitador, líder, organizador, evaluador y coordinador, que le permitan desarrollar de manera más efectiva su labor (Villa, 2006). En este trabajo se parte de la premisa de que, para tener un mejor desempeño académico y aprendizaje significativo bajo el nuevo modelo educativo en asignaturas de matemáticas, que son un soporte fundamental en la formación como ingeniero, se requiere también de un alto grado de motivación por parte del estudiante. Es decir, que de manera complementaria se conjuga el nuevo rol del profesor como guía y motivador y del estudiante como gestor de su conocimiento a partir de autocontrol, automotivación y autodisciplina. No obstante, en el contexto educativo universitario en

México y en el Estado de Hidalgo en lo particular, el empleo de estrategias de motivación para aprender matemáticas no son la práctica común, ni por parte de los profesores, ni de los mismos estudiantes.

1. Motivación y aprendizaje de matemáticas

En un estudio realizado por el Instituto Nacional para la Evaluación de la Educación (INEE) que tuvo como propósito identificar aquellas variables de la escuela que pudieran ayudar a comprender las diferencias en los niveles de logro educativo, en Español y en Matemáticas, de los estudiantes que terminan la primaria y la secundaria en México, considerando sus características sociales e individuales, se hace notar que las inasistencias del docente, la motivación del alumno y el equipamiento escolar impactan más en el aprendizaje de las Matemáticas que del Español (Backhoff, Bouzas, Contreras, Hernández y García, 2007). La consideración de la motivación del estudiante como una variable relevante de análisis en el aspecto individual denota la importancia de este factor para lograr un buen desempeño académico y reducir las tasas de deserción y reprobación. En dicho estudio se menciona además que los docentes y las escuelas varían en su habilidad para lograr que los estudiantes valoren la importancia del estudio y sus consecuencias, sobre todo en el caso del salón de clases, donde es necesario que el estudiante esté bien motivado para lograr aprendizajes significativos. De igual forma en dicho informe se destaca que la habilidad que tenga cada docente para generar esta motivación con sus alumnos resulta de primordial importancia para el logro de los objetivos educativos (Backhoff, et al., 2007).

De acuerdo a los resultados dados a conocer en el año 2015, correspondientes a la aplicación de la prueba PLANEA (Plan Nacional para la Evaluación de los Aprendizajes) realizada por el Instituto Nacional para la Evaluación de la Educación (INEE) y la Secretaría de Educación Pública (SEP) de México, el 81% de los estudiantes que finalizaron su educación media superior tuvieron 'deficientes' habilidades matemáticas, dado que, 51% de los jóvenes se ubican en el nivel I y 29.9% están en el nivel II (León, 2015). Lo anterior refleja para el caso de México, una problemática de deficiencia formativa en el campo de las matemáticas que se traslada de un nivel educativo a otro, en forma ascendente. Además incide en la deserción y reprobación escolar, que es un fenómeno que cada vez adquiere dimensiones más significativas en lo social y económico. En el caso de los estudiantes de Ingeniería Industrial e Ingeniería Civil de la Universidad Autónoma del Estado de Hidalgo, se tiene que en promedio el 34% de estudiantes de esas carreras no acreditaron las materias de Precálculo, Cálculo Diferencial e Integral, Álgebra lineal y Probabilidad y Estadística en el período 2012-2016.

En España, también se observan problemas con la enseñanza y aprendizaje de las matemáticas, ya que algunos expertos como Agustín Carrillo, secretario general de la Federación Española de Sociedades de Profesores de Matemáticas, han expresado que el

modelo tradicional de enseñanza de las matemáticas en la Secundaria no es efectivo y genera aversión, situación generada debido a que el programa académico está muy centrado en el cálculo, en la parte más abstracta de las matemáticas y muchos alumnos no entienden para qué sirven, además de que las formas de enseñanza limitan un mayor protagonismo a los alumnos a través de la experimentación (Torres, 2016).

Juarez y Limón (2013), consideran que en los estudios de nivel superior, la motivación es una parte fundamental en el proceso enseñanza-aprendizaje, ya que sin una adecuada motivación no habrá resultados en el aprendizaje, además de tomar en cuenta que la motivación debe corresponder a los intereses de los alumnos, es decir, no debe ser genérica. Estos mismos autores también hacen notar tres aspectos importantes en torno al tema de la enseñanza de las matemáticas: a) El aprendizaje de las matemáticas debe ser un proceso creativo y explicativo de la realidad, b) Los docentes están en la obligación de adecuar ad hoc la metodología empleada hasta el momento para impartir la asignatura de las matemáticas, y c) A nivel de la educación superior se debe investigar acerca de técnicas de motivación en matemáticas que puedan ser enseñadas a los profesores de todos los niveles para ser aplicadas en las aulas (Juarez y Limón, 2013). Sin embargo, a nivel universitario se carece de medios o modelos que faciliten el rol de motivador por parte del docente y sirvan a su vez de guía para los estudiantes para que puedan aplicar técnicas que los ayuden a automotivarse. Se hace necesario entonces, diseñar un modelo de estrategias de motivación que sirva de complemento al conjunto de estrategias de mejora implementadas en la enseñanza de las matemáticas.

2. Objetivo y utilidad de la investigación

El rol de motivador para el aprendizaje como bien señala Villa (2006) es una actividad preponderante en la nueva practica docente, por lo que vale la pena diseñar y poner en práctica un modelo de estrategias de motivación que considere el contexto sociocultural y familiar de los estudiantes. Por lo tanto, el objetivo de este trabajo de investigación es proponer un modelo teórico-conceptual de estrategias que ayuden a los estudiantes a dirigir y energizar su conducta hacia la mejora de su propio rendimiento académico en las materias de matemáticas.

En relación con el objetivo que se persigue, se considera que la investigación es de nivel descriptivo, ya que caracteriza un fenómeno o situación concreta indicando rasgos propios y diferenciadores, con la intención de conocer la situación predominante por medio de la descripción de las actividades, objetos, procesos y sujetos para la identificación de las relaciones que existen entre dos o más constructos (Cook y Reichardt, 2005; Münch y Ángeles, 2009; Hernández, et al., 2010). El modelo propuesto es susceptible de contrastación empírica en estudios posteriores, que se pretenden realizar una vez aplicado en las aulas.

Se considera que este trabajo tiene importancia y utilidad para los estudiantes de ingeniería industrial, ingeniería civil o carreras afines de ingeniería, así como para los docentes de asignaturas de matemáticas que apoyan en la formación de estos estudiantes, dado que el entendimiento y dominio de los conceptos y métodos usados en la solución de problemas con pensamiento matemático requiere de una alta dosis de motivación interna para su apropiación y puesta en práctica.

3. Metodología

Para elaborar el modelo visual propuesto se utilizó un modelo de investigación encuadrado en el paradigma cualitativo, que se caracteriza por que el investigador ve el escenario y a las personas en una perspectiva holística, se sigue un diseño de investigación flexible, se usa el método inductivo y se considera que todas las perspectivas son valiosas (Taylor y Bogdan, 1986). De acuerdo con Valles (citado en Bolseguí y Fuguet Smith, 2006), la metodología cualitativa tiene una lógica que sigue un proceso, donde a partir de una experiencia se trata de interpretar el contexto bajo diversos puntos de vista y su diseño está abierto a la invención (creatividad), la obtención de datos al descubrimiento y el análisis a la interpretación, aspectos con los que se concuerda para el diseño de ésta investigación.

Primeramente, se utilizó la revisión documental de modelos de motivación para el aprendizaje en estudiantes y como apoyo se empleó la técnica de análisis de contenido (método para estudiar y analizar los documentos de una forma sistemática, objetiva y cuantitativa) y la metodología comparada, lo cual permitió reflexionar sobre el tema y plantear los tópicos básicos a ser incluidos en el modelo. Como soporte para el diseño del modelo visual, se utilizaron las propuestas de Novak y Gowin (1998) para hacer mapas conceptuales y de Buzan (1996) para realizar mapas mentales. El método general de diseño empleado para estructurar el modelo consistió de cuatro fases: a) Identificación de las ideas principales; b) Construcción del bosquejo de ideas; c) Integración de los bosquejos de ideas; y d) Trazo final del modelo visual.

4. La motivación como factor de logro académico

En México como en otros países latinoamericanos se vive una crisis educativa que se visualiza de manera particular en altos niveles de reprobación, repetición y deserción escolar causadas de manera importante por la escasa motivación-estímulo del alumno, planes de estudio rígidos y un entorno socioeconómico que provee un clima negativo para un buen aprendizaje en general y de las matemáticas en lo particular. Lo anterior favorece la desmotivación en el estudiante y esto a su vez genera el sentimiento de inferioridad de que las matemáticas son las materias más difíciles y que sólo son comprendidas y usadas por los alumnos más capaces e inteligentes (Juárez y Limón, 2013).

El profesor universitario que imparte asignaturas de matemáticas en los primeros semestres de la carrera se enfrenta también a una larga cadena de distorsiones, deficiencias y aversión

hacia las matemáticas formada desde la educación básica hasta el nivel medio superior, donde el docente de esos niveles cumple con la enseñanza y aplicación de un programa pero no les brinda a los alumnos la ilustración de la aplicación y utilidad de las matemáticas en la vida real, ni cómo se interrelaciona con las demás ciencias, repitiendo en muchos casos estas experiencias en los niveles siguientes, lo que lleva a los alumnos a concluir que es más efectivo aprenderse de memoria las fórmulas que desarrollar un pensamiento lógico y analítico. Esa situación provoca que la gran mayoría de los estudiantes genere la costumbre de sólo preocuparse por acreditar las asignaturas de matemáticas, dejando de lado la finalidad básica de esta área, la cual es que el alumno desarrolle la capacidad de analizar y tener un pensamiento crítico (Juárez y Limón, 2013).

Derivado de lo anterior, se considera necesario que los estudiantes reciban un reforzamiento continuo e intenso durante los primeros periodos escolares a su ingreso en la universidad, de modo que tengan la motivación suficiente para el estudio de las matemáticas y generen una motivación intrínseca (que procede del propio sujeto basada en emociones positivas) que les permita percibir o experimentar que son competentes (Arana, Meilán, Gordillo y Carro, 2010). Para ello es importante que las tareas asignadas les permitan ejercitar sus propias posibilidades sin aburrimiento ni ansiedad, aumentando su autoestima y confianza.

El tener siempre la disposición a efectuar todo aquello que conduzca al cumplimiento de las metas académicas requiere de interés y de voluntad por parte del estudiante. La motivación se define como un estado psicoafectivo positivo y persistente en el tiempo relacionado con los estudios, que se caracteriza por vigor o energía para estudiar y aprender, a pesar de los contratiempos y dificultades; conlleva dedicación e implicación en los estudios y actividades de la carrera; y concentración y felicidad durante el desempeño de la actividad académica (Schaufeli, et al., 2002). Para Ajello (2003), la motivación se entiende como la trama que sostiene el desarrollo de actividades que son significativas para la persona. Myers (2005) indica que la motivación es la necesidad o el deseo que dirige y energiza la conducta hacia una meta. La motivación se puede considerar como el motor que mueve a una persona a realizar o no ciertas actividades en función de objetivos autoestablecidos, por lo que este elemento es importante para cumplir con las metas que se tengan. Por tanto, se considera que es necesario que el estudiante tenga claros sus objetivos académicos y una filosofía de vida que le permita canalizar toda su energía y focalizar su mente a la realización de actividades productivas en el plano académico.

Otro elemento que representa un motor para la motivación, es la integración del estudiante a la institución como tal, para sentirse miembro de la comunidad universitaria y en la que el profesor juega un rol importante. En este sentido, se comparte lo planteado por Tinto (citado por Fonseca y García, 2016), que hace notar que cuando un estudiante universitario no tiene claro su objetivo, meta y plan de vida, es más difícil que permanezca y concluya sus estudios. Las metas y los compromisos que se plantea un estudiante al inicio de su formación universitaria impactan directamente sobre las interacciones que genera con los

sistemas académicos y sociales de la institución e inciden también en su integración a éstos (Fonseca y García, 2016). Por tanto, se hace necesario un modelo de estrategias de motivación que contribuya a que los estudiantes definan o redefinan sus metas académicas y su plan de vida, es decir que realicen una planeación de su propio desarrollo académico.

5. Teorías y modelos de motivación enfocados al logro académico

De acuerdo a Santrock (citado por Naranjo, 2009), existen tres perspectivas respecto de la motivación: a) *Conductista*, que enfatiza que las recompensas motivan la conducta y dirigen la atención de las personas hacia acciones adecuadas y la distancian de las inadecuadas; b) *Humanista*, que destaca la capacidad humana para crecer, las cualidades personales y la libertad de elección; y c) *Cognitiva*, que hace énfasis en las ideas y considera que lo que la persona piensa que puede ocurrir es importante porque determina lo que ocurre.

En el campo de las teorías de la motivación la revisión documental permitió identificar ocho teorías. Para este trabajo se consideran de utilidad dos teorías. La primera es la propuesta por Alderfer (citado por Shermerhorn, 2002), que se denomina Teoría de Jerarquía ERG, cuyas siglas en inglés significan (Existencia, Relación y Crecimiento), que pertenece a la perspectiva Humanista y se fundamenta en la Teoría de la jerarquía de las necesidades de Maslow y la segunda es la Teoría de Expectativas de Vroom, que pertenece a la perspectiva Cognitiva (Naranjo, 2009).

La Teoría ERG sostiene que las personas tienen tres conjuntos básicos de necesidades presentes de forma simultánea, estas son: necesidad de existencia (deseos materiales y fisiológicos), necesidad de relación (relaciones con otras personas, que busca satisfacer el compartir pensamientos y sentimientos) y la necesidad de crecimiento (que motivan a las personas a cambiarse a sí mismas en forma productiva y creativa). La teoría ERG es más consistente con el conocimiento que se tiene acerca las diferencias individuales entre la gente, ya que variables como la educación, los antecedentes familiares y el ambiente cultural pueden modificar la importancia o la fuerza impulsora que tiene un grupo de necesidades para un individuo determinado. Lo anterior plantea a los individuos una lucha interna a efecto de establecer cómo pueden ser satisfechas para lograr un nivel óptimo de motivación (Shermerhorn, 2002; Naranjo, 2009).

La Teoría de Expectativas de Vroom, considera que las personas se motivan a realizar cosas y esforzarse por lograr un alto desempeño para alcanzar una meta si creen en su valor (Valencia), si están seguras de que lo que harán contribuirá a lograrla (Expectativa) y si saben que una vez que alcancen la meta recibirán una recompensa (Instrumentalidad), de tal manera que el esfuerzo realizado ha valido la pena (Naranjo, 2009). La Teoría de Expectativas fue enriquecida con propuestas de Porter y Lawler (Fundació Factor Huma, 2012) y proponen que la fuerza de la motivación de una persona en una situación

determinada equivale al producto entre el valor que la persona le asigna a la recompensa y la expectativa de su posible logro.

A partir de una búsqueda y revisión documental en fuentes bibliográficas y electrónicas se identificaron cuatro modelos que están enfocados a la motivación académica. Estos modelos son: Modelo de Motivación MUSIC (eMpowerment, Usefulness, Success, Interest, and Caring) desarrollado por Jones (Jones, 2009; Jones, 2017; Jones, Li y Cruz, 2017), el Modelo de Gestión de Recursos Humanos o Human Resource Management (HRM) aplicado a la enseñanza propuesto por Spiljak, Sladoljev, Rizmaul y Krnajski (2005), el Modelo TARGET (Task, Authority, Recognition, Grouping, Evaluating, Time) desarrollado por Ames y Epstein (Deemer, 2004; Bowler, 2009; Seifert, 2011; Braithwaite, Spray y Warburton, 2011), y el Modelo de Diseño Motivacional ARCS (Attention, Relevance, Confidence, and Satisfaction) diseñado por Keller (Dempsey y Johnson, 1998; Marshall y Wilson, 2013).

A partir de la revisión de los modelos enunciados se realizó un ejercicio de comparación de las estrategias propuestas. El número de categorías o dimensiones que contempla cada modelo difiere entre ellos, pero se puede reconocer la semejanza que existe entre algunas de las estrategias propuestas por los autores en los cuatro modelos revisados.

En la Tabla 1 se muestran las dimensiones o categorías de los modelos de motivación identificados, mismas que se han agrupado por colores de acuerdo a la similitud que se observa entre ellas.

Tabla 1. Modelos de motivación enfocados al aprendizaje. Fuente Elaboración Propia en base a Jones, 2009; Jones, 2017; Jones, Li y Cruz, 2017; Spiljak, Sladoljev, Rizmaul y Krnajski, 2005; Deemer, 2004; Braithwaite, Spray y Warburton, 2011; Dempsey y Johnson, 1998; Marshall y Wilson, 2013.

	MUSIC	HRM	TARGET	ARCS
Dimensión / Categoría	eMpowered eMpodamiento (Tener la capacidad de tomar decisiones sobre algunos aspectos de su aprendizaje)	Diseño del trabajo o actividad (Uso de diferentes habilidades, identificación con la tarea, significado de la tarea, autonomía y retroalimentación)	Task Tarea (Diseño de actividades de aprendizaje)	Attention Atención (Capturar el interés del estudiante, estimulando la curiosidad para aprender)
	Usefulness Utilidad (Entender por qué lo que están aprendiendo es útil para sus metas a corto o largo plazo)	Participación y formas de alcanzar una mejor calidad (Círculos de Control de Calidad, reconocimiento de problemas y necesidades, diseño de soluciones)	Authority Autoridad (Desarrollo del sentido de control personal, toma de decisiones y de independencia)	Relevance Relevancia (Satisfacer las necesidades y metas del alumno, logrando un resultado positivo)
	Success Éxito (Creer que se puede tener éxito si se hace el esfuerzo requerido)	Administración por Objetivos (Establecimiento de metas y objetivos, definición de métodos de evaluación)	Recognition Reconocimiento (Uso de incentivos y premios formales e informales, tangibles e intangibles)	Confidence Confianza (Ayudar a construir la creencia de que se tendrá éxito y dar al estudiante el control sobre su éxito)
	Interest Interés (Estar interesado en el contenido y las actividades de instrucción)	Trabajo en equipo (Delegación de tareas y Empoderamiento)	Grouping Agrupación (Criterios para la selección y configuración de grupos de trabajo)	Satisfaction Satisfacción (Reforzar los logros con recompensas internas / externas)
	Caring Cuidado (Creer que el profesor y los compañeros de grupo se preocupan por su aprendizaje y como persona)	Cultura del salón de clase (Establecimiento de valores, creencias y una visión compartida)	Evaluation Evaluación (Estándares de desempeño considerados importantes y métodos de evaluación del aprendizaje)	
	Automotivación (Estar preparado para actuar con excelencia, tomar iniciativa, asumir riesgos y responsabilidad, adaptarse al cambio, tomar decisiones y trabajar en equipo)	Time Tiempo (Ritmo de aprendizaje)		
	Enfoque de Cuadro de Mando Integral (Balanced Scorecard) (Enfoque en cuatro perspectivas: Cliente, Interna, Innovación y Aprendizaje y Financiera)			

6. Diseño de un modelo de estrategias para la motivación

Un elemento importante en el manejo de sistemas y uso del pensamiento sistémico es el concepto de modelo. Etimológicamente, modelo proviene del italiano modello, y éste del latín modulus (molde, módulo), que quiere decir cantidad que sirve de medida o tipo de comparación, pero su uso en el ámbito de los sistemas se refiere a una abstracción de la realidad que sirve para examinar las relaciones entre factores considerados importantes en el funcionamiento de un sistema (Ander-Egg, 2001). Chesnut (1965) citado por Wilson (1993), define un modelo como una representación cualitativa o cuantitativa de un proceso o una tentativa que muestra los efectos de aquellos factores que son importantes para los propósitos que se consideran. Para Checkland (1993) un modelo es una construcción intelectual y descriptiva de una entidad en la cual al menos un observador tiene un interés y hace notar que el observador quizá desee relacionar el modelo y de ser adecuado, los mecanismos de este con los observables en el mundo. Wilson (1993) define un modelo como la interpretación explícita de lo que una persona entiende de una situación o tan solo de las ideas de una persona acerca de esa situación. Dicho modelo puede expresarse con matemáticas, símbolos, o palabras, pero en esencia es una descripción de entidades, procesos o atributos y las relaciones entre ellos. El modelo puede ser prescriptivo o ilustrativo, pero sobre todo, debe ser útil (Wilson, 1993).

A partir de las definiciones anteriores se puede entonces decir que, un modelo es una representación abstracta de un sistema o una descripción simplificada de un sistema y de sus elementos que sirve como patrón o guía de actuación o comportamiento para imitarlo o reproducirlo. En este trabajo los autores toman como referente conceptual de lo que es un modelo lo propuesto por Checkland y Wilson.

El análisis realizado y mostrado en la Tabla 1, da cuenta de las características y componentes de cada uno de los modelos de motivación descritos en ella, mismos que son usados como base para generar un modelo teórico y visual denominado *Modelo Entrelazado de Estrategias de Motivación* (MEEM). El modelo integra bajo un enfoque sistémico las estrategias de dichos modelos consideradas por los autores como clave para generar la motivación académica en los estudiantes. Las estrategias seleccionadas son: *Diseño de la actividad, Utilidad del conocimiento, Reconocimiento, Interés, Empoderamiento, Planeación para establecer objetivos y metas, Agrupamiento y Confianza*. Además se incluyen cinco estrategias adicionales para generar motivación que surgen de la revisión bibliográfica a través de un ejercicio de síntesis-inducción, que son: *Tecnointelecto*, que se refiere a usar las tecnologías de información y comunicación para mejorar la inteligencia y potenciar la capacidad cerebral, ejercitar la capacidad de análisis y síntesis utilizando las herramientas tecnológicas disponibles o que se tienen al alcance.

Pasión, que se orienta a encontrar los temas que cautivan o atrapan y permite ocuparse en tareas para impulsar la memoria y la creatividad, mantener el entusiasmo por desarrollar el propio talento.

Socialización intelectual, enfocada a pensar o reflexionar colectivamente, compartir ideas, interactuar con los demás para fomentar y reforzar el conocimiento, así como estimular procesos de empatía.

Sentido de pertenencia, que se orienta a contruir una comunidad aprendizaje activo en la que se genere solidaridad y apoyo en el proceso de comprensión del conocimiento, así como en el desarrollo personal. Se busca establecer relaciones de afecto y empatía que faciiten la interacción entre los individuos (alumno-alumno, alumno-profesor).

Curiosidad, que busca generar una actitud exploradora e incentivar una actitud orientada a comprometerse con la “diversidad cognitiva” para tener actividad mental diferente a lo cotidiano y romper las rutinas, atreverse a cometer errores para comprender mejor.

El modelo propuesto busca generar la mayor sinergia posible entre las estrategias para lograr un mejor desempeño académico y trata de proyectar por medio de su estructura visual la importancia del entrelazamiento que deben tener las estrategias de modo que la aplicación de las mismas sea dinámico, continuo y flexible. En el centro del modelo visual se ubica el componente de *Socialización intelectual* que es una estrategia eje para facilitar la interacción y aplicación de las demás estrategias (ver Figura 1).

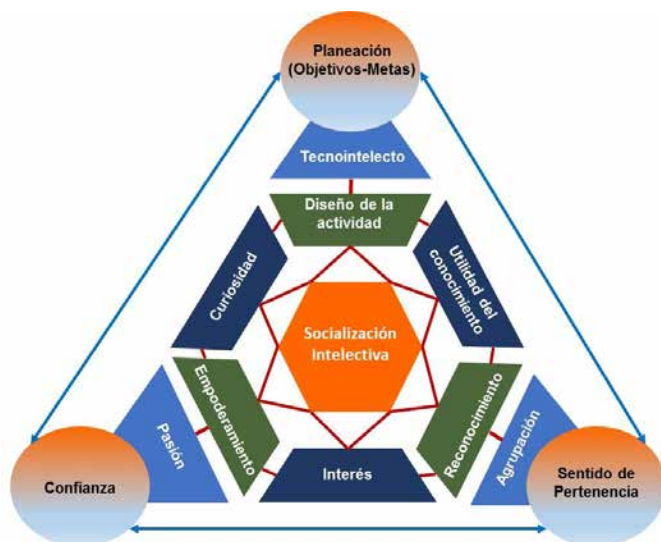


Figura 1. Modelo Entrelazado de Estrategias de Motivación (MEEM). Fuente: Elaboración propia.

En el diseño del *Modelo Entrelazado de Estrategias de Motivación* (MEEM) se ha utilizado también la psicología del color tomando como base el trabajo de la psicóloga y socióloga Heller (2004), que estudió las asociaciones entre colores y sentimientos en la sociedad alemana. Este último factor considerado en el diseño del modelo se utiliza para que los elementos o componentes del mismo generen influencia en las emociones de profesores y estudiantes hacia la motivación (naranja), la concentración (verde) y la productividad (azul) académica.

7. Reflexión final y conclusión

La función de las instituciones de educación superior es, entre otras, brindar una formación integral y de calidad, por lo tanto se considera que es función también de las mismas, el buscar los mecanismos para que esta se logre. El docente tiene un papel muy significativo en la formación de hábitos y motivación de los estudiantes. Por consiguiente, el proceso de enseñanza-aprendizaje debe ser gestionado con asertividad por parte del docente de matemáticas. Esto implica establecer estrategias de motivación que influyan en el comportamiento de los estudiantes para que puedan ser eficientes en la realización de sus actividades, y les permita un mejor desempeño académico, apropiación del conocimiento y dominio de los temas.

A partir de la revisión documental realizada y del proceso de diseño del modelo teórico conceptual de estrategias propuesto, se considera que las áreas académicas que imparten programas educativos de ingeniería requieren diseñar e impartir cursos para desarrollar habilidades socio emocionales, que les permitan a los alumnos controlar sentimientos como estrés, frustración o ansiedad y enfocarse en estudiar.

El modelo resultante integra elementos (estrategias) de cuatro modelos de motivación para estudiar y aprender (MUSIC, HRM, TARGET y ARCS), además de otras cinco estrategias que tratan de responder a los entornos y características de los estudiantes de la generación Millennial. El *Modelo Entrelazado de Estrategias de Motivación* (MEEM), se ha orientado hacia el aprendizaje de las matemáticas por ser las asignaturas de esta área las que presentan un mayor índice de reprobación en los primeros semestres de las licenciaturas en ingeniería industrial e ingeniería civil. La puesta en práctica del modelo será una actividad que habrá que analizar en futuros trabajos para valorar su impacto y eficacia en la mejora de los niveles de motivación de los estudiantes.

La revisión de los modelos de motivación descritos también revela la importancia que tienen algunos factores de orden intrínseco vinculados con los alumnos, mismos que pueden paralelamente condicionar la manera en que deban abordarse las estrategias para que la actividad docente se adapte a los factores de contingencia detectados a nivel de grupo y en lo individual. Los componentes del modelo se han conceptualizado como estrategias, que aplicadas de manera articulada y holística pueden contribuir a disminuir la reprobación y mejorar el rendimiento académico en las asignaturas de matemáticas y de

otras áreas del conocimiento. El modelo integra también aspectos del uso del color para estimular las emociones positivas hacia el aprendizaje. Finalmente, el modelo trata de reflejar el carácter sistémico de la actividad docente y la formación de recursos humanos, así como de la interacción necesaria entre las estrategias consideradas en procesos de aprendizaje. Por otra parte, se considera que la aplicación del modelo debe estar impregnada por una filosofía basada en valores como la honestidad, el respeto y la tolerancia para fomentar la motivación del alumno.

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Integración de los nuevos paradigmas educativos en la docencia universitaria de alemán

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Abstract

The traditional masterclass at university has been taken over in recent times by all the new teaching methods in various ways – on the one hand, by implementing the teaching-learning spaces in the virtual campuses and, on the other, by using models such as blended learning, flipped classroom or project-based learning, among many others. It has all happened in a moment in which the Spanish university system has experienced a major change in its structure and organisation based on the proposals made by the so-called Bologna process. All these elements together have sunk the university teaching staff into confusion and helplessness in a frankly serious situation.

In this paper we expose the changes that are still taking place at university and we propose a comprehensive model of the new teaching methods taking the teaching of German as a foreign language as an example.

Keywords: blended learning, flipped classroom, foreign languages, German, project-based learning.

Resumen

Los nuevos paradigmas educativos han invadido en los últimos años el espacio tradicional de la clase magistral en las aulas universitarias, y lo han hecho en varios sentidos: por un lado, la implantación de los espacios de enseñanza-aprendizaje en los campus virtuales y, por otro, los modelos educativos como el blended learning, la flipped classroom o el aprendizaje basado en proyectos, entre otros muchos. Todo ello se ha producido en un momento, además, en el que la Universidad española ha reorganizado sus enseñanzas al calor de los cambios propuestos por el conocido como plan Bolonia. La conjunción de todos estos elementos ha sumido al personal docente universitario en una situación de desamparo y desorientación francamente graves.

En esta comunicación se exponen los cambios a los que aún está expuesta la docencia universitaria y se aporta una sugerencia de integración de los nuevos modelos y herramientas, con el ejemplo de la didáctica del alemán como lengua extranjera en un grado filológico.

Palabras clave: *alemán, aprendizaje basado en proyectos, blended learning, flipped classroom, lenguas extranjeras.*

Introducción

En el año 1999 los ministros europeos de Educación de los 28 estados miembro de la Unión Europea firmaron conjuntamente la denominada Declaración de Bolonia, un documento generalista de cuatro páginas cargado de buenas intenciones en el que se recogen frases como: «[se resalta] la creación del Área Europea de Educación Superior como vía clave para promocionar la movilidad de los ciudadanos y la capacidad de obtención de empleo y desarrollo general del Continente» o «la independencia y autonomía de las Universidades asegura que los sistemas de educación superior e investigación se adapten continuamente a las necesidades cambiantes, las demandas de la sociedad y los avances en el conocimiento científico». Los objetivos que se fijaron en aquel encuentro se pueden resumir así:

- Adoptar un sistema de titulaciones fácilmente comprensible y comparable.
- Adoptar un sistema basado en dos ciclos fundamentales, cuyo primer ciclo deberá ser de al menos tres años y condición de acceso al segundo.
- Establecer un sistema de créditos adecuado para promocionar la movilidad estudiantil.
- Promover la movilidad y el intercambio libre en cuanto a formación y mercado laboral.
- Promover la cooperación europea y las dimensiones europeas en la educación superior.

La fecha de consecución de estos objetivos también la establecía de alguna manera el documento: «[N]os comprometemos a coordinar nuestras políticas para alcanzar en un breve plazo de tiempo, y en cualquier caso dentro de la primera década del tercer milenio, los objetivos». Finalmente, la Declaración concluye: «[N]os comprometemos a conseguir estos objetivos - dentro del contexto de nuestras competencias institucionales y respetando plenamente la diversidad de culturas, lenguas, sistemas de educación nacional y de la autonomía Universitaria - para consolidar el área Europea de educación superior».

No es baladí comenzar este trabajo con esta exposición, pues es, sin duda, el origen de muchos de los cambios a los que se ha visto sometido el sistema universitario español en los últimos tiempos. Fruto de aquella Declaración, o así lo afirmaron en su momento las fuerzas políticas implicadas, vio la luz en diciembre de 2001 la Ley Orgánica de Universidades (LOU), que se vio modificada a su vez en abril de 2007 por la Ley Orgánica que modifica la Ley Orgánica de Universidades (popularmente conocida como LOMLOU). Por su parte, el Real Decreto 1393/2007 fijaba la nueva ordenación de las enseñanzas universitarias oficiales. Todos estos textos legales establecían las estructuras y organizaciones de los nuevos grados (antiguas licenciaturas) y másteres, pero no entraban en los detalles del método docente universitario. No había nada en esos textos que nos hiciera hablar hoy de nuevos modelos educativos. Lo que sí había era una reorganización de los estudios que sí ha tenido un efecto directo y muy palpable en la docencia universitaria, como veremos.

1. De dónde veníamos

Para poder observar los cambios que de manera directa tuvieron efecto sobre los planes de estudio, las asignaturas y, finalmente, en el desarrollo normal de las clases, tomaremos como ejemplo el caso que conocemos, los grados filológicos.

En los planes anteriores a la mal denominada «implantación de Bolonia», la distribución de asignaturas y créditos por curso era la siguiente:

CICLO	CURSO	CREDITOS TRONCALES	CREDITOS OBLIGATORIOS	CREDITOS OPTATIVOS	LIBRE CONFIGURACION	TOTALES
CICLO 1	1º	40	8	-	12	60
	2º	26	20	-	10	56
	3º	-	24	32	8	64
Total ciclo 1º		66	52	32	30	180
CICLO 2	4º	28	8	24	-	60
	5º	20	16	24	-	60
Total ciclo 2º		48	24	48	0	120
TOTALES		114	76	80	30	300

Figura 1. Plan de la Licenciatura en Filología Inglesa (1996) de la Universidad de Oviedo.

Fuente: página web de la Universidad de Oviedo.

Como se puede ver en la figura 1, los dos ciclos existentes eran necesarios para la obtención del título de Licenciado en Filología Inglesa, y para obtener tal titulación era necesario completar satisfactoriamente un total de 300 créditos. Aquellos créditos no contemplaban la actividad del estudiante fuera de las aulas universitarias: un crédito equivalía a 10 horas lectivas. Por lo tanto, por norma general un alumno se matriculaba de unos 60 créditos anuales, a razón de unas 10 asignaturas por curso académico (tanto anuales como semestrales).

2. Dónde estamos

Esa llamada «llegada de Bolonia» trajo consigo la implantación en España de un sistema de créditos que se venía utilizando como moneda de cambio en los exitosos acuerdos del programa Erasmus, los ECTS o European Credit Transfer System, que se basa en el volumen total de trabajo del estudiante, y no se limita a las horas de asistencia a las clases presenciales, tal y como recoge el Real Decreto 1125/2003: «En esta unidad de medida se integran las enseñanzas teóricas y prácticas, así como otras actividades académicas dirigidas, con inclusión de las horas de estudio y de trabajo que el estudiante debe realizar para alcanzar los objetivos formativos propios de cada una de las materias del correspondiente plan de estudios». En resumidas cuentas, un crédito ECTS equivale a entre 25 y 30 horas de trabajo por parte del estudiante, de las cuales un número indefinido de ellas está dedicado a la docencia directa en el aula. En ese mismo Real Decreto se recoge que el número total de créditos por curso académico será de 60 ECTS.

La actual distribución de créditos en la nueva ordenación de las enseñanzas universitarias que fija el citado Real Decreto 1393/2007 se podría resumir así:

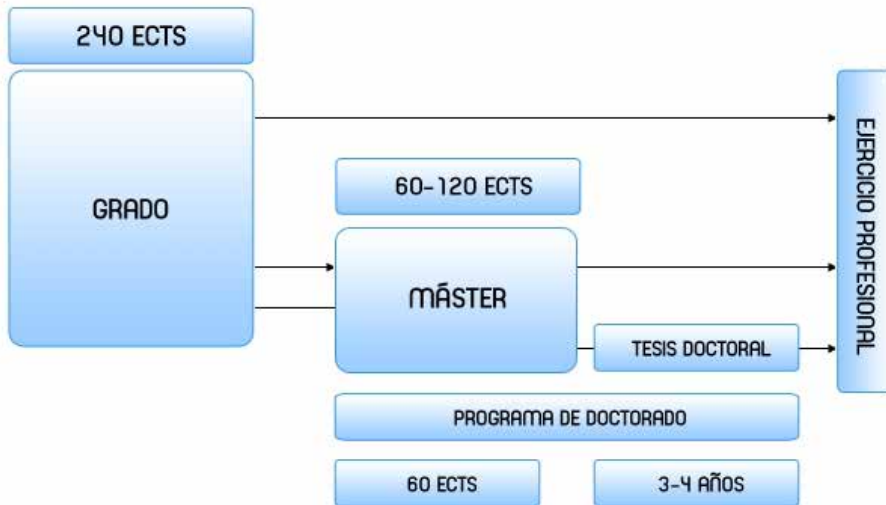


Figura 2. Ordenación de las enseñanzas universitarias oficiales según el Real Decreto 1393/2007.

Fuente: página web de la Facultad de Filosofía y Letras de la Universidad de Oviedo.

Es decir, hemos pasado de licenciaturas de 300 créditos «antiguos» (equivalentes a 3000 horas de docencia directa, a las que se deben sumar las horas de estudio y trabajo individual del alumnado fuera de las aulas) a grados de 240 créditos ECTS (equivalentes, a razón de 25 a 30 horas de volumen de trabajo del alumnado, a entre 6000 y 7200 horas de trabajo por parte del estudiante, entre las que se incluyen las de presencialidad). Visto de esta manera, podría pensarse que el cambio ha supuesto un incremento notabilísimo de la dedicación del alumnado a sus estudios universitarios y, por lo tanto, en una obtención superior de conocimiento y competencias. Lamentablemente, los datos de que disponemos y nuestra propia experiencia nos hacen ser pesimistas en este sentido.

2.1. El caso del alemán en los nuevos grados filológicos

Hasta ahora se ha expuesto el cambio de modelo universitario, basado ante todo en la estructura y organización de las enseñanzas, pero también, y de manera muy notable, tanto en el número de horas de docencia directa en el aula como en el que tienen que invertir los estudiantes en forma de trabajo autónomo fuera de ella. Y esto será un factor determinante en los modelos pedagógicos que nos veremos obligados a emplear en el aula y fuera de ella, como se verá más adelante.

En la siguiente tabla, extraída de la actual guía docente de una de las asignaturas de alemán que se imparte en los nuevos grados filológicos (*Lengua alemana II*) se observa la siguiente distribución por horas y porcentajes:

Tabla 1. Distribución de horas en la asignatura Lengua alemana II. Fuente: Guía docente de la asignatura Lengua Alemana II (Elaboración Propia).

MODALIDADES		Horas	%	Totales
Presencial	Clases expositivas	14	9,33	60
	Aula de idiomas	42	28	
	Sesiones de evaluación	4	2,67	
No presencial	Trabajo en grupo	22	14,66	90
	Trabajo individual	68	45,34	
Total		150		

Se trata de una asignatura de segundo curso, de 6 ECTS, que constituye la continuación de la asignatura previa, *Lengua alemana I*, y antecesora de la asignatura de tercer curso *Lengua alemana III*. Como se observa en la tabla 1, consta de un total de 60 horas lectivas, que a su vez se dividen en: 14 horas de clases expositivas (que pueden tener hasta 60 alumnos), 42 clases de aula de idiomas (con hasta 25 alumnos) y 4 sesiones de evaluación. En la guía docente se contemplan 90 horas totales de enseñanza no presencial, que a su vez se dividen en 22 horas de trabajo en grupo y 68 de trabajo individual. Como se puede observar, el mayor porcentaje de dedicación por parte del alumno en el cómputo global de la asignatura recae en el trabajo individual no presencial, que supone el 45 % del total. La enseñanza presencial tan solo suma el 40 % del total, dentro de la cual se incluyen las clases expositivas y las sesiones de evaluación. En resumidas cuentas, solo un 28 % de la carga académica total de la asignatura es docencia directa en el aula, frente al 60 % de trabajo que el alumno debe llevar a cabo autónomamente no solo para adquirir los conocimientos necesarios y lograr los objetivos didácticos fijados en la guía docente, sino también para lograr superar con éxito la evaluación final. En la práctica, la docencia directa de esta asignatura se reduce a tres horas semanales. A ellas debe añadir el alumno hasta un total de 90, que vienen a ser entre 6 y 7 horas semanales adicionales de trabajo fuera del aula.

Con este reparto del tiempo, cobra sentido aplicar, con restricciones y tras un pormenorizado análisis de la situación, los nuevos paradigmas educativos a los que luego nos referiremos, pues la optimización del tiempo se convierte en el eje sobre el que se vertebran todos los demás elementos.

Conviene recordar en este punto que, por lo general, un alumno universitario se matricula de unos 60 ECTS por año académico. Con una simple operación aritmética veremos que el estudiante universitario debería permanecer 30 horas semanales en las aulas recibiendo docencia directa con un profesor e invertir aproximadamente otras 60 horas semanales en trabajar por su cuenta. Es decir, actualmente estamos exigiendo a nuestros alumnos que dediquen al estudio universitario unas 90 horas semanales, a las que, como es lógico, se debe sumar el tiempo del transporte, las comidas, el descanso, el ocio y el tiempo libre. En conclusión: parece que el modelo que estamos empleando no va dirigido a jóvenes estudiantes universitarios, sino a autómatas capaces de invertir todo su tiempo en el aprendizaje. La pregunta que debemos hacernos es si todo ese tiempo está bien empleado y el reto al que debemos hacer frente es precisamente el de optimizar y racionalizar no solo el tiempo que como docentes empleamos en el aula con el grupo de alumnos, sino también aquel que dedicamos a preparar las actividades y proyectos que estos deberán realizar de manera autónoma.

3. A dónde vamos

En la búsqueda de un modelo didáctico que respetara, por un lado, el nuevo enfoque comunicativo que exige para la enseñanza de lenguas extranjeras el Marco Común Europeo de Referencia para las Lenguas (MCER), y, por otro, la exigente dedicación del alumnado, sobre todo fuera del aula, es necesario recalcar en los dos modelos, aún relativamente jóvenes, conocidos como *flipped classroom* y *blended learning*.

Estos dos modelos resultan ya bastante conocidos dentro de la comunidad educativa, especialmente en los niveles primario y secundario, no tanto en el terciario o superior, pero conviene recordar los fundamentos sobre los que se sustentan: el modelo *flipped classroom* busca ante todo la personalización pero también, simultánea y paradójicamente, la socialización del aprendizaje, de modo que no solo aprende el estudiante a título individual, sino el grupo completo, en el que se incluye al docente, a la vez que se busca personalizar el aprendizaje de modo que cada alumno pueda aplicarse a sí mismo estrategias únicamente válidas para él (cf. Tourón *et al.*, 2014; Steed, 2012; Plunkett, 2014; Boyer, 2013; Boles *et al.*, 2014, entre otros). Con este modelo se pretende fundamentalmente optimizar el empleo del tiempo, tan escaso en estos días, a fin de que las horas que los estudiantes están en el aula sean lo más productivas y efectivas posible y que sean también el acicate necesario para poder continuar con su proceso de aprendizaje de manera autónoma, lo que contribuye a fomentar la autoformación y la gestión personal del tiempo y esfuerzo de cada cual. Hay que decir, no obstante, que este modelo resulta fallido sin el trabajo individual fuera del aula por parte del

alumno, ya que las horas presenciales de docencia directa no aseguran en modo alguno el aprendizaje de los contenidos y aptitudes que se persiguen. Se facilita así la tan ansiada madurez intelectual que tantas veces los docentes echamos de menos en las aulas universitarias.

Por su parte, el modelo conocido como *blended learning* o aprendizaje mixto nace del fracaso del *e-learning* o aprendizaje a distancia apoyado en la tecnología. Como exponíamos en un trabajo anterior (Quijada Diez, 2015), tal fracaso se explica sobre todo por la ausencia de contacto personal entre profesor/alumno y alumno/grupo de alumnos, la falta de motivación y la dificultad o incapacidad de autogestionar el ritmo de aprendizaje. Este tipo de aprendizaje mixto combina la enseñanza presencial con la virtual (Coaten, 2003; Marsh *et al.*, 2003) y en realidad no es ninguna novedad, ya que la parte no presencial lleva existiendo desde que un profesor pidió a sus alumnos que hicieran ejercicios en sus casas de cara a la siguiente sesión. La novedad de este modelo radica en su aplicación por medio de las ya no tan nuevas tecnologías de la información y en que, al igual que el modelo de clase invertida, centra el foco del proceso en el aprendizaje por parte del alumno, y no en la enseñanza por parte del docente (cf. Bartolomé, 2014; Coaten, 2003; Marsh *et al.*, 2003; Santiago *et al.*, 2015, entre otros).

No cabe duda de que este cambio de foco de interés del profesor al alumno y de la enseñanza al aprendizaje es muy positivo en términos generales: abandonar la clase magistral en la que los alumnos, cual amanuenses, se dedicaban a anotar cuanto oían para después reproducirlo en un examen final ha sido, qué duda cabe, todo un acierto (véase tabla 2).

Hay un tercer modelo o enfoque, el denominado aprendizaje basado en proyectos (ABP), que resulta especialmente pertinente para la didáctica de una lengua extranjera si tomamos como base el enfoque comunicativo que propugna el citado MCER y que es el que hoy en día se aplica mayoritariamente. No hay que olvidar que aprender una lengua es, ante todo, aprender a comunicar y a comunicarse en esa lengua y que, por lo tanto, salir airoso de una situación comunicativa dada debería ser el objetivo superior del aprendizaje. Por ello una estrategia con la que propugna el ABP (Cullen *et al.*, 2004) cobra mucho sentido en nuestro caso: si pedimos a un alumno que sea capaz de realizar con éxito una gestión telefónica para hacer una reserva hotelera bajo unas circunstancias determinadas, estamos en realidad proponiéndole una actividad basada en un problema o proyecto. No en vano, quienes se han ocupado de investigar en torno al ABP destacan que no deja de ser un método que promueve «desarrollar el sentido común» (Capon y Kuhn, 2004: 74).

Tabla 2. Comparación de modelos. Fuente: Quijada Díez, 2015: 436

Modelo centrado en el profesor	Modelo centrado en el estudiante
El conocimiento lo transmite el docente a los discentes	Los estudiantes construyen el conocimiento mediante la búsqueda y síntesis de la información, indagación, resolución de problemas y pensamiento crítico
Los estudiantes reciben la información de una forma pasiva	Los estudiantes están implicados en todo el proceso de enseñanza/aprendizaje de un modo activo
El conocimiento se adquiere fuera del contexto en que será empleado	El énfasis se pone en cómo emplear el conocimiento adquirido en contextos reales
El profesor es básicamente un proveedor de información y un evaluador	El profesor asesora, facilita y evalúa conjuntamente con los alumnos
Enseñanza y evaluación se separan	Enseñanza y evaluación están entrelazadas
La evaluación se utiliza para controlar el aprendizaje	La evaluación se utiliza para diagnosticar la tarea docente y el aprendizaje del alumno
El foco del interés es que las respuestas sean correctas	El foco del interés es que las preguntas sean adecuadas y en aprender de los errores
El aprendizaje que se busca se evalúa mediante pruebas estandarizadas	Se evalúa mediante trabajos, portfolios, proyectos y ejemplos prácticos
El enfoque se centra en una única disciplina	Enfoque interdisciplinar
La cultura es competitiva e individualista	La cultura es cooperativa y de ayuda mutua y grupal
Los estudiantes son los únicos que aprenden (o eso se pretende)	Docente y alumnos aprenden conjuntamente

En conclusión, debemos decir que la nueva configuración de los planes de estudio y, por lo tanto, la dedicación tanto de profesorado como de alumnado a todo el proceso de enseñanza-aprendizaje ha variado notablemente en los últimos años. La implantación de las nuevas tecnologías facilita enormemente el cambio de paradigma, si bien exige una formación y reciclaje constante del docente en lo que a herramientas informáticas y nuevos modelos educativos se refiere.

4. Conclusiones

La clase universitaria tradicional ha cambiado significativamente. En el caso del alemán, la tradicional concepción del proceso de enseñanza-aprendizaje por segmentos (Cross, 2002) no debe abandonarse, si bien es necesario adaptarla a los modelos antes expuestos. Estrategias como el ABP ayudan a formular nuevos módulos de aprendizaje en los que el alumno se convierta en el centro y protagonista del proceso, y el profesor adquiere un papel de enorme relevancia en cuanto a planificación pero muy poco visible en el discurrir diario dentro y fuera del aula (frente a su protagonismo indiscutible en su papel de guía y moderador en la clase por segmentos). De esta manera, el idioma se aprende no tanto dentro como fuera del aula, un espacio este que se convierte en mero escenario en el que en conjunto se observan, analizan y evalúan las prácticas llevadas a cabo por los estudiantes. El objetivo último es el de que se produzca una interacción constante en lengua alemana entre los estudiantes y una producción prácticamente diaria de textos, tanto escritos como verbalizados, un objetivo que los expertos en la didáctica de lenguas hace tiempo ya que establecieron como primordial (Lyster, 2007).

Bien haríamos los docentes universitarios de lenguas extranjeras en dedicar más tiempo a diseñar, planificar y organizar la docencia de nuestras asignaturas teniendo en mente el tiempo del que se dispone de acuerdo a la nueva organización, y, por lo tanto, usando estos nuevos paradigmas educativos, que no han llegado como una mera moda, sino que están aquí para quedarse, evolucionar y crecer de la mano de unas nuevas generaciones que buscan, ante todo, un aprendizaje práctico de destrezas que les permitan salir airosos de las situaciones comunicativas de todo tipo ante las que tarde o temprano acabarán enfrentándose.

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Dificultades para trabajar la competencia digital en titulaciones de Ciencias Sociales

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Abstract

This paper shows some difficulties that undergraduate students must face during their first year at the University when they are working with digital skills in the Mathematics classroom. In addition to the usual issues and difficulties for any Mathematics course, we must also consider a high level of digital illiteracy, since our undergraduate students are accustomed to use software and any other computer application for idle questions (video games, Internet, etc.). Consequently, teachers have to implement motivational and innovative teaching strategies in order to apply some computational software in their classroom, which involves the corresponding shift to assess the specific skills being affected by this approach. Regarding this, we want to show the strategies and tools that we are using with 1st-year students enrolled in the degrees appointed to Faculty of Business from Pablo de Olavide University.

Keywords: *Higher Education (Social Sciences), Digital Skills, ICT, Mathematics.*

Resumen

Este trabajo pretende mostrar las dificultades a las que se enfrentan el alumnado de nuevo ingreso a la Universidad cuando se trabajan competencias digitales en un aula de matemáticas. A las dificultades tradicionales de esta materia hay que añadir un alto grado de analfabetización digital, puesto que nuestro alumnado parece que solo usa herramientas informáticas para cuestiones puramente ociosas (videojuegos, internet, etc.). Esto lleva a los docentes a tener que introducir estrategias motivadoras e innovadoras para el uso de software computacional con el correspondiente cambio en la evaluación de las competencias específicas afectadas. A este respecto, mostraremos las estrategias y herramientas utilizadas con el alumnado de primer curso de las titulaciones de la Facultad de Ciencias Empresariales de la Universidad Pablo de Olavide.

Palabras clave: *Educación Universitaria (Ciencias Sociales),. Competencia Digital, TIC, Matemáticas.*

Introducción

En nuestra sociedad actual es innegable que se han producido cambios profundos y además se sigue experimentando una incesante innovación tecnológica día a día. Tales cambios han llevado a una transformación en muchos y diversos ámbitos de nuestra vida cotidiana y de la realidad que nos rodea, como pueden ser culturales, comunicativos, sociales, económicos y laborales por poner algunos ejemplos. En resumen, nos ha tocado vivir una situación que se ha denominado “sociedad de la información”, término que acuñó Masuda (1968) y popularizó Castells (1996) entre otros. En este contexto, por primera vez los cambios suceden en un escenario de globalización del que no había precedentes históricos previos, con lo que se generaron y se siguen generando ciertas expectativas e incertidumbres.

Hay que señalar que la educación es un sector en el que los cambios suelen introducirse de manera paulatina y no con la velocidad que cabría esperarse del paradigma que acontece en la época de cambios globales y vertiginosos que estamos viviendo. Eso se debe en buena parte a que la tendencia que suele observarse en cualquier docente al enseñar a sus estudiantes consiste en la repetición y/o replicación de las estrategias, metodologías y técnicas docentes que utilizaron sus maestros y maestras cuando le enseñaban y formaban. No obstante, cuando todo va cambiando a nuestro alrededor de la manera en la que se acontecen los cambios en la sociedad actual, perseverar en esta postura de reticencia al cambio y de no querer cambiar técnicas que antes funcionaba (lo cual podría entenderse como una postura inmovilista por parte del docente) puede terminar volviéndose un buen precedente para el fracaso más que un garante para alcanzar el éxito en nuestra práctica docente. En este sentido, la revolución digital continúa su avance continuo e imparable en el sector de la educación, lo cual se refleja en la apertura de escenarios digitales tanto a docentes como a discentes y la consiguiente creación de nuevas oportunidades de aprendizaje.

La competencia digital se hace prácticamente imprescindible en cualquier asignatura (ya sea ésta cuantitativa o no) pues cobra un muy significativo valor transversal en su función de metalenguaje para expresar la realidad. Esta afirmación pudiera quedarse corta si tenemos en cuenta que, de alguna manera, esta competencia está redefiniendo algunos conceptos tan básicos como puede ser el de alfabetización predigital; además de generar una nueva gramática narrativa (es decir, cómo realizar el relato que le permite a nuestros estudiantes alcanzar los aprendizajes), la cual está sufriendo una evolución vertiginosa (Gobierno Vasco, 2012).

Por otra parte, podemos afirmar que la competencia digital no se limita a las TIC en sí mismas, sino que presenta una evolución que, partiendo de éstas, alcanzan diferentes ámbitos del aprendizaje que no se limitan a las TIC. Es más, la competencia digital trasciende a la

capacidad de aprendizaje a lo largo de la vida, ya que poseer esta competencia nos permite ser más participativos, visibles, activos y comprometidos a la hora de afrontar los diferentes desafíos que han aparecido en estas primeras dos décadas del siglo XXI. Por tanto, la educación formal en general y la educación superior en particular, no pueden quedar al margen de estos procesos.

1. Las TIC en la Educación Superior

Bloom et al. (1956) ordenaron la taxonomía de las diferentes capacidades cognitivas en base a la madurez intelectual del estudiante y que se utiliza tradicionalmente como una herramienta para establecer objetivos de aprendizaje y estructurar jerárquicamente niveles de conocimiento. Esta taxonomía fue posteriormente revisada por Anderson et al. (2001) para un entorno digital como en el que nos encontramos inmersos, añadiendo otros elementos adicionales a los puramente cognitivos, a saber: métodos y herramientas, tal y como puede apreciarse en la Figura 1 (en azul están los verbos que se introducen en la versión revisada para el entorno digital).

2. La Competencia Digital

En la Figura 2 puede observarse el ideograma realizado por Fernández (1997) para representar cuáles eran sus planteamientos sobre el significado de las competencias.

En el Proyecto de Definición y Selección de Competencia (DeSeCo), un grupo de expertos analizaron cuáles deberían ser las competencias que habrían de ser consideradas como necesarias para cualquier ciudadano en la sociedad actual, determinando un reducido grupo de competencias que consideraron claves; siendo una de ellas la correspondiente al uso de herramientas de manera interactiva (OCDE, 1997). Sería unos veinte años más tarde cuando, en 2006, la Ley Orgánica de Educación introduce el «Tratamiento de la información y competencia digital» como una de las competencias claves que deberían trabajarse con nuestros estudiantes, siendo su adquisición por parte del estudiante algo imprescindible para el proceso de aprendizaje. Esta misma competencia vuelve a recogerse en el texto de la reforma educativa que tuvo lugar en 2013 con la aprobación de la Ley Orgánica para la Mejora de la Calidad Educativa de 2013.

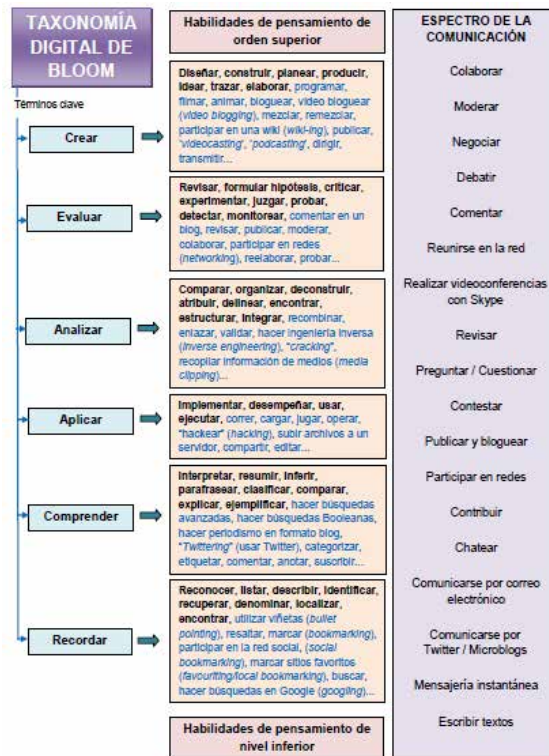


Figura 1. Taxonomía de Bloom revisada para la era digital. Fuente: Gobierno Vasco (2012).
Fuente: página web de la Universidad de Oviedo.

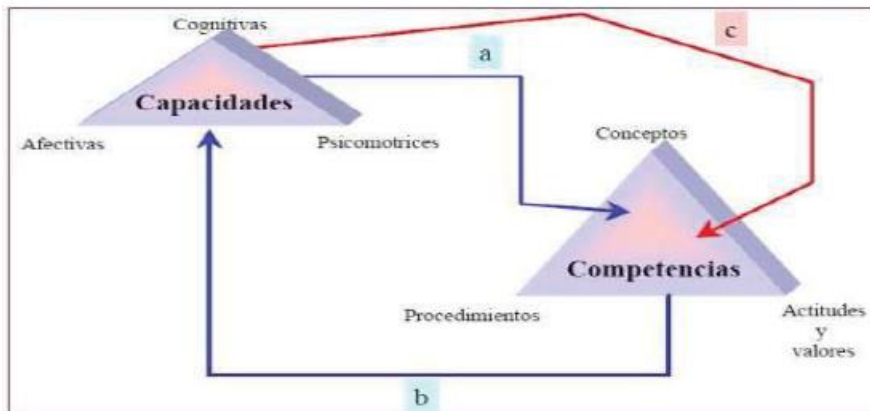


Figura 2. Concepto de competencia. Fuente: Fernández (1997).

La competencia en el tratamiento de la información y competencia digital es definida por Vivancos (2008) como la capacidad para “disponer de habilidades para buscar, obtener, procesar y comunicar información, y para transformarla en conocimiento. Incorpora

diferentes habilidades, que van desde el acceso a la información hasta su transmisión en distintos soportes una vez tratada, incluyendo la utilización de las tecnologías de la información y la comunicación como elemento esencial para informarse, aprender y comunicarse. [...] Significa, asimismo, comunicar la información y los conocimientos adquiridos empleando recursos expresivos que incorporen, no sólo diferentes lenguajes y técnicas específicas, sino también las posibilidades que ofrecen las tecnologías de la información y la comunicación». «Ser competente en la utilización de las tecnologías de la información y la comunicación como instrumento de trabajo intelectual incluye utilizarlas en su doble función de transmisoras y generadoras de información y conocimiento. [...] Asimismo, esta competencia permite procesar y gestionar adecuadamente información abundante y compleja, resolver problemas reales, tomar decisiones, trabajar en entornos colaborativos ampliando los entornos de comunicación para participar en comunidades de aprendizaje formales e informales, y generar producciones responsables y creativas. [...] En síntesis, el tratamiento de la información y la competencia digital implican ser una persona autónoma, eficaz, responsable, crítica y reflexiva al seleccionar, tratar y utilizar la información y sus fuentes, así como las distintas herramientas tecnológicas; también tener una actitud crítica y reflexiva en la valoración de la información disponible (...)».

3. Dificultades

La docencia de las Matemáticas resulta sumamente complicada y sitúa en una situación de desventaja al docente respecto de la enseñanza de otras asignaturas que presentan un mayor atractivo para el discente, en buena parte, por no presentar tantos prejuicios previos a la hora de afrontar la materia. Esto es especialmente relevante en el caso de las titulaciones propias de las Facultades de Empresariales, ya que los títulos están más enfocados a un perfil de estudiantes del ámbito de las Ciencias Sociales que durante la Enseñanza Secundaria (tanto a nivel de Secundaria Obligatoria como de Bachillerato) bien han procurado evitar las matemáticas bien han cursado unas matemáticas menos formales y más centradas en la resolución de problemas, pese a que realmente muchos de ellos finalizan sus estudios sin haber asimilado completamente las competencias básicas en matemáticas. Para un análisis sobre cuáles podrían considerarse algunas de las principales carencias en las competencias matemáticas básicas en los estudiantes de estas titulaciones, puede consultarse Tenorio Villalón et al. (2016).

Sin embargo, el presente trabajo no pretende analizar la problemática de los tópicos matemáticos *per se* ni las carencias matemáticas que trae nuestro alumnado de base correspondiente a cursos anteriores. Nuestro objetivo consiste en describir algunas de las dificultades que los docentes universitarios afrontamos cuando enseñamos matemáticas y, más aún, cuando se quiere hacer uso de herramientas informáticas que permitan un tratamiento computacional de los problemas. En primer lugar, hablaremos del uso de

software computacional específico para la resolución de problemas para seguidamente, discutir el uso de las plataformas virtuales de aprendizaje.

La primera dificultad consiste en los interfaces que presentan los software de computación (los denominados sistemas de álgebra computacional). Para ser usuario de un software como Mathematica, MatLab o Maple (los tres comerciales más conocidos y utilizados), el estudiante tiene que desarrollar un mínimo de destreza en el uso de la sintaxis computacional propia de los rudimentos básicos de los lenguajes de programación. No tiene que aprender a programar pero sí requiere utilizar la sintaxis propia del software y de la lógica de la asignación de valores a variables y de anidación de sentencias consecutivas.

Partiendo de que la mayoría del alumnado que se matricula en las titulaciones propias de una Facultad de Empresariales no ha cursado ninguna asignatura de informática en Bachillerato (por lo que no ha tenido ninguna experiencia previa en lenguajes de programación ni en el uso de software más avanzados que los paquetes ofimáticos), debemos asumir que no se trata de enseñar cómo usar un nuevo software y explicar la filosofía en la que se basa éste. Con este alumnado nos encontramos ante la necesidad de enseñarles a usar un software de cálculo y no a aplicar dicho software solamente, ya que no tienen ningún referente previo de un software de características similares. Especial énfasis habría que hacer en el hecho que el uso de un software de cálculo en las etapas educativas anteriores (aunque fuera un software tipo GeoGebra o WIRIS, que sí se usa en Educación Secundaria) facilitaría parte de este problema ya que los estudiantes dispondrían de una experiencia previa que, aunque no es del todo comparable, sí les facilitaría el manejo de los software de cálculo computacional debido a que estarían usando, a fin de cuentas, sistemas de álgebra computacional destinados a usuarios iniciales en los que prima la facilidad de manejo sobre la potencia de cálculo.

Una segunda dificultad que encontramos en el uso de este tipo de software por parte de nuestro alumnado, corresponde a una ausencia de iniciativa personal por nuestros estudiantes a usar las ayudas del software con el fin de consultarlas para solventar dudas sobre cómo aplicar los distintos comandos para realizar los cálculos necesarios. Los software a los que estamos haciendo referencia vienen acompañados de ayudas en las que viene la sintaxis de los comandos, ejemplos de aplicación para cada comando e indicaciones sobre las opciones que presentan los comandos en cuestión. Nuestro alumnado suele ser reticente al uso de estas ayudas incorporadas para poder subsanar carencias, solventar dudas o buscar ejemplos de aplicación de los comandos. Pese a insistirse desde el equipo docente en las virtudes de esta herramienta y de las ventajas de su uso para un adecuado aprendizaje y aprovechamiento del software, el alumnado suele optar por no aprender a manejar la ayuda del software y procede a memorizar los comandos con todas sus variantes de sintaxis posibles para la realización de los problemas que se le encomiendan. Lo cual no es una metodología efectiva de aprendizaje ya que no facilita la adaptación a otros entornos o herramientas equivalentes que, obviamente, no utilizarán ni la misma sintaxis ni los mismos comandos.

La tercera dificultad está en parte relacionada con la primera. En ocasiones, la respuesta que da el software de cálculo no es la respuesta completa desde el punto de vista matemático, sino que es una respuesta simplificada. Por ejemplo, si se resuelve una ecuación trigonométrica con el comando básico de resolución, el software suele dar la solución básica de primer o cuarto cuadrante de la circunferencia unidad, pero no indica si existe otra solución en algún otro cuadrante ni avisa de que deben sumarse 2π radianes a la solución devuelta para obtener todas las soluciones posibles de la ecuación. Igualmente, si se usa un software para calcular los autovectores de una matriz, se obtiene un conjunto linealmente independiente de autovectores, pero no suele indicar a qué autovalor está asociado o devuelve “autovectores” nulo si no existe una base formada por autovectores: es el estudiante el que debe saber que los autovectores se dan ordenados en base a la respuesta obtenida para los autovalores o que los autovectores no pueden ser nulos y que la devolución de un “autovector” nulo significa que hay autovalores que no tienen el número máximo de autovectores linealmente independientes. A este respecto, el uso del software requiere conocer los conceptos y procedimientos matemáticos pertinentes.

Finalmente, expondremos cómo se trabajan las competencias digitales por medio de la denominada aula virtual, que consiste en un entorno o plataforma virtual de aprendizaje. En dicho entorno se llevan a cabo algunas acciones formativas de las asignaturas. Así, por ejemplo, se realizan diversas actividades evaluativas que deben ser resueltas por el alumnado de manera telemática. En este sentido, es habitual la existencia de incidencias por parte del alumnado durante la realización de estas actividades de evaluación, debidas en su mayoría a que el alumnado no procede a leer las instrucciones de funcionamiento de las actividades. Un ejemplo de tal problemática consiste en iniciar una prueba de evaluación y cerrarla sin guardarla, perdiéndose la evaluación realizada y registrándose en la aplicación como que la actividad se ha realizado sin respuesta. Otra de las dificultades a las que se enfrenta consiste en la localización de información en el entorno virtual o en la subida y envío de información al equipo docente.

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Reflejos de la ética en las TIC. El espejo negro

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Resumen

En el presente artículo se presenta una propuesta de acercamiento de la ética a estudiantes universitarios de grados relacionados con las TIC. Gracias a la puerta de entrada que supone que la práctica totalidad del alumnado sea usuaria de teléfonos inteligentes, tabletas y similares, se puede entreabrir una visión de la ética. La sugerencia del presente artículo pasa por enfrentarse a los discentes a una visión de la tecnología desde fuera de la tecnología, desde su prisma ético, una vez esta se apaga, y la pantalla de sus móviles o tabletas quedan convertidos en un mero espejo negro.

Palabras clave: Ética; Ciencias de la informática; Espejo negro

Introducción

Las TIC forman parte hoy por hoy de nuestra cotidianidad, Los escenarios apocalípticos de cualquier serie que se precie de ciencia ficción pasan en sus primeros escalones por la quiebra de la tecnología. Y no es algo que resulte difícil de interpretar, baste con recordar lo que nos sucede a cualquiera de nosotros cuando nos dejamos el teléfono en casa... o cuando la wifi no funciona.

En este escenario, distinto no ya del que vivieron nuestros padres, sino nosotros mismos no hace muchos lustros aparecen nuevas oportunidades y nuevos riesgos se presentan de forma imperceptible. Eso sí, mientras las bondades se nos venden una y otra vez, los riesgos, excepto en el caso de que supongan una buena entrada de telediario con tintes amarillos, suelen pasar desapercibidos.

Podemos plantearnos que no se trata de algo excepcional. La humanidad siempre cambia. Los avances son continuos. Nos pasó con la radio, por ejemplo. Recordemos que, como nos indicaron Bringué y Sádaba (2009), en la década de los 30 del siglo XX una asociación de padres de la ciudad de Nueva York acusó a un programa de radio, EtherBogeyman, de provocar pesadillas a sus hijos.

También podemos aducir que las TIC ya no son algo tan nuevo. En efecto, no hace mucho que hablábamos de las "Nuevas Tecnologías de la Información". Hoy, quien se atreva a usar esa expresión será tachado de obsoleto y caduco. Eso provoca que ya haga décadas en que se empezaron a realizar estudios de impacto, o que los pensadores y políticos trabajasen con el

impacto de las tecnologías de la información en la sociedad como materia prima de sus estudios. Así, podemos dar una catarata de referencias clásicas, que pasarían desde los oficiales (Informe Nora Minc) (Nora & Minc, 1980) a los trabajos de Weinzenbaum (1978). Por centrar nuestro objetivo, que no es otro que el impacto en la formación en valores en la educación superior de alumnos tecnológicos, cabe traer a colación a Guerrero (2015) que señalaba que es la educación como el sector más afectado por el efecto que éstas han producido.

Centrarnos en la educación es centrarnos en el futuro de la sociedad, que de por sí ya está dando un cambio total basado en estas nuevas pantallas que nos invaden bajo nuestro beneplácito.

1. Contexto

Apuntábamos líneas atrás esos cambios que la sociedad sufre provocados por las tecnologías. Los tiempos se aceleran, el trabajo nos sigue a todas partes. Nuestros alumnos contestan desde sus teléfonos los tests de nuestras asignaturas desde la comodidad de sus sofás o la incomodidad de una cinta de andar en un gimnasio. Cambia hasta la forma de relacionarse: ya en 2013 la mitad de la gente utiliza mensajes de texto en sus relaciones sentimentales (García & Fabila, 2014).

Vivimos en una cultura de lo visual, que cambia hasta la forma en que el conocimiento llega a los estudiantes. Hoy un grado que no se impartiera con el apoyo de una plataforma educativa (y que esta sea accesible desde distintos dispositivos) sería más rara de encontrar que un perro verde. Los enlaces, que inundan el texto plano, salpimentándolos con gráficos interactivos, vídeos, etc., facilitan el conocimiento: es la virtualización del proceso de lectura y escritura. (Sybil, 2009) Y esto es bueno, muy bueno, pero...

Pero no solo debemos contemplar aquellas ventajas: hay que prevenir el lado malo, los riesgos y las amenazas. Recordemos que existen novedades peligrosas como la nomofobia (miedo irracional a salir de casa sin un teléfono móvil), el tinnitus (generación de un zumbido en el oído que causa molestias y disminuye la capacidad de escuchar), nuevas adicciones tecnológicas, incidencias en trastornos alimenticios, ciberbullying, sexting... (García & Fabila, 2014; García-Pina, 2008; Bringué & Sádaba, 2009). Dispuestos a no olvidar nada, ni en un lado de la balanza, ni en su opuesto, empezemos con una pieza clave: el docente.

2. El docente

La velocidad del cambio es rápida. El docente debe saber encajarlo, digerirlo, con un acento especial en la ética y de forma especial en los valores educativos, por la gran responsabilidad que arrastramos (García, Gutiérrez, Mújica & Henríquez, 2016). Existen múltiples experimentos de introducción de herramientas en la docencia ordinaria, en aspectos generales o concretos como la lucha contra el plagio (Reche, Quintero & Marín, 2016). o el empleo del teléfono como posibilitador de trampas durante los exámenes, además de su elemental capacidad para ser un elemento distractor (García & Fabila, 2014).

3. El conocimiento del dispositivo, realidad cuasi universal

Es obvio que no hace falta enseñar a los alumnos a usar sus dispositivos, más bien muchas veces en el aula ellos nos descubren funcionalidades de las que eramos poco o nada conocedores. Precisamente esto es una ventaja que debemos aprovechar para encontrar en ellas nuevas maneras de generar conocimiento y saberes en todas sus formas y contextos con una forma de comunicación mucho más dinámica (Guerrero, 2015), para sacar el jugo a esa comunicación que se establece de forma natural entre ellos usando estos canales para llegar a un nuevo aprendizaje.

4. Aproximación a la ética

Llegamos por fin a lo que nos ocupa: meter en juego a la ética. Existen distintos enfoques, desde los más generales, por ejemplo cuando Aznar et al. (2005), quienes enumeran elementos como la vulnerabilidad y la limitación personal y colectiva, como sustento de la interdependencia; el valor de la identidad y la cultura ajenas, como fuente de afirmación de nuestra propia identidad y cultura; el respeto a la dignidad y los derechos de la persona, como sustento de la solidaridad y como garantía de la estabilidad social, etc. a los más específicos (véase por ejemplo Ramos (2013) como la experimentación de la ciudadanía digital y la comprensión de los derechos de autor). Nuestra propuesta, como se verá, es más simple, pudiendo resumirse como la "introducción a la ciudadanía digital".

Para nuestros alumnos la pantalla, de su teléfono, de una tableta es algo más que lo que representa para sus padres. Es una ventana por la que ven el mundo... y por la que se dan a conocer. Nuestra propuesta pasa por pretender enfrentar al alumno al espejo oscuro de la pantalla apagada. A su propio reflejo, más allá de la tecnología de la información. No por despojar a la realidad de la informática, sino para que el brillo de la tecnología no les oculte los efectos de la misma. A través de ella reciben la imagen del mundo exterior y emiten la suya. Así, según (Lipoetsky&Serroy, 2009), surge una pregunta fundamental: ¿Hasta qué punto reorganiza este despliegue de pantallas la vida del ciudadano actual?

Bajo este punto de partida, empleamos el símil del espejo negro, sin la distorsión que pueda producir encendida donde vemos a los demás como quieren mostrarse, y así nos mostramos a nosotros... donde aparecen noticias ciertas mezcladas con otras falsas, como antiguos rumores, pero con la supuesta verosimilitud que les confiere el medio por el que se distribuyen, donde vemos cercanos a amigos lejanos y viceversa a pesar de que la cercanía parezca prometer un mayor grado de confianza. Y en est punto ¿qué pasa si apagamos la pantalla, si dejamos al ser humano enfrentado a su reflejo en el espejo oscuro de su móvil, de su tableta apagado, enfrentado a él mismo y solo a él? Según Lipovetsky y Serroy, (Lipoetsky&Serroy, 2009) en el adulto aparece el miedo. Desaparece esa sobreinformación en la que nos umergimos como polluelos en su caliente nido. Aunque tenemos nuestras limitaciones y somos incapaces de discernir qué es lo verdaderamente importante cuando nos inundan con millones de datos, nos sentimos desnudos sin ellos. El peligro apuntado tiene

para esos autores la solución de la "pantalla asistida": la colaboración de los docentes como herramienta imprescindible para poder crear ese marco intelectual preciso que impida que se muera ahogado en el aluvión de información.

Al margen de esa infosaturación que apuntábamos, también hay que prever otros riesgos, como el evitar engañarse a sí mismo en la autopercepción, lo que provoca desde el complejo de Adonis, donde nos vemos más bellos de lo que en realidad somos, a las muchas tipologías de dismorfofobia, que provocan que siempre nos veamos más feos de lo que somos.

5. Conclusiones

Los alumnos por sí mismos dominan el medio. El trabajo en el aula se centraría en enfrentar al alumnado al espejo oscuro de su pantalla apagada. Las reflexiones que obtengan ante ella pueden servirles de herramienta para vencer los riesgos que las propias pantallas conllevan. Cerremos con una cita clásica, de Weizenbaum, que en 1978 decía que el profesor de informática debe tener el valor de resistir a la tentación de ser arrogante, y enseñar principalmente mediante el ejemplo, la validez y la legitimidad de un conocimiento más conciliador. No hay mejor manera de desnudar el pensar de los alumnos que empezar por uno mismo (Weizenbaum, 1978). Pongámonos frente al espejo negro, veámonos y hagamos que nuestros alumnos nos vean y se vean a sí mismos.

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Masscapital, y la mejora de la gestión y el marketing en la “Ubiquitous Era”

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Abstract

This paper studies the transformation of the business environment, and combines the management and information system literature to conceptually analyze the “Ubiquitous Era of Management”, and the relevance of focusing on the “Masscapital” to face these transformations. Firstly, the paper analyzes the new ubiquitous era of management, defined as a loop of connecting customized and contextual needs of customers with the management and organization of internal and external capabilities of the organizations to satisfy these needs. For this, the article studies the transformation of the management and marketing perspectives of the post web 3.0 era, together to the evolution of the ubiquitous computing. Moreover, and in order to cope with this new environment, the paper concentrates on the relevance the called “Masscapital”, coined as the relevant capabilities of all individual or organizations, related closely or not to the company, which can help it to innovate or improve any of its activities or processes.

Keywords: *Ubiquitous Management Era, Masscapital*

Resumen

Este trabajo estudia la transformación del entorno de los negocios, y combina la literatura de gestión y sistemas de información para analizar la “Era Ubicua del Management”, y la relevancia de centrarse en el “Mascapital” para encarar esas transformaciones. En primer lugar, el artículo analiza la Era ubicua del Management, definida como un bucle que combina necesidades personalizadas y contextuales de los consumidores con la gestión y la organización de capacidades internas y externas de la organización para satisfacer esas necesidades. Para ello, el artículo estudia la transformación de las perspectivas del marketing y la dirección de empresa, de la era posterior a la Web 3.0, junto con la evolución de la informática ubicua. Además, y con objeto de encarar este nuevo entorno, el artículo se concentra en la relevancia del denominado “Masscapital”, definido como “las capacidades relevantes de todos los individuos u organizaciones, relacionados estrechamente o no con la

organización, que pueden ayudar a esta a mejorar cualquiera de sus actividades o procesos.

Palabras Clave: *Era Ubicua del Management, Masscapital*

Introducción

En el Nuevo entorno, con el avance continuo de la tecnología, y los crecientes requerimientos de los consumidores, las empresas deben proveer soluciones personalizadas para poder atender las necesidades específicas de los consumidores, que surgen en contextos específicos, y esto, de una forma invisible para estos consumidores. En un Nuevo entorno ubicuo, derivado de la creciente relevancia del denominado “internet de las cosas”, el “Pervasive and Ubiquitous Computing” (informática ubicua y omnipresente), y la evolución de la web semántica o la concebida como “Web 3.0 Era” de la gestión (Garrigos et al., 2012), las empresas necesitan cambiar la forma de concebir sus tareas.

Con objeto de incrementar su competitividad e incluso de consolidar su supervivencia, las organizaciones necesitan comprender profundamente las transformaciones acontecidas en la dirección de las empresas y en el entorno tecnológico, y obviamente los avances en estas literaturas, para poder adaptarse de forma continua a esos cambio.

Específicamente, un profundo análisis de estas literaturas, sugiere que las organizaciones necesitan crear un entorno de gestión ubicua en la producción, en el marketing, y en la dirección general de la empresa. Éste debe estar presente de forma transparente e invisible en la vida directiva de la organización, para poder atraer y apropiar para la empresa, y de una forma continua, las tareas más eficientes y las innovaciones necesarias para atender de forma recurrente y apropiada las necesidades constantes tanto de la empresa como de sus consumidores.

La innovación, suele componerse de dos fases, la generación la y la implementación de una idea (Oldham and Da Silva, 2015). En este sentido, las empresa competitvas son aquellas que pueden crear las bases para identificar e implementar esas ideas antes que las demás, y las que desarrollan esas tareas de forma más eficiente que otras..

Sin embargo, las empresas deben ser conscientes que las fuentes de innovación y eficiencia no residen tanto en las capacidades de las empresas como en las capacidades de los individuos,.A su vez, la mayoría de tareas e innovaciones no pueden realizarse o ser provistas de forma eficiente por las propias empresas, sino por otras empresas externas o individuos, muchos de ellos externos a las empresas o redes empresariales propias, o ampliamente por el “Masscapital” en un entorno global. Dado ello, aquellas firmas que puedan crear los mecanimmos o los pedios para apropiarse continamente de las innovaciones o ideas, y de las tareas generadas por los individuos, serán aquellas que permanezcan competitivas. Desafortunadamente, las literaturas de sistemas de información y de dirección de empresas están muy desconectadas, hecho que representa un problema en el intento de crear soluciones

apropiadas (tanto teóricas como prácticas), que sean adecuadas para enfrentar las nuevas transformaciones.

Con objeto de encarar estas carencias, este artículo intenta analizar y conceptual lo que denominamos como “Ubiquitous Management Environment”, derivado de la evolución del denominado “Ubiquitous Computing” y los nuevos avances in la literatura de dirección de empresas y marketing. A su vez, y con objeto de poder afrontar el nuevo entorno, el artículo se centra en el denominado “Masscapital”, concebido omo las capacidades de todos los individuos u organizaciones, relacionados de forma estrecha o no con la compañía, que pueden ayudar a esta a innovar o mejorar la eficacia y/o eficiencia de cualquiera de sus actividades y procesos.

1. La Era Ubicua del Management

Con objeto de entender la nueva concepción que planteamos sobre la dirección de empresas, debemos comenzar analizando y observando el Nuevo entorno que está surgiendo tras las nuevos desarrollos en las tecnologías de información y comunicaciones. Este nuevo entorno, esta caracterizado principalmente por la nueva era ubicua de la gestión, una evolución desde la denominada Web 2.0 y la posterior Web 3.0 o era de la web semántica, tal y como fue explicado por Garrigos et al., (2012).

Podríamos concebir la era ubicua como la nueva era, donde las empresas deben proveer soluciones personalizadas para atender las necesidades de los consumidores en las situaciones de los contextos específicos (temporales y espaciales) en donde e encuentras estos. Más ampliamente, y debido a una posible necesidad de un consumidor en su entorno diario, la concepción ubicua de una empresa sería la de una empresa que es capaz de organizar todos los mecanismos de la gestión (entre sus capacidades propias y las capacidades externas más relevantes), para satisfacer las necesidades específicas de ese y otros consumidores, en sus situaciones específicas contextuales, de una forma eficiente.

1.1. Desde una perspectiva del marketing, al enfoque externo de la era ubicua

Con objeto de entender esta nueva perspectiva, debemos de observar, en primer lugar, a la historia reciente de la dirección de empresas. De este modo, si observamos la organización de los procesos de producción en la historia de las empresas, podríamos encontrar tres perspectivas más o menos consecutivas:

En la primera perspectiva, la perspectiva más tradicional conducida por el proceso de producción, las empresas se han concentrado clásicamente en la producción de bienes y servicios con una calidad apropiada de acuerdo con los estándares de cada empresa, como proceso previo a la búsqueda de técnicas de ventas para dar salida a los productos y servicios diseñados y creados. Obviamente, esta perspectiva se convirtió ampliamente obsoleta en el siglo pasado, debido a los crecientes requerimientos de los consumidores y a los avances en

las tecnologías y los procesos de mecanización, los cuales permitieron que la demanda fuera inferior a la capacidad de producción en la mayoría de productos y servicios.

Así, y también con el desarrollo del marketing, en el siglo XX, el enfoque de la dirección de empresas cambió. Poco a poco, el proceso de producción desarrollado por las empresas, fue progresivamente concebido como un proceso enfocado en el seguimiento de las necesidades de los consumidores, las cuales habían sido observadas previamente con el desarrollo de la investigación de mercados, o con los procesos de marketing de forma amplia. De este modo, y con un enfoque central en el proceso del marketing, de forma progresiva las compañías se dieron cuenta que para ser eficientes debían focalizar previamente su atención en el proceso de marketing para detectar las necesidades de los clientes, y de forma posterior en la organización de las capacidades de sus propias empresas (junto a las capacidades de los socios en la cadena de valor), con objeto de poder crear de forma eficiente productos y servicios que pudieran encajar y ajustarse de forma precisa a las necesidades de los consumidores en un entorno competitivo dado. Esta segunda fase fue evolucionando con el desarrollo de los sistemas de información, hasta el desarrollo de la denominada web semántica o Web 3.0, en este siglo. En la nueva concepción, sistemas de información sofisticados y numerosos datos internos ayudaban a las organizaciones a analizar las necesidades de los consumidores y organizar su proceso de producción para satisfacer las necesidades de los consumidores.

Sin embargo, en el proceso de globalización, y con el desarrollo del denominado “big data”, las necesidades de los consumidores han cambiado guiadas por factores contextuales y personalizados, y el enfoque tradicional de las dos fases anteriores, considerando en primer lugar la producción al marketing, o el marketing como previo al proceso de producción, requieren y necesitan una transformación, con una nueva perspectiva. En nuestra opinión, la nueva perspectiva debe cambiar el ángulo de visión, concentrándose más la bipolaridad del enfoque externo versus el interno (interno a la empresa o a la cadena de valor) del modo de organizar la producción, el marketing o en general el proceso de dirección de la empresa. De este modo, y de forma opuesta a las dos concepciones previas, que fueron concebidas con un enfoque interno (verso al externo que planteamos) en la organización de los procesos de producción y marketing (en parte influidos por el desarrollo de la teoría de recursos y capacidades), la era ubicua, que desarrollamos posteriormente, remarca la necesidad de las organizaciones de mirar más allá de sus límites o fronteras (o de las fronteras de las empresas de su cadena de valor), para organizar y desarrollar de una forma más eficaz y eficiente los procesos de marketing, producción y ampliamente la dirección de la empresa. Ellos es necesario para poder crear productos y servicios eficientes que puedan satisfacer las necesidades contextuales de consumidores con necesidades personales y particulares.

1.2. Internet de las Cosas, “Pervasive Computing”, y “Ubiquitous Computing”

El concepto de Ubicuo podría venir esencialmente del hecho de aplicar, conectar y extender de forma amplia las tecnologías de la Web Semántica al “Ubiquitous Computing”. Dado el, es necesario comprender previamente el concepto de “Ubiquitous Computing”, el cual está estrechamente relacionado con el término “Pervasive Computing” (de hecho ambos conceptos han sido considerados por mucha literatura como términos intercambiables, aunque existen algunas diferencias que relataremos), y la evolución del “Internet de las Cosas”.

El Internet de las Cosas refiere al hecho de “extender Internet a entidades físicas de interés para humanos... detectado como un conjunto de propiedades que se pueden observar, medir, acceder o activar mediante dispositivos tales como actuadores, sensores u otros componentes inteligentes”, tales como, por ejemplo la temperatura de una habitación. El objetivo es utilizar la tecnología para encontrar dinámicamente las asociaciones entre dispositivos y preferencias humanas, con objeto de “proporcionar información significativa y servicios ricos a los usuarios sobre las cosas en las que estos están interesados” (Christophe, 2012:93).

Siguiendo a Mokhtar (2007), “la convergencia de dispositivos informáticos potentes, pequeños y asequibles con tecnologías de redes que los unen a todos ellos”, resulto en el trabajo de Weiser (1991), quien visionó un entorno en el que los sistemas informáticos se insertaban de forma invisible en el tejido de la vida cotidiana de los usuarios, y “donde el poder computacional estaría disponible en todas partes incrustado en paredes, sillas, ropa y similares” (Kappel et al., 2003:81). Weiser fue por tanto el precursor de los conceptos de “pervasive computing” (informática penetrante) y “Ubiquitous Computing” (informática ubicua). Sin embargo, un análisis detallado nos indica que estos términos se refieren a cosas diferentes.

Según Lee et al (2004:4) “Pervasive Computing se refiere a un entorno de computación transparente e invisible que proporciona servicios dinámicos, proactivos y conscientes del contexto al usuario mediante la adquisición de conocimiento de contexto del entorno y la composición de servicios disponibles”. Siguiendo a estos autores, esto representa una nueva dimensión completa de la interacción hombre-computadora, donde “el usuario está rodeado por un entorno inteligente completo con dispositivos/sensores comunicándose entre si y agregando sus funcionalidades para proporcionar un conjunto de servicios consolidados” (ibid, p.4).

En realidad, muchos autores han considerado el término “Pervasive Computing” de forma intercambiable para definir la misma concepción que la “Ubiquitous Computing” (Al-Roubaiey, & Alkhiaty, 2014), desde el trabajo pionero de Weiser (1991). Sin embargo, diversos autores como Al-Roubaiey y Alkhiaty (2014) y Niemelä y Latvakoski (2004) mencionan que “Pervasive Computing” se basa en cómo los usuarios nómadas interactúan con el entorno. Más explícitamente, la “Pervasive Computing” se ocupa de la obtención de conocimiento contextual (de acuerdo con la localización y el tiempo) y la información del

entorno, (o, tal y como Kappel et al (2003) remarca, de la obtención y aprovechamiento del conocimiento sobre la situación de uso) y “proporcionar información dinámica, proactiva y consciente del contexto para el usuario” (Singh et al., 2006:421).

Por otra parte el entorno del “Ubiquitous Computing” refiere a un paso adicional, de crear un entorno informático global, que puede proporcionar a los usuarios un “acceso transparente e invisible a los recursos informáticos” (Singh et al., 2006:421; Guo, 2008: 337), basado en la información y conocimiento proporcionado por el “Pervasive Computing”. A su vez, “Ubiquitous Computing” representa un cambio desde la concepción de la maquinaria informática que requiere la atención del usuario, hacia las capacidades de computación omnipresentes incorporadas en el entorno cotidiano del usuario (Lassila, & Adler 2005). Más específicamente, de acuerdo con Al-Roubaiey, & Alkhiaty (2014:1), el “Ubiquitous Computing” trata de conferir a los usuarios la posibilidad de acceder a “servicios de información, aplicaciones y recursos globalmente disponibles a través de cualquier dispositivo, sobre diferentes tipos de redes, todo el tiempo e independientemente de su ubicación”. En síntesis, el término “Ubiquitous Computing”, proviene de Mark Weiser (1991), quien lo acuñó para describir su idea de un mundo informático incrustado, en el que los ordenadores estaban presentes invisiblemente en la vida cotidiana humana.

Por lo tanto, el hecho de compartir conocimiento e información entre entornos informáticos omnipresentes (“Pervasive Computing”) permite construir el entorno informático ubicuo (“Ubiquitous computing) deseado (Singh et al., 2006:421). O, en otras palabras, la colaboración de los entornos omnipresentes (“Pervasive”) permiten la creación del ambiente computacional ubicuo efectivo (Al-Roubaiey, & Alkhiaty, 2014). Como consecuencia de esta naturaleza omnipresente y ubicua, la informática se convierte de forma creciente y progresiva en una extensión del ser humano, ya que modifica o mejora la experiencia humana (Hepp et al., 2007)

1.3. Características del entorno informático ubicuo y del software ubicuo

Tal y como Al-Roubaiey y Alkhiaty (2014) remarcan, si en los entornos informáticos tradicionales los usuarios eligen de forma active interactuar con los ordenadores, en el entorno informático ubicuo los sistemas informáticos están disponibles en cualquier lugar aunque no de forma siempre visible, un hecho que aumenta el dinamismo y la heterogeneidad. Mokhtar (2007) destaca el dinamismo, la movilidad y la heterogeneidad inherente a estos entornos ubicuos. Además, Al-Roubaiey y Alkhiaty (2014) también enfatizan y explican algunas características del entorno ubicuo (integración física; interoperación espontánea; conciencia del contexto; accesibilidad universal de los dispositivos a los sistemas de información; colaboración efectiva entre las partes que acceden a los servicios de información, de forma proactiva; informática en un entorno social; e invisibilidad).

Sin embargo, tal y como Al-Roubaiey y Alkhiaty (2014) apuntan, el entorno ubicuo requiere de software ubicuo con interoperabilidad, heterogeneidad, movilidad, adaptabilidad, privacidad y seguridad de supervivencia, auto-organización, realidad aumentada, y finalmente escalabilidad de contenido y descubrimiento de recursos. Características de la informática ubicua son también los dispositivos informáticos pequeños, portátiles, e inalámbricos, tal y como señalan Lassila y Adler (2005). A su vez, Schwinger et al (2008) postulan que las aplicaciones web ubicuas tienen las características de ser accesibles en varios contextos, por ejemplo a través de dispositivos diferentes, por usuarios con intereses diversos, en cualquier momento desde cualquier lugar alrededor del mundo, o se conciben como aplicaciones “que se adhieren al paradigma cualquier lugar/cualquier tiempo/cualquier medio, teniendo en cuenta que actualmente los servicios en la web no se acceden de forma exclusiva a través de ordenadores de despacho tradicionales, sino a través de dispositivos móviles con diferentes capacidades y restricciones, por usuarios con intereses y objetivos diferentes en cualquier momento y desde cualquier lugar del mundo” (ibid, p.235).

Tal y como Kappel et al (2003:79) postularon, las aplicaciones web ubicuas que se adhieren al paradigma de obtener acceso ubicuo en cualquier momento y desde cualquier lugar y con cualquier medio, a todo el mundo y todas las cosas “requieren o deben ser personalizables, lo que significa la adaptación de sus servicios hacia un cierto contexto” y también están obligadas a comunicar *lo correcto*, en el *momento adecuado* y de la *forma correcta*, para conseguir la *mejora semántica* de los servicios. Como subrayan estos autores, este entorno aumentará la productividad y permitirá formas más satisfactorias de hacer las cosas, cambiando radicalmente también la forma en que las personas interactúan, “como se llevan a cabo los negocios, y como se organizará nuestra vida diaria” (ibid, p.81).

No obstante, las aplicaciones tecnología no puede ocultar la parte gerencial del Nuevo entorno ubicuo. En este sentido, Al-Roubaiey y Alkhiaty (2014) mencionan que la mayoría de estos requisitos deben de ser acoplados con el sistema software y los niveles de negocio y organización. Por otra parte, Chen et al (2007) mencionan que con su disponibilidad ubicua u omnipresente (y también con protocolos estándar e infraestructura ligeramente acoplada) Internet ha sido reconocida como una plataforma tecnológica ideal para la colaboración empresarial y comercial basada en software. Sin embargo, estos autores señalan que cumplir una orden de un cliente dentro de un entorno ubicuo, debe requerir también la integración de varias aplicaciones internas y también la interacción y coordinación con otras empresas (estos autores hacen hincapié en la relevancia del comercio colaborativo), un hecho que extendemos en este artículo a la coordinación con la masa, en nuestra concepción del Masscapital.

1.4. Desde la informática ubicua a la era ubicua del management

Nuestra idea de la era ubicua del management sigue a misma concepción, pero trasladada al campo directive, aunque en nuestra opinión con dos perspectivas:

En primer lugar, pensamos que la competitividad de las empresas depende de crear internamente un entorno ubicuo de producción marketing y en general de gestión, presente de forma transparente e invisible en toda la vida gerencial de todos los departamentos de la empresa, e incluso en la laboral de los empleados (y también en la vida de todos los individuos, empresas o masas relevante para la organización). Este hecho, sería indispensable para crear las condiciones necesarias para permitir acceder de forma continua a las redes globales por parte de los individuos dentro de la empresa, y también para facilitar el acceso a los requerimientos de la propia empresa, para aquellos individuos o entidades externas a la empresa (las cuales pueden contribuir a la mejora de las tareas de la organización), durante todo el tiempo y desde cualquier lugar. El objetivo es ayudar a la empresa a atraer y apropiarse de forma continua, de las innovaciones y tareas más eficientes que puedan proveer empresas externas o en general el Masscapital.

En segundo lugar, y lo más importaante, si los requerimientos de los consumidores son el factor critico que atender, en entorno gerencial ubicuo debería ser concebido como un entorno, donde una red, un medio o un sistema pudiera ser capaz de atraer, combinar y organizar las habilidades más eficientes, junto con destrezas, capacidades, conocimientos, tareas y productos provenientes de diversas empresas y masas en un ámbito global, con fin de poder producir productos personalizados y adaptados (y que pudieran satisfacer de forma apropiada) a los requerimientos de los consumidores en un contexto específico de tiempo y espacio (incluso en el caso que ye estos consumidores no hayan solicitado de forma explicita esos productos o servicios). Por tanto, acuñamos la era ubicua de gestión o del management, como un bucle de conexión de necesidades personalizadas y contextuales de los clientes, con la gerencia y organización de capacidades internas o externas a la propia organización, para satisfacer las necesidades de los consumidores y de la propia empresa.

Por ejemplo, una gestión ubicua en un contexto turístico sería esa de las empresas de intermedicación que combinaran las mejores empresas (por ejemplo de transporte, acomodación, restaurantes...) y el contexto del turista (eventos de esa región, clima...) para crear un paquete turístico adaptado a las necesidades invisiblesde un posible turista (de acuerdo con sus preferencias y su contexto específico de tiempo y ubicación), incluso aunque ese posible cliente no haya solicitado o buscado específicamente un paquete turístico. Obviamente, esto hecho podría ser trasladado a las posibles necesidades de este cliente una vez que esté dentro de un avión o un hotel específico, debido que, tal y como Schwinger et al (2008) manifiesta, además de acomodación los hoteles pueden ofrecer servicios adicionales como comida, masajes, piscinas, actividades de animación o entretenimiento externo, o similares..., y como hemos apuntados, estos hoteles podrían estar conectado con otras organizaciones en su región para satisfacer las necesidades personalizadas de sus

clientes a sus consumidores en tiempo real. Es decir, in cada región o localidad, existe una oferta de actividades y eventos, los cuales, en un tiempo, o dependiendo por ejemplo de la climatología, o de la situación contextual específica del cliente (pensemos por ejemplo en su estado de humor o en el periodo del viaje en el que se encuentra), pudiera satisfacer los requerimientos de ese cliente. Ello sería una evolución de lo remarcado por Chen et al (2007:531), quienes apuntan que “proporcionar a los clientes el estado de los pedidos en tiempo real durante el complejo proceso de cumplimiento de pedidos, es lo que muchas empresas se esfuerzan por ofrecer como un importante servicio de valor añadido a sus clientes”.

En otro ejemplo, la perspectiva de la informática ubicua es similar a la perspectiva seguida por Google, cuando capta los gustos o demandas de los clientes al visitar páginas web específicas, y a partir de ahí les ofrece anuncios específicos de productos, provenientes de otras empresas, que puedan satisfacer dichas demandas. Sin embargo, nuestra perspectiva podría representar un paso añadido, donde existiera una combinación de productos (por ejemplo, si un cliente ha buscado por un mueble especial de algún estilo, para una habitación, no ofrecerle solo anuncios de muebles similares de diferentes empresas, sino ofrecerles también el diseño de diversas posibilidades de habitaciones de acuerdo a los gustos de los clientes, combinando esos muebles con otros muebles y cosas relacionadas, e incluso medios de transporte, tal vez procedentes de otras empresas). Además, traduzcamos esta perspectiva al proceso productivo de una empresa (tal y como explicamos anteriormente) para proporcionar productos o servicios de la empresa que puedan integrar productos, servicios e innovaciones de otras empresas, e incluso del Masscapital.

Tal y como Romeroy Vernadat (2016) señalan, *Pervasive y Ubiquitous Computing* deben permitir el “*Internet-of- Everything*”, creando nuevas conexiones entre personas, procesos, datos, cosas e incluso servicios. Sin embargo, de acuerdo a estos autores, en el futuro Internet de las Cosas (o Internet de Todo), la interoperabilidad será crucial para no limitar el uso del Internet de las Cosas para la industria y la sociedad. Del mismo modo, la era ubicua requiere interoperabilidad y conexiones fluidas, así como una integración gerencial entre las tecnologías, las empresas, los seres humanos y los objetos de todos los días, y necesita proveer a los usuarios con su entorno de procesamiento de información requerido y con los productos que de forma personalizada y contextualizada puedan cubrir sus requerimientos. Todo esto, bajo el paradigma de en cualquier sitio (Anywhere), tiempo (Anytime), en cualquier persona (Anybody), en cualquier tipo (Any type), y en cualquier dispositivo (Any device) (Singh et al., 2006).

Debemos destacar que la integración del Masscapital es esencial para encarar con las transformaciones de los comportamientos de los consumidores. Las necesidades de los clientes han cambiado en tres modos, los cuales representan a su vez oportunidades para las empresas: basados en la ubicación, el tiempo y las características personalizadas de los usuarios individuales. En primer lugar, la evolución de la web y los teléfonos inteligentes

hacia el Internet de las cosas incide en que los clientes tengan distintas necesidades en función a su localización, y entonces esa ubicación influye en sus requerimientos de productos. En segundo lugar, el enfoque del cliente se centra en la inmediatez de sus necesidades, o la divergencia de esas necesidades de acuerdo con el tiempo. En tercer lugar, las necesidades de los clientes se vuelven cada vez más guiadas por bases personalizadas.

Obviamente, como Kappel et al (2003:81) enfatizan, en el Nuevo entorno, la ubicuidad de la web “ofrece nuevas oportunidades y desafíos para las aplicaciones web en términos de servicios *conscientes del tiempo, conscientes de la ubicación, conscientes del dispositivo, y conscientes de la red*, servicios que pueden ser personalizados para un determinado usuario o grupo de usuarios, también”. Sin embargo, la necesidad de atender a necesidades de los consumidores cada vez más personalizadas y contextuales representa también una profunda transformación de la concepción de la gestión o management, o en la concepción de cómo producir los productos:

En primer lugar, las compañías no pueden basarse solo en sus propios datos limitados para conocer las necesidades de los consumidores, y los mecanismos centralizados de datos internos necesitan una transformación hacia mecanismos descentralizados con conexiones con múltiples datos externos, para poder encontrar en el momento y lugar específico, las necesidades específicas y personalizadas de los consumidores, con el fin de crear el producto o servicio apropiado que pueda satisfacer dichas necesidades.

En Segundo lugar, el proceso de producción no puede ser concebido simplemente como un mecanismo de combinación de recursos y capacidades internos (tanto de la empresa como de su cadena de valor), para producir el producto personalizado que el consumidor necesita en su contexto específico. Este proceso de producción está limitado por el hecho de que los consumidores pueden comparar más fácilmente la oferta de la empresa con las de sus competidores por internet, y las rápidas innovaciones que requiere el nuevo entorno no pueden ser producidas de forma sistemática utilizando solamente la limitada cadena de valor interna de la empresa, sino que es necesaria la utilización del denominado Masscapital, concebido en este trabajo como las capacidades de la masa relevantes para la organización.

2. Conceptualización del Masscapital

La relevancia del Masscapital puede entenderse después de examinar la evolución de la literatura de dirección de empresas. En los años 80 Michael Porter se centró en la relevancia del medio ambiente, y como analizarlo para posicionar la empresa en el mejor sector en el mejor país o localización. Posteriormente, en los años 90 la literatura examinó los recursos, competencias y capacidades de las organizaciones, y postuló que las organizaciones deberían centrarse en sus recursos únicos, y capacidades y competencias básicas únicas o nucleares (Grant, 1991; Barney, 1996), a la vez de externalizar hacia otras empresas más especializadas aquellas actividades y funciones que no pueden desarrollar de forma eficiente (Prahalad and Hamel 1990; Li and Petrick 2008). Esta perspectiva fue también complementada con la visión

de que las empresas deberían especializarse en fases más específicas, dentro de una amplia cadena de valor o red de valor que englobara a otras empresas (Peppard and Rylander 2006; Garrigos et al. 2014).

Sin embargo, con el proceso de globalización, y la mayor dificultad en encontrar donde podrían encontrarse esas compañías complementarias, poco a poco la visión de los recursos y capacidades fue reemplazada por nuevas perspectivas que se enfocaron más en los diferentes individuos externos, en vez de en compañías, como fuentes para proporcionar a las empresas las innovaciones necesarias requeridas dentro de las propias organizaciones, y también dentro de la red de valor. Siguiendo principalmente estas perspectivas, y observando el trabajo de Garrigos et al (2015), en este trabajo concebimos “Masscapital” como las capacidades de todos los individuos u organizaciones, estrechamente vinculados o no a la empresa, que pueden ayudar a esta a innovar o a mejorar cualquiera de sus actividades o procesos.

2.1. Las carencias de las teorías clásicas enfocadas en las capacidades externas

Las perspectivas que se centraron más ampliamente en individuos externos como Fuentes de capacidades importantes para las empresas, fueron más importantes en sectores enfocados en las tecnologías de la información, donde las innovaciones fueron externalizadas de forma masiva a “freelances” dispersos en la multitud. Sin embargo, esas nuevas perspectivas nacieron con ciertas carencias, que pretendemos superar con la concepción del Masscapital: En primer lugar, la literature considera esencialmente a los individuos externos, o ampliamente a redes externas de empresas, esencialmente como fuentes de información y conocimiento. Dichas perspectivas están influenciadas por la Teoría basada en el conocimiento de la empresa (Kogut & Zander, 1992, Grant ,1996), y buscan y observan esencialmente el número y la Fortaleza de los lazos existentes en las redes sociales (Granovetter, 1973; Reagans, & McEvily, 2003) como elementos fundamentales para mejorar la transferencia de conocimiento, especialmente de conocimiento tácito (Nonaka & Takeuchi,1995); remarcan la importancia del capital social de los individuos, como fuentes de capital humano (Coleman, 1988), o como instrumentos esenciales (como complemento del capital humano, estructural o físico) para mejorar el capital intelectual de las empresas; (Nahapiet and Ghoshal, 1998); o finalmente se centran en las capacidades de absorción de la empresa (Cohen & Levinthal, 1990; Gonzalez et al., 2014) y las capacidades de aprendizaje de las organizaciones para interiorizar tanto el conocimiento interno como el externo (Argyris & Schön, 1997; Senge, 1990; 2014). Sin embargo estas aproximaciones reducirían el Masscapital a una fuente limitada de la diversa cantidad de capacidades necesarias por las compañías; a pesar de que en el área profesional práctica, algunas organizaciones observaron pronto el potencial de otros usos de estas fuentes externas, especialmente con los procesos de autoservicio. Por ejemplo, y relamente, Hamel and Prahalad (1994:128) reconocieron que el cambio es inevitable, y que los directivos deberían preverlo, pero que: “la previsión de la

industria es una síntesis de la visión de muchas personas.... Los ejecutivos superiores no son los únicos con previsión de la industria. De hecho, su rol principal es capturar y explotar la previsión que existe en toda la organización”. Obviamente, la perspectiva de Hamel and Prahalad está superada porque, tal como señalan las nuevas perspectiva que miran fuera de los recursos y capacidades de la organización : 1) no es el gerente, sino la masa, quienes son los que pueden “prever”, y esto es un asunto descentralizada.2) las empresas deben de capturar y explotar esta previsión, pero no solo la que existe en toda la organización, sino la que existe a nivel mundial. Sin embargo, las nuevas perspectivas que se centran en el capital externo tienen una carencia importante que este artículo pretende superar: la empresa no tiene que capturar y explotar solo la “previsión” (que podríamos extender al conocimiento o la información) desde la masa, además la empresa debe ser capaz de explotar todo aquello procedente de la masa que pueda mejorar todas y cada tarea que la organización desarrolla. En Segundo lugar, las compañías con una perspectiva externa han mirado esencialmente a los clientes, como fuente del capital necesario por las organizaciones (esta perspectiva es explicada y desarrollada en las literaturas de “Knowledge Management” e “Intellectual Capital”), aunque poco a poco la literatura se enfocó hacia el capital social, aparte del procedente de los clientes, que podría ser aportado por otros miembros o grupos de interés externos de las organizaciones. En este sentido, el capital social (definido por Nahapiet and Ghoshal (1998:243) como “la suma de los recursos reales y potenciales incorporados, disponibles a través y derivados de la red de relaciones poseídas por una unidad individual o social”) que originalmente se centro en el individuo, y posteriormente en las relaciones organizativas, se redujo sistemáticamente como el proveniente de los clientes. En tercer lugar, la literatura se centró en cómo buscar y encontrar a estos individuos o sus capacidades, en lugar de centrarse en cómo atraerlos, o específicamente en cómo crear las condiciones para atraer, capturar y gestionar de forma continua, las competencias básica o nucleares necesarias para competir . En cuarto lugar, la literatura no considera tampoco la relevancia de la masa interna, como fuente de capacidades o capital, que podrían ser necesarios o requerirse en otras áreas de la empresa, especialmente en grandes corporaciones y redes de empresas.

3. La relevancia del Crowdsourcing como fuente del Masscapital y sus deficiencias

Uno de los mecanismos utilizados recientemente para resolver algunas de estas carencias es el denominado Crowdsourcing. En este sentido, existe una creciente literatura con numerosos autores señalando la importancia de los procesos de Crowdsourcing. Crowdsourcing, también conocido como “outsourcing masivo” o “outsourcing voluntario”, se concibe como “el acto de tomar una tarea específica y externalizarla a un gran grupo de personas a través de internet, mediante una llamada abierta” (Galdon et al 2016:95), o el acto de tomar un trabajo o una tarea específica esencial para la fabricación o venta de un producto, previamente

realizado por un empleado de la compañía, o más ampliamente desarrollado por un “agente designado”, como un contratista (Howe 2006), y externalizarlo a través de una llamada abierta a un gran número de personas, una comunidad, o el público en general (muchedumbre o masa) a través de internet (Garrigos et al. 2014; Kleeman et al. 2008, p.6).

La perspectiva del Crowdsourcing soluciona en parte las dos primeras carencias de las perspectivas externas previas de la empresa, ya que: 1) introduce y desarrolla los procesos tradicionales de auto-servicio y de outsourcing a diferentes tareas de la organización (no reducidas por ejemplo a la innovación o gestión del conocimiento), o a tareas específicas del proceso de producción o comercialización (Boudreau et al., 2011), dado que incluye casi todos los pasos o procesos de la cadena de valor (Garrigos et al., 2014), y 2) aparte de los consumidores, la perspectiva del Crowdsourcing incluye un amplio número de autores o “stakeholders” (la multitud, no reducida solo a clientes) en la concepción y desarrollo de todas las tareas de la organización (producción logística, marketing...) (Garrigos y Narangajavana, 2015).

Sin embargo, la concepción del Crowdsourcing también adolece de diversas carencias:

1) Es concebida esencialmente como un proceso distributivo en línea o por internet (Estelles and Gonzalez, 2012), no considerando otras evoluciones de procesos físicos, como es el caso por ejemplo del auto servicio.

2) Está diseñado para comenzar con una llamada abierta, no siendo considerado como un medio sistemático para atraer de forma continua las innovaciones o desarrollos de tareas que pudieran llevar a cabo la multitud. Estamos de acuerdo que el proceso de Crowdsourcing no se concibe como un mecanismo de búsqueda y encuentro de socios o innovadores tales como el proceso de “outsourcing” previo, sino como un mecanismo para ayudar a que los socios encuentren a la empresa, si esos individuos piensan que puede proporcionar a la empresa una solución a su problema y si esa solución es interesante para ellos (Garrigós and Narangajavana, 2015) (superando las perspectivas previas de la externalización o outsourcing tradicional). Sin embargo, es problema es que, tal y como postulan estos autores, las organizaciones no pueden obtener continuamente la participación de la multitud lanzando llamadas abiertas, y esto es una carencia fundamental.

3) Se concibe como una concepción que va desde la empresa hacia el exterior, y no en ambos sentidos. En la perspectiva del Crowdsourcing es la organización quien detecta o identifica sus problemas y busca o pide soluciones, y no la multitud u otras empresas las que pueden detectar o identificar problemas o ineficiencias, o identificar las tareas que necesitan mejora en las organizaciones, ineficiencias que la propia organización puede no haber detectado anteriormente, o cuestiones de las que la organización no es consciente que está haciendo las cosas mal. Este aspecto es esencial, dado que, del mismo modo que la multitud puede superar a la industria de una manera más rápida y barata, superando incluso a las mentes más privilegiadas en el campo (Brabham, 2008:79), en nuestra visión, la multitud, en algunos aspectos, podría detectar mejor, y obviamente encontrar también la solución a la deficiencias

de la organización, o aportar los desarrollos, innovaciones o la forma de hacer las tareas que podrían ayudar a toda organización a avanzar.

4) Se concibe esencialmente para obtener el capital de la muchedumbre externa, pero no se ha considerado ampliamente la importancia de la multitud dentro de las empresas, especialmente en las grandes corporaciones. Obviamente, empleados o miembros internos de la organización también podrían ser fuentes importantes de capital, incluso para otras áreas, departamentos, funciones o delegaciones de las organizaciones.

Realmente, las empresas más innovadoras están creando mecanismos que más allá de las perspectivas teóricas actuales, capturando continuamente el “Masscapital”, utilizando de forma creciente las capacidades de la masa sin formulas basadas en el lanzamiento de llamadas abiertas a través de internet, y sin pedir de forma repetida por soluciones a problemas específicos (Garrigos y Narangajavana, 2015). Sin embargo, este hecho no es concebido teóricamente como una perspectiva, incluso a pesar de su relevancia crucial, hecho este que justifica el por qué de este artículo.

En resumen, y siguiendo a Garrigos y Narangajavana (2015), la perspectiva de Masscapital innova en el sentido de que: a) las principales capacidades están principalmente en la masa, y esencialmente fuera de la empresa; b) El Masscapital no puede reducirse a la gestión de capacidades solo relacionadas con el conocimiento y la información de la multitud; c) algo del Masscapital escapa al control de la organización, la cual a veces puede solo utilizarlo, pero sin capturarlo o gestionarlo (aunque mecanismos sofisticados pueden apropiarse para la organización cada vez más de ese capital), o interiorizarlo dentro de la empresa (pensemos por ejemplo en el marketing viral); d) La gestión del Masscapital no es solo una cuestión tecnológica, sino que también comprende estructuras gerenciales y estratégicas; e) La masa incluye a grupos de interés o “stakeholder” que van más allá de los clientes; d) Es necesario considerar la relevancia del tiempo (para poder manejar el tiempo de las personas, pensemos por ejemplo en el éxito de innovaciones tecnológicas que ocurren solamente cuando la multitud está preparada, o el momento cuando capturamos la participación de la masa), espacio (reflexionemos sobre la importancia de los conglomerados o “clusters” industriales o la importancia del entorno para insertar en la compañía el capital de la masa) y el volumen (algunas innovaciones no pueden ser replicadas, dado que las primeras organizaciones que las llevaron a cabo obtuvieron un volumen o participación de la masa que no puede ser replicado) o el éxito del uso del Masscapital.

4. Conclusiones

En la nueva Era Ubicua, donde las empresas deben adaptar las soluciones a las necesidades de los clientes en su contexto específico, el foco anterior de competitividad de las empresas, que se ha concentrado tradicionalmente en la importancia de la producción versus marketing de productos (o viceversa), ha cambiado. En nuestra opinión el Nuevo punto focal debe conceder más atención a la organización externa versus interna de los procesos de producción y comercialización, o más específicamente a un enfoque externo para la mejora de la gestión general de las organizaciones.

A través de concentrarse en esta organización de los procesos de marketing y producción (o más ampliamente en la gestión de las empresas) este document postual que las fuentes de recursos y capacidades, esenciales para mejorar todos los procesos dentro de la organización no residen más principalmente dentro de la empresa. Por el contrario, el artículo postula que las Fuentes de la competitividad hoy en día existen principalmente fuera de la empresa, en el denominado Masscapital (Garrigos y Narangajavana, 2014), definido como las capacidades de la masa relevantes para la organización. Este capital externo es crucial, porque la masa puede ser una mayor fuente de innovación, y también de eficiencia para el desarrollo de tareas, que las capacidades internas de la empresa consideradas tradicionalmente (y ampliamente predicadas a finales del siglo XX), o incluso que las capacidades internas de la red de valor de las empresas (tal y como se desarrollón a principios de este siglo).

En este trabajo hemos explicado estos procesos. En primer lugar el artículo se ha concentrado en la transformación del entorno empresarial, desde las eras anteriores centradas en la producción y el marketing, a la actual Era Ubicua. En este sentido hemos analizado y definido esta nueva era a partir de la combinación de las literaturas de sistemas de información y de dirección de empresas. En segundo lugar, el documento se ha centrado en la relevancia del denominado Masscapital, como un recurso apropiado par encarar los nuevos cambios que requiere el entorno empresarial de hoy en día En este sentido, el trabajo ha definido el Masscapital, y explicado esta concepción como un avance esencial de los procesos de Crowdsourcing y de innovación abierta.

El artículo se concibe como un documento conceptual, que puede servir de guía para autores teóricos al considerar los nuevos desarrollos de la gestión y el marketing de las organizaciones en general. Además, el documento podría ser relevante para los profesionales, tanto en las áreas de marketing como de dirección de empresas, dado que el mismo abre nuevas concepciones sobre las fuentes de competitividad de las empresas en la nueva era que surgen tras la difusión de las nuevas tecnologías de la información y la comunicación.

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Caracterización de los factores clave en la evaluación de proyectos turísticos: Una revisión de la literatura

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Abstract

The tourism sector has an important place in the sustainable development of a country; therefore, the objective of this research is to characterize the factors and the methodologies most used in the evaluation of such sites by researchers worldwide. To reach this aim, a literature review focused on the methodologies used for the selection and evaluation of tourism projects was carried out. As a result, 9 factors are proposed, consisting of multiple hierarchical levels which condense the characteristics of the methodologies studied: Natural Factors, Cultural Factors, Tourism Plant, Infrastructure, Superstructure, Accessibility, Human Capital and Tourism, Security and Price/Quality. In addition, a correspondence study is carried out in which the methodologies are classified according to their relation with the proposed factors.

Keywords: *Review, factors, methodologies, correspondence analysis*

Resumen

El sector turismo ocupa un lugar importante en el desarrollo sostenible de un país; por tal motivo, el objetivo de la presente investigación es caracterizar los factores y las metodologías más utilizados en la evaluación de dichos sitios por investigadores a nivel mundial. Con este fin, se llevó a cabo una revisión de literatura enfocada en las metodologías usadas para la selección y evaluación de proyectos turísticos. Como resultado se encuentran 9 factores constituidos por múltiples niveles jerárquicos los cuales condensan las características de las metodologías estudiadas, éstos son: Factores Naturales, Factores Culturales, Planta Turística, Infraestructura, Superestructura, Accesibilidad, Capital Humano y Turístico, Seguridad y Precio/Calidad, adicionalmente se realiza un

estudio de correspondencia con el cual se clasifican las metodologías según su relación con los factores propuestos

Palabras clave: *Revisión, factores, metodologías, análisis de correspondencia*

Introducción

El turismo se puede definir como el movimiento de personas a lugares que se encuentran fuera de su lugar de residencia habitual, ya sea para pasar vacaciones, realizar negocios, o motivos personales. (OMT, 2007). Por tanto, es un fenómeno social, cultural y económico que tiene efectos sobre el entorno natural perteneciente a la población local de los lugares visitados y a su vez sobre las personas que visitan dichos lugares.

Este fenómeno es de especial interés teniendo en cuenta que la actividad turística puede influenciar directa o indirectamente el crecimiento de un país debido a los beneficios económicos que comúnmente brinda este sector: creación de empleo, generación de divisas, uso de infraestructura existente y uso de productos locales. Además, complementa otras actividades económicas y tiene efectos multiplicadores generando beneficios socioculturales tales como el mejoramiento de la educación, la reducción de barreras lingüísticas, socioculturales, raciales, políticas, religiosas, reforzando el mantenimiento de la cultura y el patrimonio y mejorando la apreciación de la cultura propia. (Jafari, 2005).

La evidencia del impacto del sector turismo se refleja en el crecimiento económico histórico ya que, en el año 2.000 generó unos ingresos mundiales de \$495.000 millones de dólares, los cuales aumentaron en el año 2.015 a \$1.260.000 millones de dólares, además, generó ingresos 211.000 millones de dólares por servicios de transporte internacional de pasajeros prestados a no residentes en 2015 (OMT, 2016) y desde el 2010 tiene como meta atenuar la pobreza con la realización de un manual el cual sirva de ayuda y de guía en el cumplimiento de este propósito. (OMT, 2010)

Teniendo en cuenta lo anterior, los países en vía de desarrollo han decidido apostarle a este sector ya que se genera un incremento significativo en las llegadas de los turistas (el 46% de las llegadas de visitantes en el 2011 fueron a los países subdesarrollados); posicionando al turismo como la segunda fuente de divisas para 20 de los 48 países menos avanzados en el mundo y, aportando en ciertos casos más del 25% del Producto Interno Bruto (PIB) en pequeños estados insulares en desarrollo. (OMT, 2010)

Por otra parte, debido a la formación, transformación de las visiones, y aportes que genera el turismo, éste tiene propiedades y herramientas que generalmente son asociadas a campos de investigación desarrollados, es decir el turismo se considera como una disciplina científica el cual genera interés en este tipo de comunidades, así como también en la comunidad académica (Jafari, 2005)

Finalmente, teniendo en cuenta que las características del turismo (disciplina científica generadora de beneficios) es posible proponer estrategias para el aprovechamiento adecuado de este sector en un sitio geográfico específico, por tanto, la presente investigación busca

caracterizar *Factores* y *Metodologías* que han sido aplicados para la adecuada selección de un sitio con potencial turístico con el fin desarrollar la economía del lugar, buscando así contribuir de manera directa o indirecta a atenuar la pobreza. Para ello, la estructura de esta investigación consta de una primera sección relacionada con la metodología aplicada para la revisión de literatura, seguida de una segunda donde se muestran los resultados obtenidos para posteriormente llegar a la tercera sección en la cual se discuten los alcances del estudio, y finalmente cuarta sección enfocada a las conclusiones del trabajo.

1. Metodología

La presente investigación se divide en tres etapas que apoyan una revisión de literatura narrativa correspondiente a recopilar, analizar, sintetizar y organizar información relacionada con factores y metodologías utilizados para la evaluación del potencial turístico de un sitio. Así mismo, se recopila información con el fin de agrupar según categoría gramatical y deductiva los factores y las metodologías halladas y, por último, se utiliza una técnica estadística denominada análisis de correspondencia para estudiar y describir posibles relaciones entre las variables (Factores y Metodologías).

La primera etapa se enfoca en una revisión de literatura la cual consta de cuatro fases: 1) Consulta en bases de datos la cual incluye: Scopus, Web of Science, EBSCO HOST, Crossref, GoogleScholar, Emerald Insight, Digitalia España y la comunidad académica Research Gate. 2) Selección de los documentos avalados por la comunidad académica publicados en la modalidad de artículos científicos, libros y casos de estudio. 3) Delimitación del idioma (español e inglés) y 4) Publicaciones a partir del año 2000, tomando como premisa los cambios sociales, la globalización, la sociedad de la información (TIC) y las nuevas corrientes ideológicas como la preocupación por la sostenibilidad medioambiental, la autenticidad cultural y la equidad social del siglo XXI. (Fallis, 2013)

Los artículos encontrados mediante el protocolo descrito anteriormente fueron seleccionados según su disponibilidad en las bases de datos (libre acceso o acceso institucional) y la calidad de su contenido (afin al objetivo de la presente investigación). Finalmente, se realiza una refinación de los documentos, para ello de forma recurrente se consultan fuentes académicas mediante una revisión en bola de nieve y son escogidos a partir de los criterios de selección (disponibilidad y calidad).

En la segunda etapa se propone la formación de factores mediante la asociación de características, para ello se seleccionaron palabras y frases relacionadas con la evaluación del potencial turístico de un sitio, las cuales son fusionadas según su afinidad, categoría gramatical, semejanza y tipo de sinonimia total (utilizada cuando dos términos se pueden intercambiar en un mismo contexto), sinonimia conceptual (usada cuando los términos relacionados remiten al mismo referente y significan exactamente lo mismo), y sinonimia contextual (cuando los términos relacionados pueden conmutarse únicamente en el contexto de análisis) (Ríos, 2009).

Posteriormente, las características obtenidas son agrupadas generando de esta manera subfactores, y éstos a su vez factores. En cuanto a las metodologías se categorizaron de forma deductiva aquellas que son reconocidas por la comunidad académica mediante su publicación, entidades u organizaciones y de forma inductiva para las restantes (Lecanda, 2002), además, las variables de la investigación (Factores y Metodologías) se organizaron teniendo en cuenta el número de documentos que los nombran o utilizan.

En la tercera etapa se realiza un análisis de correspondencia con el fin de identificar relaciones entre los factores y las metodologías, para ello se construye una tabla de contingencia entre las variables (Factores y Metodologías) con el objetivo de hacer un análisis de agrupación por medio de un gráfico de dispersión biplot, en el cual, las posiciones relativas de las variables representan la afinidad o interacción entre ellas, es decir, entre más cercano se encuentran las variables, más relacionadas están.

2. Resultados

Los resultados obtenidos se dividen en tres categorías de acuerdo a la metodología planteada. Estas son:

2.1. Resultados de la Revisión Literaria

Teniendo en cuenta el protocolo de revisión se encontraron un total de 88 documentos, entre ellos libros, casos de estudio y artículos científicos, de los cuales el 62,5% están en idioma español. Una vez refinada la búsqueda se seleccionaron 50 documentos (34 casos de estudio, 8 artículos y 8 libros (en el Anexo 1 se registra el listado de los documentos consultados), es decir, el 68% de los documentos son casos estudio), de los cuales el 80% son en idioma español, el 76% fueron publicados entre los años 2003 a 2015 (ver Figura 1) y el 72% son de países tales como España, México, Argentina, Colombia, Chile y Brasil. (ver Figura 2).

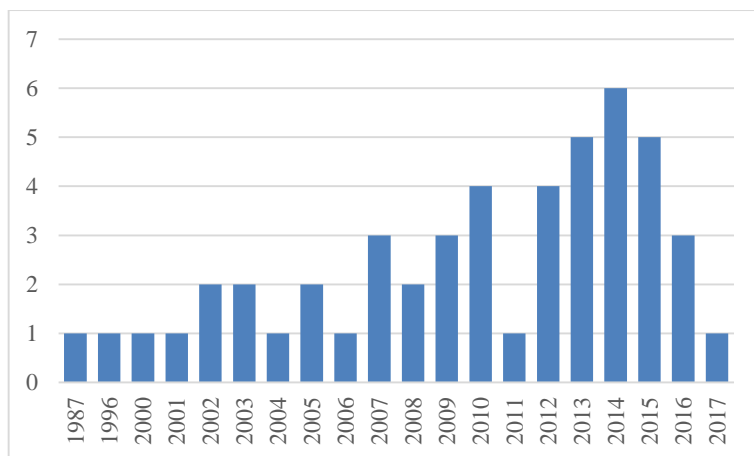


Figura 1. Histograma de la distribución de los artículos por año de publicación

2.2. Resultados de la conformación de grupos de factores y metodologías

2.2.1. Factores

En los documentos seleccionados se encontraron un total 887 características (palabras y frases) relacionadas con la evaluación del potencial turístico las cuales indicaban un concepto o idea diferente (según su afinidad, categoría gramatical, semejanza y sinonimia), al agruparlas teniendo en cuenta el concepto que describen se generaron 36 subfactores, y estos a su vez 9 Factores (ver Anexo 2). La descripción de los factores se registra en la Tabla 1.

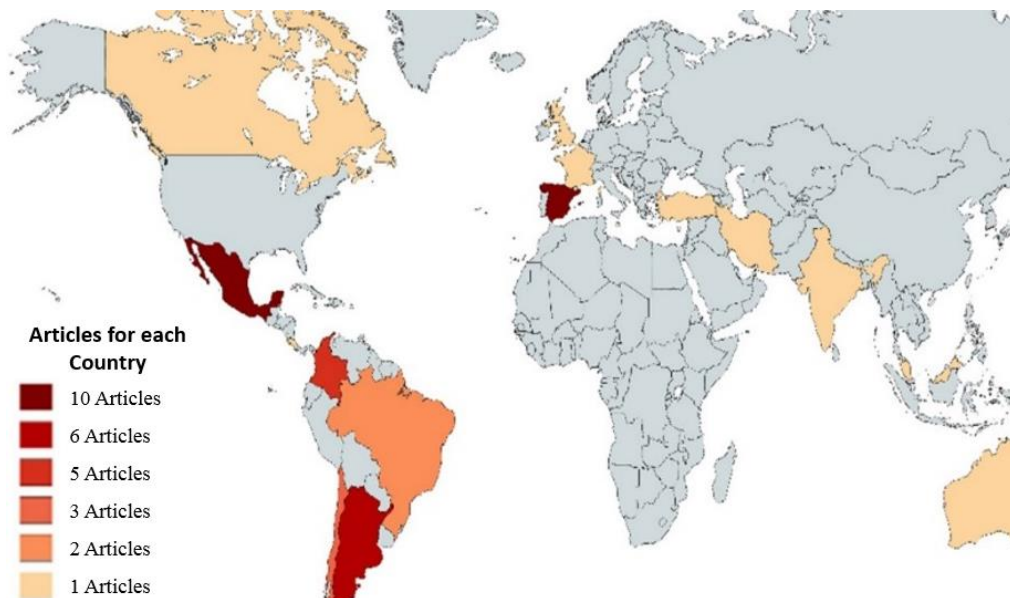


Figura 2. Representación gráfica de la distribución de los documentos por países

Tabla 1. Factores Planteados

Factor	Descripción
Natural	Considerado como todo elemento geomorfológico, biofísico cuyas características posibilitan la visita, apreciación y satisfacción por parte de los turistas, lo cual se alinea con lo planteado por Zimmermann quien dice que un recurso natural es aquel que el hombre puede utilizar para la satisfacción de sus necesidades de ser vivo. (<i>Zimmermann, 1957</i>) (elementos naturales distintivos, asociaciones vegetales, hidrografía, flora, fauna, clima etc.)
Cultural	Comprendiendo expresiones históricas de tradición o de otra época, lo cual se alinea con lo planteado por el Consejo Internacional de Monumentos y Sitios ICOMOS quienes dicen que el patrimonio cultural son todos los sitios históricos, tradiciones pasadas y presentes, etc. (ICOMOS, 1999) (manifestaciones culturales, folclore, arte y monumentos, acontecimientos programados, gastronomía, etc.)
Planta Turística	Relacionado con establecimientos administrados por el sector público o privado, que se dedican a prestar servicios turísticos (<i>Labrada, 2014</i>), encargada de atender y satisfacer las necesidades y deseos de los turistas (<i>Castro, 2006</i>) (hoteles, restaurantes, centros de visitantes, centros comerciales, servicios de apoyo, agencias de viaje, etc.)
Infraestructura	Referente al conjunto de elementos, dotaciones o servicios necesarios para el buen funcionamiento de un país, de una ciudad o de una organización cualquiera (<i>RAE, 2015</i>) (sistemas de transporte, sanidad, servicios públicos, señalización, instalaciones médicas, etc.)
Superestructura	Abarcando todos los organismos especializados, tanto públicos como de la actividad privada, de la comunidad local encargados de optimizar y cambiar, cuando fuere necesario, el funcionamiento de cada una de las partes que integran el sistema turístico. (<i>Labrada, 2014</i>) (<i>Castro, 2006</i>)
Capital Humano y Turístico	Definido como la cantidad de conocimientos técnicos y cualificaciones que poseen los trabajadores del sector, procedente de las inversiones en educación formal y en formación en el trabajo (<i>Lillo, 2007</i>) (Atención en otro idioma, comunidad nativa, educación, condiciones de salud, características sociales de la población, etc.)
Accesibilidad	Teniendo en cuenta las características que permite que los entornos, los productos, y los servicios sean utilizados sin problemas por todas las personas, para conseguir los objetivos para los que están diseñados así como también la relación con las tres formas básicas de actividad humana: movilidad, comunicación y comprensión; las tres sujetas a limitación como consecuencia de la existencia de barreras (<i>López, 2002</i>)
Seguridad	Interpretada como un estado subjetivo que nos permite percibir que nos

	desplazamos en un espacio exento de riesgos reales o potenciales. (MINCIT, 2003) (Vigilancia, prevención de incendios, salubridad de los alimentos, servicios policiales, etc.)
Precio y Calidad	Definido como el resultado de un proceso que implica la satisfacción de todas las necesidades, exigencias y expectativas legítimas de los consumidores respecto a los productos y servicios, a un precio aceptable (OMT, 2003)

2.2.2. Metodologías

En la revisión literaria se encontraron documentos que utilizan diferentes metodologías, ya sea para la selección de factores a tener en cuenta para evaluar el sitio con potencial turístico y/o metodologías que ayudan a analizar los factores ya planteados. Teniendo en cuenta que el fin del presente trabajo se encontró 28 metodologías las cuales fueron clasificadas en 9 grandes grupos (Ver Tabla 2)

Tabla 2. Grupos de Metodologías

Metodologías	Descripción
Técnicas de Evaluación Multicriterio	Proceso decisorio que con la aplicación de métodos de comparación apoya al tomador de decisiones (Pacheco, 2008), en esta categoría se encuentran tipos de evaluación multicriterio y herramientas necesarias para su mejor aprovechamiento tales como fuzzy logic, Sistemas de Información Geográficos (SIG), etc.
LEADER (I, II)	Se trata de una iniciativa comunitaria que responde a la concepción moderna de los planteamientos del desarrollo rural, la cual plantea una guía para realizar la evaluación del potencial turístico de un lugar. (Zimmer & Grassman, 1996)
Metodologías propuestas por autores	Recopilación de metodologías planteadas de diversos autores que buscan mejorar el proceso de la evaluación del potencial turístico de un lugar de acuerdo a sus conocimientos investigativos
Métodos estadísticos	Abarca técnicas que integran la estadística como herramienta para apoyar la toma de decisiones, en esta categoría se encuentran metodologías tales como un modelo de ecuaciones estructurales, análisis de correspondencias, entre otros.
FODA	Herramienta de estudio que consiste en la identificación sistemática de oportunidades, fortalezas, amenazas, debilidades y peligros que surgen el futuro. (Ramírez-Rojas, 2009)
Análisis de competitividad turística (ACT)	Modelo planteado en base a las capacidades dinámicas e implicaciones turísticas de un destino. (Pascarella & Fontes, 2010)
Metodología propuesta por	Metodología Propuesta por la Organización de los Estados Americanos para

la OEA	llevar a cabo un análisis de un sitio con potencial turístico.
Metodologías propuestas por otras organizaciones	En esta agrupación se encuentran metodologías de organizaciones como la Organización Mundial del Turismo (OMT), planes de ordenamiento territorial (POT), entre otras.
Modelo de Flujos de Turismo (TFM)	Herramienta de planificación de infraestructura, actualmente utilizada como herramienta de uso general para entender el turismo en los niveles local y nacional. (Prideaux, 2005)

2.3. Resultados del análisis de correspondencia

En esta etapa metodológica se encontraron diferentes relaciones entre los factores y las metodologías. En primera instancia a partir de una tabla de contingencias (*ver Figura 3*) se puede observar que los factores más representativos son los naturales, la planta turística, los factores culturales, y la infraestructura, esto debido a que de las 887 características encontradas en la revisión literaria la mayoría se relacionaban con características propias de dichos factores como: flora, fauna, paisajes, relieve, hidrografía para el caso de los factores naturales; alojamiento, restaurantes, entretenimiento, centros comerciales para planta turística; monumentos, templos, folclore, tradiciones para los factores culturales y; red de carreteras, acueductos, electricidad, servicios de transporte para la infraestructura.

En el caso de las metodologías, las más representativas son la Evaluación Multicriterio, LEADER, metodologías propuestas por autores y métodos estadísticos, además, se puede visualizar que la evaluación Multicriterio es una metodología que posee mayor relación con los factores naturales, esta proximidad se da porque de los 50 documentos científicos analizados 20 (40%) de ellos utilizan la evaluación Multicriterio y de las 281 características encontradas en estos 20 documentos 104 (37%) son asociadas dentro de la categoría factor natural, este hallazgo nos permite concluir que a la hora de analizar y tomar decisiones con respecto a cuáles factores naturales tienen potencial turístico en determinado lugar es la evaluación Multicriterio.

A partir de la tabla cruzada (*ver Figura 3*) y la matriz de distancia derivada de ella, se construye la gráfica biplot de dispersión (*ver Figura 4*), en la cual se evidencia que hay factores y metodologías que pueden estar eventualmente relacionadas debido a las distancias relativas que hay entre ellas tales como

las que están en el cuadrante superior derecho, la metodología LEADER junto con el factor Planta Turística tienen una eventual relación debido a la aproximación que hay entre estas variables, esto debido a que el 37% de las características que se seleccionaron de los documentos que analizan los factores con la metodología LEADER, son asociados al factor Planta Turística.

Las variables con un poco más de aproximación se encuentran en donde los dos ejes se cortan, estas son: las metodologías propuestas por organizaciones, la matriz FODA y el factor cultural, estas variables se relacionan por que el 22% de los términos encontrados en los documentos que utilizan estas metodologías están asociadas con el factor cultural, el 78% restante incluyen términos asociados a los otros 8 factores propuestos.

Otro resultado a analizar está ubicado en el cuadrante inferior de la gráfica (ver Figura 4), los factores capital humano y turístico y, precio y calidad están más alejados de las demás variables de estudio, esto debido a que los términos asociados son mencionados por diferentes metodologías que están alejadas porque tienen mayor relación con otros factores y/o metodologías.

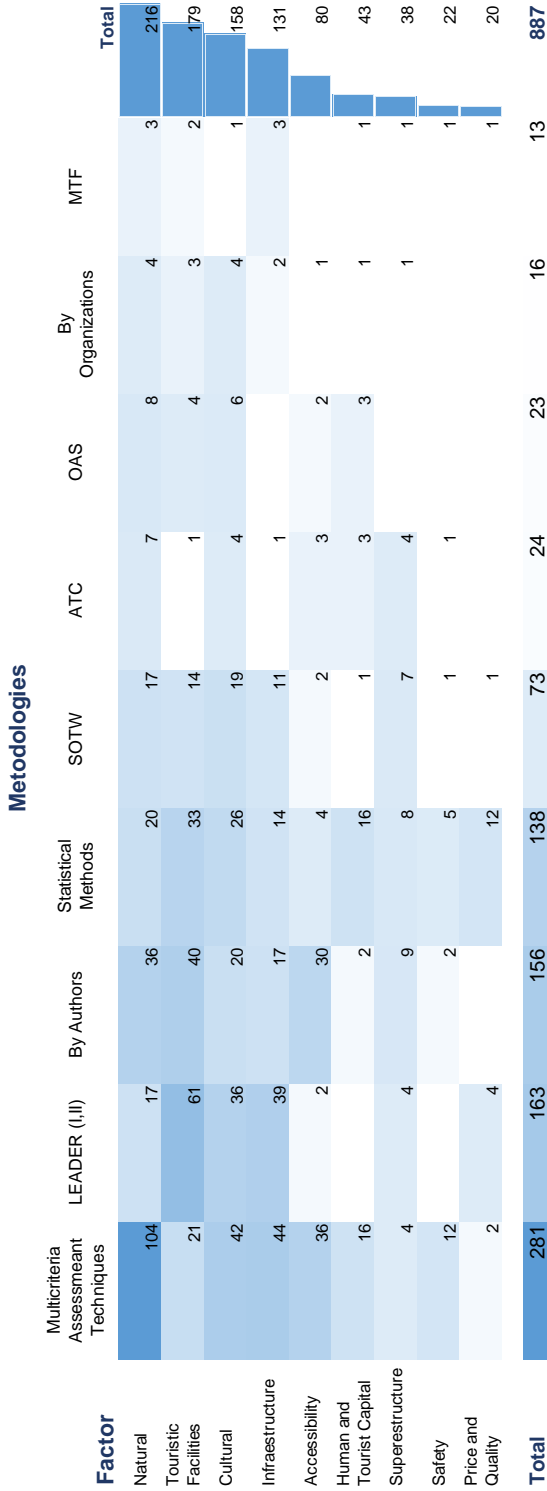


Figura 3. Tabla de contingencias entre factores y metodologías

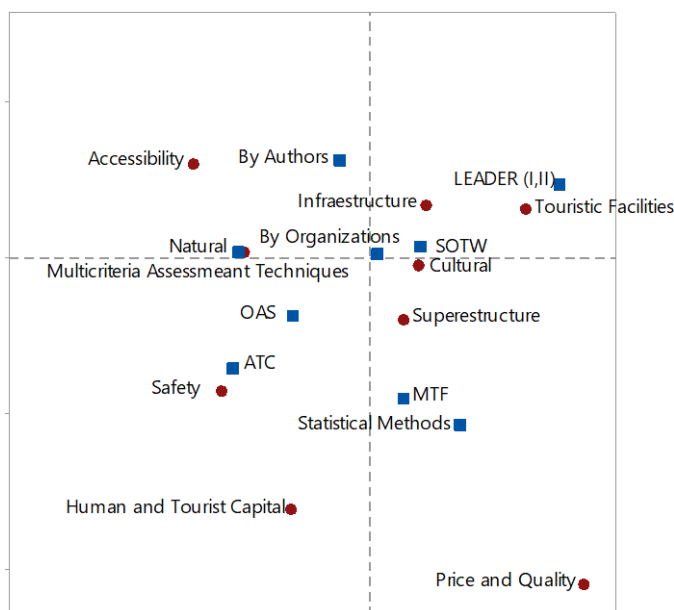


Figura. 4. Gráfica de dispersión bidimensional

3. Conclusiones

Existe un notable interés y tendencia a la aplicación del turismo en diferentes lugares del mundo debido a los beneficios que éste genera; sin embargo, identificar o evaluar el potencial turístico de un sitio conlleva el uso de diversos recursos como tiempo, personal capacitado, consecución de datos, análisis de información, etc. Por tanto, es necesario que la selección se enmarque en una metodología afín a las características del lugar con el fin de realizar un adecuado análisis.

Uno de los problemas que se generan al momento de seleccionar una metodología es la identificación de características relacionadas con el sitio de interés, puesto que, éstas pueden ser elegidas de manera arbitraria o no existe suficiente información relacionada con los factores generando así resultados con sesgos debido a la incorrecta identificación de las características o a limitaciones del conocimiento del investigador (evaluador del sitio).

Por esta razón, la estructura de factores propuestos en esta investigación, puede ser de ayuda para generar futuras guías o marcos de trabajo, ya que recopilan de manera jerárquica 887 características identificadas en la literatura y las metodologías más flexibles para su estudio. Por otra parte, a partir del análisis de correspondencia simple desarrollado durante el presente trabajo, es posible a futuro generar indicadores que comparen la flexibilidad de aplicar una (o más) metodologías según la información del sitio de interés (características).

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Anexos

Anexo 1. Listado de los 50 documentos consultados para el análisis de Factores y Metodologías

Autores	Título	Año	País
Raúl Alvarez Cuervo	Jerarquización de los recursos turísticos	1987	ESP
Peter Zimmer	Evaluar el potencial turístico de un territorio	1996	ESP
Paul F.J. Eagles	Guidelines for Tourism in Parks and Protected Areas of East Asia	2001	CHN
Laguna Marín-Ysali	La potencialidad turística del medio natural en sierras ibéricas Riojanas mediante evaluación Multicriterio	2001	ESP
Jinyang Deng	Evaluating natural attractions for tourism	2002	GBR
Carmen Ocaña Ocaña	Un Modelo de Aplicación de SIG y Evaluación Multicriterio, al Análisis de las Capacidad del Territorio en Relación a Funciones Turísticas	2002	ESP
Carmen Delgado Viñas	Turismo y desarrollo local en algunas comarcas de la montaña cantábrica recursos y planificación	2003	ESP
Bruce Prideaux	Factors affecting bilateral tourism flows	2005	AUS
Oscar Reyes Pérez	Metodología para determinar el potencial de los recursos turísticos naturales en el estado de Oaxaca Mexico	2005	MEX
Marina Novelli	Networks, clusters and innovation in tourism: A UK experience	2005	GBR
Fabiana Manzato	Turismo cultural Evaluación del potencial turístico de sitios arqueológicos	2007	BRA
Glauber Eduardo de Oliviera Santos	Modelos teóricos aplicados al turismo	2007	BRA
María Elena Valdez	Recursos turísticos regionales del municipio de tandil	2007	ARG
Jesús Aranguren	Evaluación de la capacidad de carga turística en la playa Conomita, Municipio Guanta, Estado Anzoátegui	2008	VEN
Marvin Blanco M	Guía para la elaboración del plan de desarrollo turístico de un territorio	2008	CRI
Anupriya Kaur Abhilasha Chauhan Yajulu Medury	Destination image of Indian tourism destinations: An evaluation using correspondence analysis	2009	IND
Sergio Franco-Maass	Evaluación de los recursos turísticos Parque Nacional Nevado de Toluca - México	2009	MEX
Beatriz Román Alzérrecá	Evaluación Turística Ochovenado	2009	MEX
Roberto Pascarella	Competitividad de los destinos turísticos. Modelo de evaluación basado en las capacidades dinámicas y sus implicancias en las políticas públicas	2010	BRA
Fernando Peña-Cortés	Diagnóstico del sistema turístico en la cuenca del Lago Ranco	2010	CHL
Mario Alberto Enríquez Martínez	Evaluación Multicriterio de los recursos turísticos del Parque Estatal Sierra de Nanchititla, Estado de México	2010	MEX
Rebeca Serrano Barquín	Una vision desde Sistemas Complejos para la evaluación Multicriterio Multiobjetivo	2011	MEX
Sergio Moreno Gil	Entender la imagen de un destino turístico, factores que la integran y la influencia de las motivaciones	2012	COL
Alfredo Conti	Evaluación de atractivos para la identificación de nuevos productos turísticos. Caso de estudio: región Capital de la provincia de Buenos Aires.	2012	ARG
Ctirad Schejbal	Evaluation of tourist destination attractiveness	2012	CZE

Ana Vera Martín	La toma de decisiones en la localización de la actividad turística en áreas de montaña	2012	ESP
Manuel Fuenzalida Díaz	Evaluación de la aptitud territorial para el turismo de naturaleza y rural, Reserva de la Biosfera La Campana – Lago Peñuelas, Chile	2013	CHL
Gleini Gallardo García	Evaluación del potencial turístico de las playas del departamento del Atlántico – Colombia, desde la perspectiva ambiental	2013	COL
María José Solís	Evaluación Multicriterio de la potencialidad turística de un territorio. caso de estudio parque nacional pan de azúcar, región de Atacama. Chile	2013	CHL
José Manuel Sánchez Martín	La evaluación del potencial para el desarrollo del turismo rural. aplicación metodológica sobre la provincia de cáceres	2013	ESP
Gustavo Aravena Paillalef	Manual para el desarrollo de circuitos de turismo de intereses especiales	2013	CHL
Charles Jean Camara	Metodología para la identificación, clasificación y evaluación de los recursos territoriales turísticos del centro de ciudad de Fort-de-France	2013	FRA
Ricardo Medina Covarrubias	Validación de recursos, motivaciones y emociones para el desarrollo de productos turísticos integrales	2013	MEX
Elena del Pilar Infante Sánchez	Elementos determinantes en Cundinamarca para el desarrollo del turismo como actividad estratégica regional	2014	COL
Yandy Cejas Castellanos	Evaluación del índice de desarrollo turístico en la ciudad de Matanzas	2014	COL
Eduardo Lizarralde	Mapa de los recursos turísticos de la provincia de huelva	2014	ESP
Mildred Joselyn Mikery Gutiérrez	Métodos para el análisis del potencial turístico del territorio rural	2014	MEX
Rubén Molina Martínez	Políticas públicas y factores que determinan la competitividad turística de Morelia, México y de Alcalá de Henares, España	2014	ESP
Xulio X. Pardellas de Blas	Una propuesta de turismo sostenible para el municipio de caldas de reis (pontevedra)	2014	ESP
Ali Göksu	Ranking of tourist destinations with multi-criteria decision making methods in bosnia	2014	BIH
Nilsen Kundakçi	Tourist hotel location selection with analytic hierarchy process	2014	TUR
Claudia Patricia Castellanos Menjura	“Evaluación de los recursos turísticos con vocación ecoturística y caracterización de la demanda turística en las zonas de uso público de la reserva forestal protectora del cerro Quininí (Tibacuy-Cundinamarca)	2015	COL
Paloma Blanco López	Inventario de recursos turísticos como base para la planificación territorial en la zona altiplano de San Luis Potosi México	2015	MEX
Sergio Andrés Cabello	La construcción del turismo en nuevos destinos: Luces y Sombras. El caso de la Rioja (España)	2015	ESP
Diego Navarro	Recursos turísticos y atractivos turísticos: conceptualización, clasificación y valoración	2015	ARG
Halima Begum	The Factors of Selecting Malaysia as Tourist Destination	2015	MYS
María Laura Rubio	Análisis de localización de emprendimientos turísticos en el sector norte del partido de villarino (Argentina)	2016	ARG
Daniela Arciniega Camarena	Evaluación de los recursos turísticos naturales del municipio de San Pedro Lagunillas, Nayarit, México, a partir de la metodología Multicriterio	2016	MEX
Juan Gabriel Vanegas	Evaluación Multicriterio e inventario de atractivos turísticos: Caso de Estudio	2016	COL
Zarei Morteza	Selection of the optimal tourism site using the ANP and fuzzy TOPSIS in the framework of Integrated Coastal Zone Management: A case of Qeshm Island	2016	IRN

Anexo 2. Principales factores y subfactores propuestos



Competencias versus Empleabilidad: Espacio Europeo de Educación

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Resumen

El panorama internacional está condicionando enormemente el acceso de los jóvenes universitarios al mercado laboral. No sólo se requiere una formación técnica excelente, ésta debe completarse con una formación en habilidades y competencias que aseguren su empleabilidad al más alto nivel. La adecuación de los contenidos de los distintos grados requiere el conocimiento exacto de la situación actual. El periodo de crisis iniciado a finales de 2008 ha acentuado esta necesidad, dado el volumen de jóvenes en paro con alta cualificación. El objetivo del artículo es realizar un análisis sobre el nexo existente entre Competencias-Empleabilidad ante la implantación del Espacio Europeo de Educación Superior, con la incorporación de las prácticas en empresa en los itinerarios educativos y el fomento de la movilidad de los estudiantes, y además determinar si la formación u otros condicionantes como el sexo o la edad condicionan los resultados. El estudio empírico se realizará mediante el análisis de la información recogida de bases de datos nacionales, así como de la literatura existente al respecto

Palabras clave: *Formación, cualificación, universitarios, mercado laboral.*

Introducción

El proceso de inserción laboral al que se enfrentan los jóvenes es cada vez más exigente, la globalización ha elevado el nivel de competencia internacional, precisando una preparación más adaptada a las necesidades del mercado. Las instituciones educativas deben orientar sus esfuerzos en lograr una sincronización entre la oferta de empleo y la preparación de los aspirantes, jugando un papel primordial la eficiencia y calidad del sistema educativo en todos sus niveles. Todas las etapas de la fase de aprendizaje son importantes para lograr una formación completa del individuo.

La educación en España comienza a la temprana edad de 3 años, pasando por distintos ciclos (infantil, primaria, secundaria y bachillerato), concluyendo en la universidad y los cursos de posgrado. La formación universitaria se inicia y desarrolla sobre una base de conocimientos que debe estar muy consolidada y preparada para asimilar nuevas habilidades, claves en la determinación del desarrollo personal y profesional de la persona. Se trata de un gran reto del sistema educativo; preparar a los jóvenes para asegurar su correcta entrada en el mercado laboral.

Las nuevas tecnologías junto con las novedosas prácticas de aprendizaje deben despertar el interés del alumno por adquirir las competencias y habilidades que aseguren su mejor empleabilidad. Los fondos privados y públicos destinados a la educación son cuantiosos, siendo necesario aportar resultados que justifiquen el esfuerzo realizado. Se debe evitar que la inversión efectuada en nuestros jóvenes, la aprovechen terceros países por carecer de puestos de trabajo adecuados a sus competencias.

A nivel nacional, el gasto público realizado en garantizar los estudios universitarios debe recuperarse en términos de futuros ingresos al erario público, derivados de la mayor producción generada. El país tiene la obligación de ir escalando puestos en el ranking de productividad internacional, y para ello la formación está comprometida en garantizar el desarrollo y crecimiento económico del país (Pastor y Peraita, 2012). También a nivel individual, la preparación académica asegura al individuo mayores ingresos y, en ocasiones, una mayor estabilidad en el mundo laboral.

En todo este panorama, el objetivo del artículo se centra en analizar la evolución del acceso de los jóvenes universitarios al mercado de trabajo. Se trata de determinar si la formación u otros condicionantes como el sexo o la edad condicionan los resultados. El estudio empírico se realizará mediante el análisis de la información recogida de bases de datos nacionales, así como de la literatura existente al respecto.

El artículo se estructura de la siguiente manera. En la sección siguiente se realiza una revisión de la empleabilidad de los graduados. En la sección tercera, utilizando información estadística, se presenta la evolución de los principales indicadores. Por último, en la cuarta sección se muestran las principales conclusiones del estudio.

1. La empleabilidad de los titulados en el marco del Espacio Europeo de Educación Superior

La adaptación al Espacio Europeo de Educación Superior (EEES) supuso un punto de inflexión y, por tanto, un cambio de rumbo en la educación superior española. Todas las licenciaturas e ingenierías tuvieron que adaptar sus itinerarios a las nuevas exigencias europeas, siguiendo las indicaciones establecidas en el Real Decreto de 29 de octubre de 2007. El eje central del mismo gira en torno a las competencias profesionales y la empleabilidad como finalidad última de los estudios universitarios, sin menoscabar el enfoque tradicional basado en contenidos y horas lectivas. En definitiva, la nueva regulación ha puesto el énfasis en dos líneas de actuación (García y Pérez, 2008):

Incrementar la empleabilidad, garantizando su compatibilidad con las carreras profesionales. Los nuevos grados deben potenciar la educación por competencias para asegurar no sólo la adquisición de conocimientos sino también el saber hacer tan demandado por los empleadores.

Potenciar las prácticas externas como vía para enriquecer la formación de los estudiantes e iniciar la primera toma de contacto con el mercado laboral.

El término empleabilidad, actualmente muy utilizado en el mundo universitario, tiene sus orígenes en Hillage y Pollard (1998) cuando se atrevieron a definirlo como la capacidad de obtener un empleo, mantenerlo e, incluso, de obtener otro si fuera necesario. Yorke (2004) se atreve a ir más allá considerando la empleabilidad como el conjunto de conocimientos y habilidades que aumenten la probabilidad de los egresados de encontrar un trabajo adecuado que les beneficie individualmente a ellos y a la economía en donde se desarrolle.

La literatura ha dejado evidencia sobre la preocupación constante de lograr un nexo de unión entre educación universitaria y mundo del trabajo. Así por ejemplo, Semeijn et al (2006) considera que es responsabilidad de las universidades transmitir a sus estudiantes las herramientas necesarias para asegurar la adquisición de las competencias para el correcto desarrollo de sus tareas profesionales.

Todo ello explica la relación existente entre empleabilidad y competencias. Estas últimas, bien desarrolladas y adaptadas a las necesidades del mercado laboral aseguran un alto grado de empleabilidad a los estudiantes que las desarrollen. El término competencia ha sido definido en distintos ámbitos. Así, por ejemplo, el Real Decreto 797/1995 define competencia como “la capacidad de aplicar conocimientos, habilidades y actitudes, al desempeño de la ocupación de que se trate”, de manera similar otros autores y organismos internacionales han puntualizado aspectos más concretos (Boyatzis, 1982; Mertens, 1996; OCDE, 2002; Gonzalez y Wagernaar, 2003; Martinez y Sauleda, 2005; Delgado et al, 2005; Fernández, 2005, entre otros). Paralelamente, y en un intento de abandonar el nivel más teórico para alcanzar un grado de mayor aplicabilidad, se han categorizado las competencias en básicas, genéricas y específicas:

- Competencias básicas: referidas al comportamiento y conducta elemental que los trabajadores tienen que demostrar (Vargas, 2005).
- Competencias genéricas: conducta común a las distintas actividades profesionales, están asociadas al desarrollo (Villa y Poblete, 2007).
- Competencias específicas: habilidades propias de cada puesto de trabajo (Boshuizen, 2004).

Los programas educativos tienen que estar orientados a garantizar la adquisición de las competencias necesarias que aseguren la empleabilidad de los que las adquieran. Los egresados dispondrán de un amplio abanico de habilidades que les hacen aptos para ocupar los puestos de trabajo que ofrece el mercado laboral. Así la Organización Internacional del Trabajo (OIT) define la empleabilidad como “las competencias y cualificaciones transferibles que refuerzan la capacidad de las personas para aprovechar las oportunidades de educación y de formación que se les presenten con miras a encontrar y conservar un trabajo decente, progresar en la empresa o al cambiar de empleo y adaptarse a la evolución de la tecnología y de las condiciones del mercado de trabajo” (OIT, 2004). Incluso se atreve a ir más allá afirmando que la educación es la clave para garantizar la empleabilidad de las personas, concretamente calificaciones como el trabajo en equipo, capacidad para resolver problemas, tecnologías de la comunicación, conocimientos de idiomas, entre otros.

2. Análisis de la situación actual de los jóvenes universitarios.

La adaptación de los planes de estudios al nuevo marco establecido por el EEES ha supuesto una herramienta de gran utilidad para acercar a los jóvenes al mundo laboral. Desde su origen ha existido una gran preocupación por modificar los sistemas de aprendizaje e introducir las competencias como herramientas básicas a transmitir a los estudiantes.

Se trata de completar la educación tradicional basada en contenidos con un aprendizaje en competencias que facilite la empleabilidad de los egresados. Las últimas estadísticas disponibles aportadas por el Instituto Nacional de Estadísticas (INE) dejan patente este esfuerzo realizado en la nueva formación universitaria (Tabla 1).

Tabla 1. Situación laboral en 2014 de los titulados universitarios del curso 2009-2010. Fuente: Elaboración Propia a partir de datos del INE

	Trabajando	En desempleo	Inactivo
Ambos sexos			
Total	75,63%	17,99%	6,38%
Menores de 30 años	74,52%	18,76%	6,71%
De 30 a 34 años	76,14%	18,66%	5,21%
De 35 y más años	78,94%	14,06%	7,00%
Hombres			
Total	77,97%	16,21%	5,82%
Menores de 30 años	75,47%	17,82%	6,70%
De 30 a 34 años	79,51%	16,16%	4,32%
De 35 y más años	81,92%	12,20%	5,88%
Mujeres			
Total	74,08%	19,16%	6,75%
Menores de 30 años	74,04%	19,25%	6,72%
De 30 a 34 años	73,02%	20,96%	6,03%
De 35 y más años	76,03%	15,87%	8,10%

Tal y como se observa en la Tabla 1, más del 75% de los titulados universitarios del curso 2009-2010 ocupaban un puesto de trabajo en 2014, sin una discriminación demasiado acusada entre hombres y mujeres. Sin embargo, hay que analizar y determinar las causas por las que casi un 20% de los mismos están desempleados. En el estudio de Lantarón (2014) se ratifica el esfuerzo de las universidades en facilitar a sus egresados la transición desde la vida académica al ámbito laboral. Más del 84% de ellas ofrecen servicios de orientación profesional, donde los jóvenes pueden instruirse para completar su formación.

La adaptación de los planes de estudios a la nueva normativa establecida por el EEES ha inducido a las universidades a incorporar prácticas en empresa en sus itinerarios educativos. Así los estudiantes durante su formación tendrán un primer contacto con el mundo laboral que les permitirá completar su formación y determinar la orientación más adecuada a su perfil profesional. En la Tabla 2 se muestran los estudiantes que durante sus estudios realizaron prácticas en empresa.

Tabla 2. Titulados del curso 2009-2010 que realizaron prácticas en empresa durante su formación universitaria. Fuente: Elaboración propia, datos del INE

Realizaron prácticas	
Ambos sexos	
Total	72,41%
Menores de 30 años	77,68%
De 30 a 34 años	72,29%
De 35 y más años	53,05%
Hombres	
Total	63,96%
Menores de 30 años	70,65%
De 30 a 34 años	67,06%
De 35 y más años	42,36%
Mujeres	
Total	77,99%
Menores de 30 años	81,26%
De 30 a 34 años	77,13%
De 35 y más años	63,51%

Analizando el total se observa que más del 70% de los estudiantes realizaron prácticas en empresa durante su formación universitaria, apreciando una diferencia por sexo de más de 10 puntos porcentuales. Las mujeres han tenido una mayor inclinación e interés en formarse en el mundo laboral que los hombres (casi un 78% las mujeres frente al 63,9%).

La implantación del EEES se realizó sobre la idea común de mejorar la competitividad de los sistemas universitarios europeos, fomentando la movilidad del estudiante como vía para lograr una mayor inserción del egresado en el mundo laboral. Se busca que el sistema educativo europeo esté preparado para los cambios socioeconómicos que le permita afrontar la creciente competitividad internacional (Martín-González y Pérez, 2013). En la Tabla 3 se observa que la movilidad todavía es una asignatura pendiente en los egresados nacionales.

Tabla 3. Movilidad de los titulados universitarios del curso 2009-2010. Fuente: Elaboración Propia a partir de datos INE

	Ha residido fuera de España	No ha residido fuera de España
Ambos sexos		
Total	21,79%	78,21%
Ha trabajado después de acabar la carrera	21,87%	78,13%
No ha trabajado después de acabar la carrera	20,44%	79,56%
Hombres		
Total	23,69%	76,31%
Ha trabajado después de acabar la carrera	23,88%	76,12%
No ha trabajado después de acabar la carrera	20,39%	79,61%
Mujeres		
Total	20,53%	79,47%
Ha trabajado después de acabar la carrera	20,54%	79,46%
No ha trabajado después de acabar la carrera	20,48%	79,52%

3. Conclusiones

En el artículo que se presenta se hace una revisión de la situación de la empleabilidad en el nuevo marco del EEES, buscando su nexo con los niveles competenciales de los egresados. Se trata de un término relativamente novedoso y en ocasiones mal utilizado.

Empleo y empleabilidad son dos términos que se encuentran en dimensiones muy distintas aunque influenciados por factores comunes como las competencias individuales, situaciones personales y socioeconómicas, así como el marco institucional. La empleabilidad es el mecanismo que protege al individuo frente a la inestabilidad y precariedad del mundo laboral, haciéndolo atractivo en sí mismo y, por tanto, más independiente de las circunstancias puntuales del mercado laboral.

Con independencia de la ideología del gobierno, las autoridades deberían potenciar la educación por competencias para asegurar que los ciudadanos adquieren las habilidades necesarias demandadas por el mercado laboral. A su vez, ésta supondrá grandes retornos económicos y profesionales de los que se beneficiarán la sociedad en su conjunto. Las competencias tienen que cubrir las necesidades demandadas por los empleadores, intentando

ajustar la formación para evitar desfases entre la oferta y la demanda. En todo este proceso el aprendizaje juega un papel primordial, donde las políticas universitarias deben orientar toda esta etapa de adaptación.

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Propuesta de mejora continua del proceso de enseñanza-aprendizaje en una asignatura universitaria en base a un análisis de opinión del alumno

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Abstract

The main objective of the research presented in this paper is to make a proposal to improve the teaching activity of a university subject. The improvement is proposed based on the opinion of the students assuming that, in order to improve the quality of the teaching-learning process, it is necessary to inquire about the impressions that they have. In this case, the analysis focuses on university students, since they are considered the protagonists of the teaching-learning process, and they can constitute a valuable means to redirect it, with the purpose of improving it. To know the perception that the students have after attending the course, an opinion survey was proposed. This survey measures the students' perception of the subject in relation to their future work, the satisfaction with the contents taught and the satisfaction with the practical activities carried out. The results show that there is a positive relation between the importance perceived by the student for his future work and the level of satisfaction with the content of the course taken, as well as with the activities carried out. Based on this, a set of improvements of the teaching-learning process of the evaluated subject are proposed, to be applied in the following courses.

Keywords: *Student's perception, continual improvement, teaching-learning process*

Resumen

El objetivo fundamental de la investigación que se presenta en este trabajo es realizar una propuesta de mejora de la actividad docente de una asignatura universitaria. La mejora se propone en base a la opinión del alumnado asumiendo que, para mejorar la calidad del proceso de enseñanza-aprendizaje, es necesario indagar sobre las impresiones que tienen los implicados en el mismo. En este caso, el análisis se centra en los estudiantes universitarios, ya que se considera que estos, como verdaderos protagonistas del proceso de enseñanza-aprendizaje, pueden constituir un valioso medio para reconducirlo,

con la finalidad de mejorarlo. Para conocer la percepción que tienen los alumnos tras cursar la asignatura se planteó una encuesta de opinión. En dicha encuesta se mide la percepción de los alumnos de la asignatura en relación con su futuro laboral, la satisfacción con los contenidos impartidos y la satisfacción con las actividades prácticas realizadas. Los resultados demuestran que existe una relación positiva entre la importancia percibida por el alumno para su futuro laboral y el nivel de satisfacción con el contenido de la asignatura cursada, así como con las actividades llevadas a cabo. En base a ello, se proponen un conjunto de mejoras del proceso de enseñanza-aprendizaje de la asignatura evaluada, para ser aplicadas en los siguientes cursos.

Palabras clave: *Percepción del alumnado, mejora continua, proceso enseñanza-aprendizaje*

Introducción

El objetivo principal de la investigación que se presenta en este trabajo es mejorar en el proceso de enseñanza-aprendizaje en una asignatura universitaria. Esta mejora se planteará en base a la opinión del alumnado de la misma, como fuente de información de primera mano y principales actores en el proceso de enseñanza-aprendizaje. Por tanto, evidentemente, se debe recoger la percepción de los alumnos, para lo cual, se ha diseñado una encuesta que se hará llegar a los mismos para que la rellenen una vez cursada la asignatura. En esta encuesta se pregunta por la percepción que tienen de la importancia de la asignatura para su futuro laboral, y por la satisfacción con la misma y las actividades llevadas a cabo.

El artículo está estructurado de la siguiente forma: en el siguiente apartado se justifica la importancia que la percepción y opinión de los alumnos tiene en un proceso de enseñanza-aprendizaje. Tras ello, se presentará el contexto de la asignatura en la que se ha llevado a cabo la investigación, para seguidamente presentar la estructura de la encuesta. A continuación, se presentan los resultados obtenidos y un análisis de los mismos, para finalizar este trabajo con las conclusiones obtenidas.

1. La importancia de la percepción y opinión del alumno

La implantación del Espacio Europeo de Educación Superior (EEES) ha generado indudables cambios a nivel estructural en el ámbito de la enseñanza universitaria, siendo una de las principales premisas de estos cambios el desplazamiento del centro de gravedad del proceso de enseñanza-aprendizaje desde la figura del docente hacia la del alumno (Hortigüela et al 2015). De este modo, el EEES implica la transición de un modelo educativo centrado en la enseñanza, hacia un modelo centrado en el aprendizaje autónomo del alumno, en el que éste último debe adoptar un papel activo en el proceso de aprendizaje (Oltra-Badenes y Gil-Gómez 2015) mientras que el profesor tendrá que impulsar el aprendizaje de las competencias y habilidades que tengan que adquirir los estudiantes (Fernández March, 2006).

Evidentemente, en este nuevo entorno, el acercamiento y análisis a las impresiones que tienen los implicados sobre una asignatura, y sobre todo, los estudiantes como los principales protagonistas del proceso de enseñanza-aprendizaje, puede constituir un valioso medio para reconducir el proceso con la finalidad de mejorarlo (Ricoy y Fernández-Rodríguez, 2013). Por tanto, parece evidente que para establecer un proceso de mejora continua en la enseñanza-aprendizaje de una asignatura, es imprescindible contar con la opinión del alumnado de la misma, y saber qué percepción tienen de la asignatura en varios aspectos. Una de las cuestiones sobre las que se considera importante investigar en este trabajo para proponer mejoras se centra en la percepción que tienen los alumnos sobre la importancia que tiene la asignatura, y los diferentes contenidos que en ella se tratan, para su futuro laboral. Los alumnos aprenderán más y mejor en la medida en que vean que ese aprendizaje va a contribuir al alcance de unos objetivos (Finkel 2008). En este caso, el objetivo al finalizar el grado será incorporarse al mercado laboral en las mejores condiciones. Por tanto, ese es uno de los puntos que se analizará en la investigación que aquí se presenta. Por otra parte, para conseguir que el aprendizaje sea de calidad, alcanzando los niveles más avanzados de la taxonomía de Bloom, es evidente que hay que conseguir motivar a los alumnos e impartir la asignatura de forma que les llegue, que los conocimientos que adquieran sean permanentes en el tiempo y que les guste lo que están aprendiendo y la forma de hacerlo (Tapia 2005). Por ello, también se indagará en esta cuestión en la encuesta realizada, con el objetivo de incorporar metodologías docentes que puedan mejorar este aspecto de la docencia.

2. Datos básicos de la asignatura

La investigación y mejora docente que se presentan se encuadran en una asignatura impartida dentro del plan de estudios del Grado en Ingeniería de Organización Industrial (GIOI) de la UPV. La asignatura tiene por nombre “Sistemas Integrados de Información en Empresas Industriales” y se imparte en el segundo cuatrimestre del 4º curso, teniendo 6 créditos divididos en 3 créditos de teoría y 3 créditos de prácticas. Es importante destacar que la asignaturas se imparte de forma intensiva, durante dos meses (febrero y marzo) lo cual hace que los alumnos tengan una carga importante de clases, prácticas y trabajos, ya que la docencia se encuentra muy concentrada. En la tabla 1 se muestran los datos básicos de la asignatura.

Tabla 1. Datos básicos de la asignatura. Fuente: Elaboración propia.

Código	Nombre asignatura	Carácter	Curso/ Cuatr.	Teoría	Práctica
11517	Sistemas Integrados de Información en Empresas Industriales	Optativo	4º B	3	3

Las competencias específicas y transversales que, según el plan de estudios, deben adquirir los alumnos a través de esta asignatura, son las se presentan en la tabla 2.

Tabla 2. Competencias específicas y transversales de las que es punto de control la asignatura.
Fuente: Elaboración Propia

Competencias Específicas	Competencias Transversales
19 (E) Diseñar, proyectar, planificar y gestionar la información de una empresa industrial u organización usando la tecnología y los sistemas adecuados.	(05) Diseño y proyecto (10) Conocimiento de problemas contemporáneos

En cuanto a la organización de la asignatura, sus contenidos y actividades, cabe decir que en el curso de estudio está organizada en 9 Temas de teoría y 10 actividades, de las cuales, 4 son prácticas de laboratorio, 2 son trabajos académicos, 2 son casos que realizan los alumnos en el aula y todo ello se completa con 2 charlas de profesionales reconocidos en el sector, que explican su experiencia en el mundo laboral en relación a los contenidos de la asignatura.

3. La encuesta de opinión

Para llevar a cabo la investigación que se presenta en este trabajo, se planteó una encuesta a los alumnos de la asignatura para recoger la percepción y opinión que tenían la misma, con el objetivo final de mejorarla, en la medida de lo posible, en función de la información extraída de los resultados obtenidos.

La encuesta constaba de un total de 38 preguntas, divididas en los siguientes 6 bloques:

1. Temas de teoría (importancia para el futuro laboral)

En este primer bloque de la encuesta se preguntaba por la importancia que los alumnos creen que cada uno de los 9 temas de los que se compone la asignatura va a tener en su futuro laboral. Por tanto había una cuestión por cada uno de los 9 temas, cuyas respuestas estaban planteadas en base a una escala Likert, siendo las valoraciones 1 Nada importante, 2 Poco importante, 3 Normal, 4 Importante y 5 Muy importante.

2. Temas de Teoría (si les ha gustado la forma en que se han impartido)

Este segundo bloque preguntaba también por cada uno de los 9 temas de teoría de la asignatura, pero desde el punto de vista de si les había gustado y parecido adecuada la forma de impartirlos (metodología, actividades, prácticas de aula, etc.). Las respuestas se planteaban, al igual que en caso anterior, en base a una escala Likert, siendo 1 No me ha gustado nada, 2 No me ha gustado, 3 Indiferente, 4 Me ha gustado y 5 Me ha gustado mucho.

3. Contenido de la asignatura

En este bloque se preguntaba a los alumnos si añadirían o eliminarían algún tema en concreto, y cuál sería, así como la opinión general sobre el contenido de la asignatura. En este caso se trata de una pregunta abierta.

4. Actividades y prácticas (4 prácticas, 2 actividades de clase, 2 charlas y 2 trabajos)

Este bloque se centraba en la parte de actividades y prácticas de la asignatura y, por tanto, se solicitaba que se valoraran cada una de las 10 actividades realizadas, valorando cada una en función de una escala Likert, siendo 1 Valoración muy negativa, 2 Negativa, 3 Normal, 4 Positiva y 5 Valoración muy positiva. También en este cuarto bloque se preguntaba si añadirían o eliminarían alguna actividad, y cual sería en caso afirmativo.

5. Valoración de la asignatura en general

En esta cuestión se pedía una valoración global de la asignatura, en base a una escala Likert, de forma gradual, siendo 1 Nada satisfecho y 5 Muy satisfecho

6. Valoración del profesor en general

En esta cuestión se pedía una valoración global del profesor y su labor docente, en base a una escala Likert, siendo 1 Nada satisfecho y 5 Muy satisfecho

Cabe decir que en cada uno de los bloques, se añadía una pregunta abierta, para que los alumnos pudieran expresar cualquier comentario u opinión que tuvieran al respecto.

4. Resultados de la encuesta

La encuesta se desarrolló en formato on-line, utilizando para ello la aplicación Google Drive. Se les envió a los alumnos el enlace a la misma después de que hubieran cursado totalmente la asignatura y de que las notas de la misma estuvieran puestas y comunicadas oficialmente, para conseguir que las respuestas fueran los más sinceras y objetivas posible. Del total de 25 alumnos matriculados en la asignatura, contestaron 19.

En los dos primeros bloques de la encuesta, en que se preguntaba por cada uno de los nueve temas vistos, los resultados obtenidos se muestran en las tablas 2 y 3 y las gráficas 1 y 2, que se presentan a continuación. En ellas se puede ver la media obtenida en cada uno de los temas en cuanto a si se ve relevante para el futuro laboral y si ha gustado la forma en que se ha enfocado en la asignatura.

Tabla 3. Media y desviación típica preguntas Bloque 1 de la encuesta. Fuente: Elaboración Propia.

	Recuento	Media	Desviación típica
T1_FLaboral	19	4.11	0.88
T2_FLaboral	19	3.00	1.33
T3_FLaboral	19	4.74	0.56
T4_FLaboral	19	4.53	0.70
T5_FLaboral	19	4.58	0.61
T6_FLaboral	19	4.37	0.83
T7_FLaboral	19	4.63	0.68
T8_FLaboral	19	3.95	1.08
T9_FLaboral	19	4.00	0.82

Tabla 4. Media y desviación típica preguntas Bloque 2 de la encuesta. Fuente: Elaboración Propia.

	Recuento	Media	Desviación típica
T1_S	19	4.16	0.76
T2_S	19	2.58	1.35
T3_S	19	4.47	0.61
T4_S	19	4.42	0.77
T5_S	19	4.47	0.70
T6_S	19	4.16	0.60
T7_S	19	4.42	0.96
T8_S	19	3.89	1.15
T9_S	19	3.68	1.06

Fuente:Elaboración propia

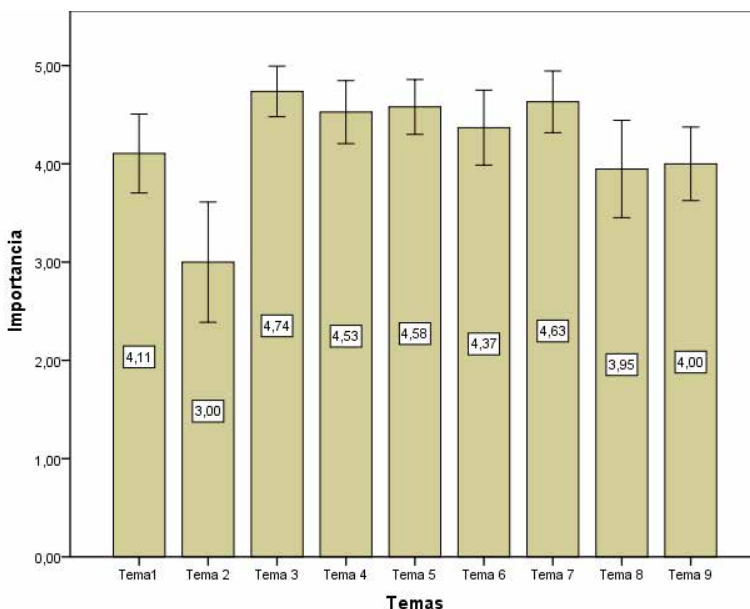


Figura 1. Media y desviación típica preguntas Bloque 1 de la encuesta. Fuente: Elaboración propia

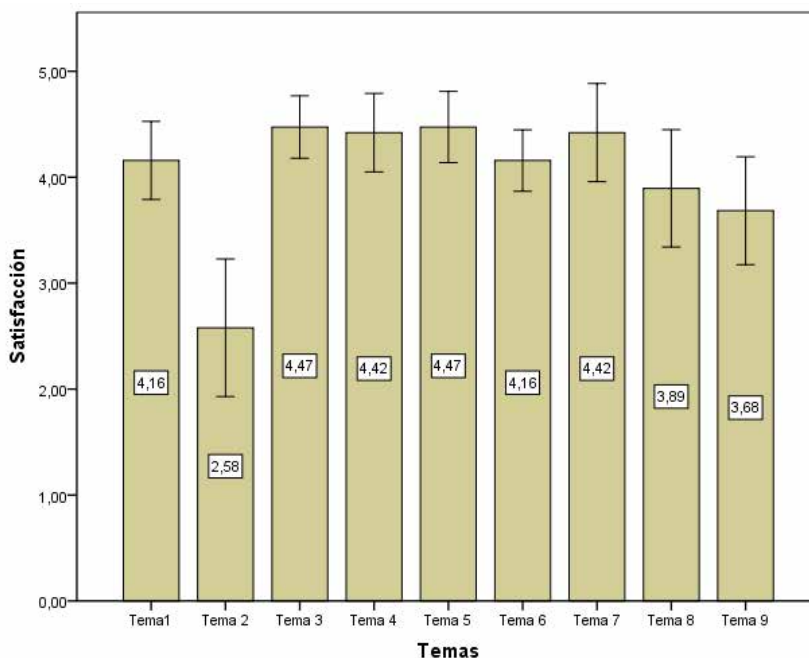


Figura 2. Media y desviación típica preguntas Bloque 2 de la encuesta

Finalmente, para cerrar la parte de contenidos y parte teórica, en el bloque 3, las respuestas referentes a la agregación de nuevos temas indican que cerca del 85 % de los alumnos dice que no añadirían ni eliminaría nuevos temas del contenido de la asignatura.

En cuanto a la parte práctica de la asignatura, la valoración de cada una de las actividades es la que se muestra en la Figura 3.

Cabe añadir que cerca del 69 % de los alumnos indica, en las respuestas al bloque 4, que no añadiría ninguna actividad práctica a la asignatura

En cuanto a la satisfacción con la asignatura en general (Bloque 5) del total de 19 alumnos, 12 valoraron la asignatura con un 5, mientras que 7 lo hicieron con un 4, siendo por tanto la valoración global media de 4,63 sobre 5, con una desviación típica de 0,49.

Finalmente, en el bloque 6, es decir, el que hace referencia a la valoración del Profesor en General, las respuestas de los alumnos fueron 17 respuestas de Muy satisfecho (un 5) y 2 de Satisfecho (un 4), obteniéndose por tanto una satisfacción media de un 4,89 sobre 5, con una desviación típica de 0,32

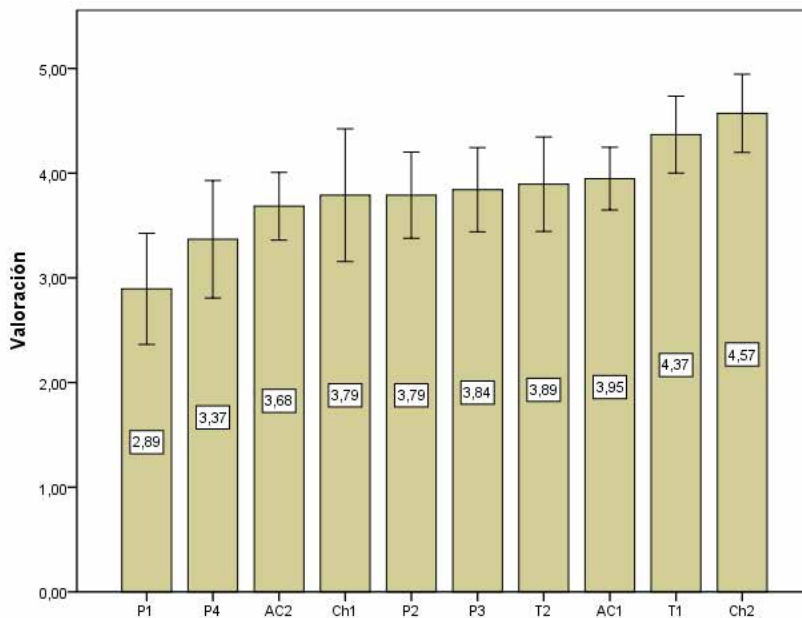


Figura 3. Media y desviación típica preguntas Bloque 3 de la encuesta (Actividades prácticas).

Fuente: Elaboración Propia.

5. Análisis de resultados

Al analizar los resultados obtenidos, se puede decir que la asignatura ha sido bien valorada por los alumnos, ya que ha obtenido una valoración en general de 4,63 sobre 5. Similar reflexión se puede hacer con la valoración del profesor que obtiene un 4,89 sobre 5. Por tanto, en líneas generales, la percepción global de la asignatura es buena. Sin embargo, al entrar a hacer un análisis más en detalle, se pueden hacer algunas observaciones interesantes.

En cuanto a la percepción de si los temas de la asignatura son relevantes para el futuro laboral, cabe decir que prácticamente todos obtienen una nota por encima del 4, excepto el tema 8 que obtiene un 3,95 (prácticamente un 4) y el tema 2, que es el que recibe la valoración más baja, con un 3.

Curiosamente, la satisfacción con cada uno de los temas tiene una distribución similar, como se observa en las gráficas, si bien las medias son algo inferiores. En este caso, los temas 2, 8 y 9 tienen satisfacción inferior al 4. Esto coincide también con que son los que se perciben como menos importantes para el futuro laboral.

En cuanto a las actividades prácticas, cabe destacar que la práctica menos valorada es la práctica de laboratorio 1 (P1), precisamente la que está relacionada directamente con el tema 2, siguiéndole la práctica de laboratorio (P4) relacionada con el 7, curiosamente uno de los mejor valorados. En el extremo contrario, tenemos las más valoradas, que son la Charla profesional 2, el Trabajo académico y la Actividad de aula 1.

6. Acciones emprendidas para curso siguiente

Evidentemente, parece que el tema más crítico de la asignatura, en cuanto a la percepción y valoración por parte de los alumnos, es el tema 2, que recibe las peores valoraciones, así como la práctica que va asociada al mismo. Es un tema con un enfoque teórico que se hace algo tedioso, cosa que ya se había intuido por parte del profesor dada la actitud de los alumnos en el aula. Por tanto, como primera acción para la mejora de la asignatura, se propone cambiar el enfoque del tema 2 y la práctica asociada, de forma que sea más dinámico. Además, se realizarán acciones dentro de la asignatura para que sea más visible su importancia y relación con el futuro entorno laboral de los alumnos.

Se propone también cambiar la Práctica de laboratorio 4, asociada al tema 7, de forma que sea una actividad más cercana a lo que los alumnos pueden percibir de su entorno cercano.

Adicionalmente, y dado que la actividad más valorada ha sido una charla profesional, se propone aumentar este tipo de actividades a 4, ya que se considera que pueden ayudar en gran medida a que se perciba la importancia de los contenidos de la asignatura en el futuro laboral de los alumnos.

7. Conclusiones

Tras el análisis de resultados de la investigación presentada, se puede concluir que hay una relación directa entre la satisfacción de los alumnos con los temas de la asignatura, y la percepción de su importancia en su entorno laboral futuro. Cuanto mayor es la percepción de que el tema es importante para el futuro laboral, mayor es la satisfacción con el tema impartido y las actividades realizadas. Por tanto, es importante transmitir a los alumnos lo valioso que va a ser el conocimiento adquirido en la asignatura para su futuro laboral, ya que esto conseguirá motivar al alumno y que se interese realmente por aprender.

Para conseguir este objetivo, en función de los resultados obtenidos en la encuesta y su análisis, se han propuesto una serie de acciones de mejora. Estas acciones de mejora se pondrán en marcha en el siguiente curso, con lo que se espera aumentar la valoración de la asignatura y cada uno de sus temas y actividades por parte del alumnado. Para ello, se repetirá la encuesta al finalizar la asignatura en el próximo curso, y se compararán los resultados, siendo de suponer que los cambios aumenten la valoración obtenida en los temas y actividades relacionados.

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PORTUGUES

DigComp 2.0 - referencial para a competência digital intergeracional

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Abstract

DigComp is the European Digital Competence Framework which aims to develop and understand digital competence in Europe to use digital technologies in a confident, critical, collaborative and creative way, in order to achieve goals related to work, employability, learning, leisure, inclusion and participation in society. In its 2.0 version, DigComp (DigComp 2.0: The Digital Competence Framework for Citizens) identifies the set of competencies that are necessary for all citizens today, in terms of knowledge, skills and attitudes. This new framework reflects, on the one hand, the recent demands of a society in constant evolution and digital transformation and, on the other hand, the orientations and strategies of the stakeholder consultations. DigComp 2.0 includes changes in its conceptual reference model, to update the vocabulary, the designation of areas of competence, the designation of skills and their description. Following this update, we suggest, through a critical and holistic analysis of the digital competence, the updating of an educational proposal for an intergenerational digital competence reference, initially elaborated based on DigComp 1.0. The main objective for the intergenerational digital competence reference is to facilitate the application of DigComp 2.0 to intergenerational learning environments, in that digital competence is a transversal and essential competence for the acquisition of other key competences for lifelong learning. Based on such reference, we propose to launch greater challenges to educational innovation, promoting the debate around the transformation of schools in open spaces to non-formal, informal and digital intergenerational environments that encourage the development of the digital competence of all citizens and of an intergenerational and lifelong education.

Keywords: *Digital competence; DigComp 2.0; intergenerational education; lifelong learning; innovation.*

Resumo

O DigComp (European Digital Competence Framework) é o Quadro Europeu Comum de Referência para a Competência Digital, que visa o desenvolvimento e a compreensão da competência digital na Europa para usar as tecnologias digitais de uma forma confiante, crítica, colaborativa e criativa, com vista a atingir as metas relacionadas com o trabalho, a empregabilidade, a aprendizagem, o lazer, a inclusão e a participação na sociedade. Na sua versão 2.0, o DigComp (DigComp 2.0: The Digital Competence Framework for Citizens) identifica o conjunto de competências que são necessárias a todos os cidadãos de hoje, em termos de conhecimentos, habilidades e atitudes. Este novo referencial reflete, por um lado, as recentes exigências de uma sociedade em constante evolução e transformação digital e, por outro, as orientações e estratégias das partes interessadas consultadas. O DigComp 2.0 inclui alterações no seu quadro concetual, ao nível do vocabulário, da designação de áreas de competência, da designação das competências e da sua descrição. Na sequência desta atualização propomos também, através de uma análise crítica e holística da competência digital, a atualização de uma proposta educativa de referencial para a competência digital intergeracional, inicialmente elaborada com base no DigComp 1.0. O principal objetivo do referencial para a competência digital intergeracional é facilitar a aplicação do DigComp 2.0 a ambientes educativos intergeracionais, na medida em que a competência digital é uma competência transversal e essencial para a aquisição de outras competências chave para a aprendizagem ao longo da vida. Com este referencial propomo-nos lançar desafios maiores à inovação educativa, promovendo o debate em torno da transformação das escolas em espaços abertos a ambientes não-formais, informais e digitais intergeracionais impulsionadores do desenvolvimento da competência digital de todos os cidadãos e de uma educação intergeracional e ao longo da vida.

Palavras-chave: *Competência digital; DigComp 2.0; educação intergeracional; aprendizagem ao longo da vida; inovação.*

Introdução

O *Joint Research Centre (JRC)* e o *Institute for Prospective Technological Studies (IPTS)* apoiam as políticas da Comissão Europeia nas dimensões socioeconómica e científico-tecnológica. Em 2005, o IPTS inicia a investigação intitulada “TIC para Aprendizagem” com o objetivo de fornecer apoio político baseado em evidência à Direção Geral de Educação e Cultura e Estratégia Europa 2020 para aproveitar o potencial das TIC para inovar as práticas de educação e formação, melhorar o acesso à aprendizagem ao longo da vida e lidar com

novas competências (digitais) necessárias para o emprego, o desenvolvimento pessoal e a inclusão.

O potencial e o impacto das TIC para a aprendizagem continuam a ser um dos temas prioritários para a Comissão Europeia. Atualmente, a investigação do IPTS sobre “TIC para Aprendizagem, Competências e Educação Aberta” é estruturada em torno de quatro linhas principais de pesquisa interrelacionadas e em todos os setores educativos: 1) Educação Aberta e Recursos Educativos Abertos; 2) Aprendizagem e Ensino Inovadores; 3) Competências-chave e Competências do século XXI; 4) Futuro da Aprendizagem (European Commission, 2009).

Neste artigo, iremos focar-nos na terceira linha de investigação, nomeadamente no DigComp - European Digital Competence Framework. Apresentaremos os seus objetivos e atualizações, hoje na sua versão 2.1, para depois propormos, através de uma análise crítica e holística da competência digital, a atualização de uma proposta educativa de referencial para a competência digital intergeracional, inicialmente elaborada com base no DigComp 1.0. Finalizamos com algumas sugestões e desafios à inovação educativa promovendo o debate em torno da transformação das escolas em espaços abertos a ambientes não-formais, informais e digitais intergeracionais, impulsionadores do desenvolvimento da competência digital de todos os cidadãos e de uma educação intergeracional e ao longo da vida.

1. DigComp

O relatório técnico do JRC apelidado ‘*Digital Competence in Practice: An Analysis of Frameworks*’ (Ferrari, 2012) visou identificar, selecionar e analisar o quadro atual para o desenvolvimento da competência digital. Neste relatório a competência digital é descrita como um:

conjunto de conhecimentos, habilidades e atitudes (incluindo capacidades, estratégias, valores e consciência) necessárias para usar as tecnologias da informação e comunicação (TIC) e os meios de comunicação digitais para executar tarefas, resolver problemas, comunicar, gerir informações, colaborar, criar e partilhar conteúdo, e construir conhecimento de forma eficaz, eficiente, adequada, crítica, criativa, autónoma, flexível, ética e reflexiva, para o trabalho, o lazer, a participação, a aprendizagem, a socialização, o consumo e o empoderamento (Ferrari, 2012, pp. 3-4).

O DigComp surgiu da necessidade de potenciar a competência digital e de um entendimento comum a nível europeu. O seu objetivo foi identificar e descrever os componentes chave da competência digital em termos de conhecimentos, habilidades e atitudes. Em 2013, é publicada a primeira proposta da Comissão Europeia para o conjunto de competências necessárias a todos os cidadãos de hoje. O DigComp descreve 21 competências, organizadas em 5 áreas de competência, para usar as tecnologias digitais de uma forma confiante, crítica,

colaborativa e criativa, com vista a atingir as metas relacionadas com o trabalho, a empregabilidade, a aprendizagem, o lazer, a inclusão e a participação na sociedade (Ferrari, 2013).

O DigComp está estruturado em cinco dimensões. A primeira dimensão corresponde às 5 áreas de competências: Informação, Comunicação, Criação de Conteúdo, Segurança e Resolução de Problemas. A segunda dimensão descreve as 21 competências, organizadas de acordo com as 5 áreas de competência. Na terceira dimensão apresentam-se os três níveis de proficiência (básico, independente e avançado) que correspondem ao nível de proficiência do utilizador para cada competência. A dimensão 4 identifica exemplos de conhecimentos, habilidades e atitudes aplicáveis a cada competência e, na dimensão 5, apresentam-se exemplos de aplicação da competência a diferentes propósitos, seja para o lazer, o social, o comprar e vender, a aprendizagem, o emprego, a cidadania ou o bem-estar.

Na tabela 1, proporciona-se uma visão das dimensões 1, 2 e 3. Ou seja, as áreas de competência (5), as competências (21) pertinentes para cada área e os níveis de proficiência (3) para cada competência: básico (A), independente (B) e avançado (C).

O DigComp, enquanto referencial de apoio aos decisores políticos e às autoridades educativas, tem contribuído para a construção de um indicador de competência digital que indique informações específicas dos países acerca das competências digitais dos seus cidadãos, bem como para a implementação, a medição, o desenvolvimento do currículo, as competências dos professores, a certificação e a autoavaliação. Este documento está já a ser utilizado para avaliar o nível de competência digital dos cidadãos, através da ferramenta do Curriculum Vitae Europass (<http://bit.ly/2saZMIU>).

Em 2016, o JRC-IPTS atualizou o Quadro de Referência para a versão 2.0 e elaborou o quadro de competências para a profissão docente, a cidadania, o consumidor online, a par de outros trabalhos em diferentes setores, como por exemplo no mercado único digital europeu ou nos cuidados de saúde. O DigComp 2.0 constitui a fase 1 da atualização do Quadro de Referência e reflete, por um lado, as recentes exigências de uma sociedade em constante evolução e transformação digital e, por outro, as orientações e estratégias das partes interessadas consultadas. Este documento (Vuorikari et al., 2016) inclui alterações no seu quadro concetual, ao nível do vocabulário, da designação das 5 áreas de competência (dimensão 1) e dos descritores de competências (dimensão 2).

Tabela 1. DigComp 1.0: áreas de competência, competências e nível de proficiência (European Commission, 2014)

Dimensão 1: áreas de competência	Dimensão 2: competências	Dimensão 3: nível de proficiência
1. Informação (Identificar, localizar, recuperar, armazenar, organizar e analisar a informação digital, avaliando a sua finalidade e relevância.)	1.1. Navegar, pesquisar e filtrar informação	A B C
	1.2. Avaliar informação	A B C
	1.3. Armazenar e recuperar informação	A B C
2. Comunicação (Comunicar em ambientes digitais, partilhar recursos através de ferramentas online, conectar e colaborar com outros através de ferramentas digitais, interagir e participar em comunidades e redes; consciência intercultural.)	2.1. Interação através de novas tecnologias	A B C
	2.2. Partilhar informação e conteúdos	A B C
	2.3. Participar na cidadania online	A B C
	2.4. Colaborar através de ambientes digitais	A B C
	2.5. Netiqueta	A B C
	2.6. Gestão da identidade online	A B C
3. Criação de Conteúdo (Criar e editar conteúdos novos (textos, imagens, vídeos...), integrar e reelaborar conhecimentos e conteúdos prévios; criar produções artísticas, conteúdos multimédia e utilizar linguagens de programação; saber aplicar os direitos de propriedade intelectual e licenças de reprodução.)	3.1. Criar conteúdo	A B C
	3.2. Integração e reelaboração	A B C
	3.3. Direitos de autor e licenças	A B C
	3.4. Programação	A B C
4. Segurança (Proteção pessoal e de equipamentos, proteção de dados e da identidade digital, medidas de segurança, proteção da saúde e do meio ambiente.)	4.1. Proteção de dispositivos	A B C
	4.2. Proteção de dados e da identidade digital	A B C
	4.3. Proteção da saúde	A B C
	4.4. Proteção do meio ambiente	A B C
5. Resolução de Problemas (Identificar necessidades e recursos digitais, tomar decisões informadas a respeito de que ferramentas digitais são mais apropriadas de acordo com o propósito ou necessidade, resolver problemas conceptuais através de meios digitais, usar criativamente as tecnologias, resolver problemas técnicos, atualizar as próprias competências e as dos outros.)	5.1. Resolução de problemas técnicos	A B C
	5.2. Identificação de necessidades e respostas tecnológicas	A B C
	5.3. Inovação e uso da tecnologia de forma criativa	A B C
	5.4. Identificação de lacunas na competência digital	A B C

O DigComp 2.1 corresponde à fase 2 da atualização do Quadro de Competência Digital para os Cidadãos, que inclui o aperfeiçoamento dos níveis de proficiência do DigComp para os 8 níveis de resultados de aprendizagem (dimensão 3) e exemplos de utilização sobre a aplicabilidade da competência a diferentes fins (dimensão 5). A dimensão 4 (conhecimentos, competências e atitudes aplicáveis a cada competência) não sofre atualização, dada a preferência em proporcionar exemplos de utilização na área do emprego e da aprendizagem. O objetivo desta fase é apoiar as partes interessadas na implementação do DigComp através do desenvolvimento de materiais de aprendizagem e formação, assim como na conceção de instrumentos de avaliação da competência digital dos cidadãos, da orientação profissional e da promoção no trabalho.

Os oito níveis de proficiência para cada competência foram definidos através de resultados de aprendizagem (usando verbos de ação, seguindo a taxonomia de Bloom) e inspirados na estrutura e no vocabulário do Quadro Europeu de Qualificações. Além disso, cada descrição de nível contém conhecimentos, habilidades e atitudes explicitadas num único descritor para cada nível de competência. Portanto, cada nível representa um avanço na aquisição da competência pelos cidadãos, de acordo com o seu desafio cognitivo, a complexidade das tarefas e a autonomia na conclusão das tarefas. Os seis primeiros níveis de proficiência correspondem aos três níveis do DigComp 1.0. Na versão atual do DigComp foi adicionado um novo nível ‘altamente especializado’ que inclui os níveis sete e oito. Na tabela 2 apresentam-se as principais palavras-chave dos oito níveis de proficiência.

Tabela 2. Principais palavras-chave dos níveis de proficiência (Carretero et al., 2017)

Níveis no DigComp 1.0	Níveis de proficiência no DigComp 2.1	Complexidade das tarefas	Autonomia	Domínio cognitivo
Básico	1	Tarefas simples	Com orientação	Recordar
	2	Tarefas simples	Autonomia e orientação quando necessário	Recordar
Independente	3	Tarefas de rotina bem definidas e problemas simples	Por minha conta	Compreender
	4	Tarefas e problemas bem definidos e não rotineiros	Independente e de acordo com as minhas necessidades	Compreender
Avançado	5	Tarefas e problemas diferentes	Orientar os outros	Aplicar
	6	Tarefas mais apropriadas	Adaptação aos outros num contexto complexo	Avaliar
Altamente especializado	7	Resolve problemas complexos com soluções limitadas	Integração para contribuir com a prática profissional e orientar os outros	Criar
	8	Resolve problemas complexos com interação de muitos fatores	Propõe novas ideias e processos na área	Criar

2. Metodologia

No seguimento das atualizações do referencial europeu para a competência digital consideramos importante regressar ao tema com um novo olhar sobre o assunto, mais minucioso e reflexivo. Optámos por uma abordagem metodológica qualitativa de natureza interpretativa através da análise documental. Para Piña Vera & Morilla (2007), a análise documental é um processo dinâmico na medida em que permite representar o conteúdo de documentos de uma maneira distinta do original e, assim, gerar um novo documento. É, ainda, um meio para organizar e representar o conhecimento registado em documentos e criar informação nova, num processo de relação com o conhecimento já produzido, adequada aos propósitos da investigação. Por conseguinte, no contexto deste trabalho a análise documental do referencial europeu para a competência digital, o DigComp nas versões 1.0, 2.0 e 2.1, possibilitou recolher dados sobre a evolução do quadro concetual da competência digital. A

apreciação crítica e holística destes dados permitiu conhecer informação relevante sobre esta temática, que em conexão e confronto com o conhecimento teórico e empírico especializado no campo intergeracional tem o propósito de acrescentar valor à produção científica na área com a criação de informação essencial.

3. DigComp Intergeracional

Em 2016, considerou-se a necessidade de oferecer algumas indicações para uma boa articulação de atividades intergeracionais com o desenvolvimento da competência digital e elaboramos uma proposta educativa de competência digital intergeracional (Patrício & Osório, 2016) com base no DigComp 1.0. Deste modo, e após uma análise cuidada à primeira versão, adotamos as 5 áreas de competências (dimensão 1), tivemos em consideração o título e a descrição da competência (dimensão 2) para a elaboração de exemplos de conhecimento, habilidades e atitudes (dimensão 4), com propósitos de aplicação a atividades de aprendizagem intergeracionais (dimensão 5). Nesta proposta não fizemos diferenciação dos 3 níveis de proficiência previstos para cada competência (dimensão 3), dado que o nosso objetivo era criar motivação para o desenvolvimento de competências digitais em todas as gerações e de todas as idades. Não obstante, os níveis de proficiência eram estimados e adaptados aos participantes aquando da preparação e implementação das atividades.

Na sequência da atualização do DigComp para a versão 2.0 (fase 1) propomos, através da sua apreciação crítica e holística, em conexão com conhecimento teórico e empírico especializado, uma nova proposta educativa para a competência digital intergeracional. Esta proposta (tabela 3) faz a atualização do quadro de referência nas dimensões 1 (áreas de competências) e 2 (competências).

Tabela 3. Quadro de referência 2.0 para a competência digital intergeracional

Dimensão 1: áreas de competência	Dimensão 2: competências
1. Alfabetização em informação e dados	1.1. Navegar, pesquisar e filtrar dados, informação e conteúdo digital sobre gerações diferentes
	1.2. Avaliar dados, informação e conteúdo digital sobre gerações diferentes
	1.3. Gerir dados, informação e conteúdo digital de natureza intergeracional em ambientes digitais
2. Comunicação e colaboração	2.1. Interagir com gerações diferentes através de tecnologias digitais
	2.2. Partilhar com gerações diferentes através de tecnologias digitais
	2.3. Participar em plataformas de cidadania intergeracional através de tecnologias digitais
	2.4. Colaborar com pessoas de diferentes idades através de tecnologias digitais
	2.5. Aplicar a Netiqueta e respeitar a diversidade geracional em ambientes online
	2.6. Gerir a identidade online para maximizar os benefícios da aprendizagem e solidariedade intergeracional
3. Criação de conteúdo digital	3.1. Desenvolver conteúdo digital para criar e apresentar práticas intergeracionais
	3.2. Integrar e reelaborar conteúdo digital para expressar novas ideias e boas práticas de aprendizagem intergeracional
	3.3. Saber como os direitos de autor e licenças se aplicam a informação e conteúdo digital
	3.4. Programar um sistema computacional para resolver um problema de âmbito intergeracional
4. Segurança	4.1. Proteger equipamentos pessoais e orientar outras gerações
	4.2. Proteger dados pessoais e privacidade e orientar outras gerações
	4.3. Proteger a saúde e o bem-estar e orientar outras gerações
	4.4. Proteger com a ajuda de outras gerações o meio ambiente
5. Resolução de Problemas	5.1. Resolver problemas técnicos em ambientes digitais de aprendizagem intergeracional
	5.2. Identificar necessidades e respostas tecnológicas para problemas intergeracionais
	5.3. Usar criativamente as tecnologias digitais para inovar práticas e criar soluções colaborativas para problemas intergeracionais
	5.4. Identificar lacunas na competência digital intergeracional, melhora-la e apoiar outros no seu desenvolvimento

Os 8 níveis de proficiência (dimensão 3), os exemplos de conhecimentos, habilidades e atitudes digitais e intergeracionais (dimensão 4) e os cenários de aplicação da competência a propósitos intergeracionais (dimensão 5), como a partilha e a transferência de conhecimentos, habilidades e atitudes entre gerações, não são contemplados nesta atualização uma vez que só foram incluídos muito recentemente na fase 2 de atualização do DigComp 2.1. - Quadro de Referência da Competência Digital dos Cidadãos.

4. Conclusão

Apresentamos uma visão global da evolução do DigComp, bem como uma proposta para a competência digital intergeracional que descreve as 21 competências agrupadas nas 5 áreas de competência.

O objetivo do quadro de referência para a competência digital intergeracional é simplificar a aplicação do DigComp 2.0 a ambientes educativos intergeracionais promovendo, assim, o desenvolvimento da competência digital em todas as idades. Sendo transversal, esta competência é essencial para a aquisição de outras competências chave para a aprendizagem ao longo da vida. Desafiamos, assim, professores e educadores a abrirem as salas de aula a outras gerações mais velhas. por meio de metodologias e práticas inovadoras, tais como a metodologia de projeto e a resolução colaborativa de problemas, com recurso às novas tecnologias, para o desenvolvimento de projetos criativos e colaborativos, com foco nas necessidades da comunidade e, simultaneamente, o desenvolvimento não apenas da competência digital mas também das competências do século XXI.

O referencial que propomos, corresponde unicamente à nossa visão, irá oportunamente ser atualizado nas dimensões 3, 4 e 5, validado pela comunidade, aplicado na prática e ajustado à diversidade intergeracional e ao surgimento de novas tendências e desafios, na medida em que a nossa preocupação é contribuir para o desenvolvimento da competência digital de todas as gerações. Preocupação que vai mais além da capacidade técnica necessária para usar ferramentas digitais, com vista a desenvolver capacidades críticas e reflexivas para compreender, no seu conjunto, os riscos e as oportunidades do mundo digital. E, portanto, facilitar a utilização do DigComp 2.1 a múltiplos contextos, sejam formais, não-formais ou informais de aprendizagem, com o propósito de uma educação intergeracional para uma sociedade digital que deve promover o pensamento crítico, a criatividade, a inovação, a autonomia, a confiança e a segurança de todas as gerações num espírito colaborativo de cidadania intergeracional.

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Concepções históricas sobre educação e seus reflexos nos avanços tecnológicos das escolas públicas na Bahia

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Abstract

This study presents the current situation of public schools in Bahia, Brazil. It aims the technology infrastructure with reflections upon the historical conceptions about education and the teacher's appreciation and his influence in this context. The point is, in which extension do education conceptions, reflected upon public policies and actions, affect the technology development of public schools in Bahia? The methodology used was the descriptive research, with quantitative and qualitative approaches, based on bibliography, documentary and field researches, applying surveys to managers, teachers and students. We found that education, historically, has been deprecated in Brazil. The schools investigated do not have the basic technology infrastructure needed to support teachers in the classrooms. The absence of public policies and actions demonstrates little importance to education and affects the technology development of public schools and the quality of education, creating future problems for the nation

Keywords: *Information and Communication Technology, Teacher Appreciation, Education, Mathematics Teaching.*

Resumo

Trata-se de estudo sobre a situação atual das escolas públicas estaduais da Bahia, Brasil, quanto à infraestrutura tecnológica, com reflexões acerca das concepções históricas sobre educação e valorização do professor e sua influência nesse contexto. Busca-se responder a seguinte questão: em que medida as concepções sobre a educação, ao longo do tempo, refletidas nas ações e políticas públicas, afetam o desenvolvimento tecnológico das escolas públicas na Bahia? A metodologia utilizada foi a pesquisa descritiva, com

abordagem quantitativa e qualitativa, embasada por pesquisa bibliográfica, documental e pesquisa de campo, através de levantamento por inquérito a gestores, professores e alunos. Constatamos que historicamente a educação foi preterida no Brasil. As escolas investigadas não possuem infraestrutura tecnológica básica necessária para dar suporte aos professores em sala de aula. A ausência de ações e políticas públicas demonstram pouca importância à educação e afetam o desenvolvimento tecnológico das escolas públicas e a qualidade do ensino, gerando futuros problemas para a nação.

***Palavras-chave:** Tecnologia da Informação e Comunicação, Valorização do professor, Educação, Ensino da matemática.*

Introdução

Este artigo discute a problemática de 77 escolas públicas estaduais do ensino médio do Território Portal do Sertão, Estado da Bahia, Brasil, o qual é constituído por 19 municípios. Nesta pesquisa foram pesquisadas 100% das escolas e um quantitativo de 171 professores de matemática, do quadro efetivo do ensino médio, 391 alunos e 61 gestores.

O estudo foi motivado pelo resultado de pesquisa para a tese de doutorado de uma das autoras deste artigo, realizada com essas mesmas escolas, em que ficou constatado que 100% delas não possuem infraestrutura física e tecnológica adequada ao desenvolvimento de atividades pedagógicas inovadoras. Em decorrência disso, os professores afirmaram que não há possibilidade de utilização das Tecnologias da Informação e Comunicação (TIC) no ensino. Tal constatação despertou reflexões acerca deste fato, levando ao seguinte questionamento: em que medida as concepções sobre a educação, ao longo do tempo, refletidas nas ações e políticas públicas sobre educação, afetam o desenvolvimento tecnológico das escolas públicas na Bahia? Partimos do pressuposto que o descaso com a educação, pelo poder público, é decorrente de concepções históricas sobre a educação.

Em vista disso, buscamos, neste artigo, promover reflexões acerca dessas concepções históricas no Brasil, para entender sua influência nesse contexto. Concluímos que as ações do poder público traduzem a pouca importância dada à educação, ao longo do tempo, tendo como resultante a desvalorização da profissão docente e o baixo desenvolvimento tecnológico das escolas públicas, o que implica na redução da qualidade do Ensino.

1. Metodologia

A opção metodológica para este estudo foi a pesquisa descritiva, com abordagem quantitativa e qualitativa, embasada por pesquisa bibliográfica, documental e pesquisa de campo, através de levantamento por inquérito, mediante aplicação de questionários e entrevistas a gestores, professores e alunos das 77 escolas.

As pesquisas descritivas têm como principal objetivo “a descrição das características de determinada população ou fenômeno ou o estabelecimento de relações entre variáveis. São inúmeros os estudos que podem ser classificados sob este título e uma de suas características mais significativas está na utilização de técnicas padronizadas de coleta de dados” (Gil, 2008, p. 27).

A pesquisa quantitativa, pela sua natureza, assegura a precisão e o rigor que requer a ciência (Serrano, 1994). Flores (2010,) ressalta que “o método quantitativo permite a recolha de medidas quantificáveis de variáveis e inferências a partir de amostras de uma população e os dados são sujeitos a análise estatística no sentido de testar as hipóteses levantadas” (p. 308). Por outro lado, a pesquisa qualitativa tende a salientar os aspectos dinâmicos, holísticos e individuais da experiência humana, para apreender a totalidade no contexto daqueles que estão vivenciando o fenômeno (Gerhardt & Silveira, 2009).

A elaboração dos instrumentos de coleta de dados foi embasada pela pesquisa bibliográfica e pelos objetivos da pesquisa. A recolha dos dados objetivou a busca de informações a respeito do fenômeno estudado abrangendo a observação *in loco* dos estabelecimentos de ensino, como também a realização do levantamento por inquérito a gestores e alunos, visando conhecer suas percepções e motivações com o intuito de obtermos os dados e as informações necessárias para as análises e conclusões.

A análise dos dados quantitativos foi feita com apoio do Statistical Package for the Social Sciences (SPSS) e dos dados qualitativos, com apoio do MaxQDA.

2. Concepções históricas sobre educação e valorização do professor

Desde os primórdios que as relações de poder entre os seres humanos são caracterizadas pela desigualdade entre os indivíduos, de acordo com a condição social, etnia, gênero ou diferenças. Os menos favorecidos sempre estiveram em situação de inferioridade, à margem, tendo que se submeter ao imposto pelas classes dominantes. No Brasil, a história não foi diferente e havia tais distinções até mesmo para o acesso à educação.

A educação no Brasil começou através da Companhia de Jesus, organização fundada em 1534 por jesuítas, que chegaram ao Brasil em 1549, liderados pelo Padre Manoel da Nóbrega e se instalaram inicialmente no Estado da Bahia. Saviani e Nascimento (2003) consideram esse o primeiro período da história da educação brasileira que se estende até 1759, quando foram expulsos pelo Marquês de Pombal.

Segundo Guimarães e Cadenassi (2013), a educação, sob o monopólio dos jesuítas, excluía as mulheres, os negros e os índios. No início, visava à catequese, com o objetivo de difundir a crença cristã católica ao novo país. Aos filhos dos índios, cabia catequizar e pacificar, tornando-os dóceis para o trabalho, enquanto, aos filhos dos colonos cabia instruir, ou seja, ensinar a ler e escrever. “Para catequizar, os jesuítas utilizavam como instrumento o ensino das primeiras letras, ou seja, a alfabetização e, a partir daí, chegavam à aculturação do indígena, imprimindo-lhe os costumes e crenças do homem branco” (Oliveira, 2011, p. 7). Esse era o papel do colonizador e o ensino que era oferecido pelos jesuítas atendia a esse papel, contribuindo para atender aos interesses dos grupos dominantes e ressaltar as desigualdades sociais. Até 1759 era o único sistema de organização escolar do país. Nem os escravos negros nem as mulheres tinham qualquer direito à educação. Quanto aos homens brancos estudavam nos colégios religiosos ou iam para a Europa. Desta forma, pode-se perceber o papel da escola naquela época, com discriminação aos considerados “desiguais”. Com a expulsão dos Jesuítas, esse sistema foi extinto, mas não houve qualquer reforma no ensino.

A partir de 1808, com a chegada da família Real ao Brasil, a situação da educação passa por uma significativa mudança, com a implantação de cursos, instalação de Academias Militar e da Marinha, entre outras ações, mas não foi, durante o período imperial, constituído e consolidado um sistema educacional. A instrução primária, nesse período, teve como base o ensino da leitura, escrita e cálculo.

Com a independência, no reinado de D. Pedro I foram criadas escolas técnicas, universidades e faculdades, iniciando uma nova etapa. Após a Independência, em 1822, a educação passou a ser um direito do cidadão e dever do Estado. Entretanto, a preocupação era dotar o país de um sistema de ensino visando a habilitar o povo para o exercício do voto (Peres, 2005). Na Constituição de 1824 os analfabetos, mendigos, praças militares e as mulheres, ficaram impedidos de votar, ressaltando as desigualdades e reforçando a exclusão social. Essa Constituição sequer faz menção à palavra “educação”.

Em 1827, o Artigo 6.º da lei promulgada, considerada a única Lei Geral para a Instrução Pública do Brasil, determinava que “os professores ensinarão a ler, escrever, as quatro operações de aritmética [...], a gramática de língua nacional e os princípios de moral cristã e da doutrina da religião católica e apostólica romana.” (Silva & Souza, 2011, p. 71). Assim, nas escolas de primeiras letras o ensino estava restrito a ler, escrever e contar. O artigo quinto, dessa mesma lei, definiu como método de ensino, o método *mútuo ou lancasteriano*, adotado pelos professores nas escolas, que consistia em atribuir aos alunos mais inteligentes e capazes, a responsabilidade pelo repasse aos demais estudantes da turma (Silva & Souza, 2011). Isso reduzia o custo com cada professor, que podia se responsabilizar por uma classe de centenas de alunos, gerando, também, um aumento de alunos e diminuição na contratação de novos professores.

Em 1889, com a instauração da República, a educação sofreu mudanças levando em consideração os princípios adotados pelo novo regime: centralização, formalização e autoritarismo. Em 1890 ocorre importante reforma curricular, com novas diretrizes para a instrução pública, entre elas, o ensino voltado para formação científica, rompendo com a tradição humanista clássica.

De 1894 a 1930, período da República das Oligarquias ou República Velha, apenas 3% dos brasileiros eram eleitores, pois só votava quem tivesse mais de 25 anos de idade, do sexo masculino e alfabetizado. Nesse período, marcado por muitas revoltas, a economia brasileira era basicamente agrícola. Como na monarquia, durante a República Velha a cultura continuou sendo um direito exclusivo da elite e a educação enfrentava diversos problemas, sendo privilégio de poucos, mesmo com as mudanças da constituição. Assim, até 1930 “a educação configurou-se de forma dualista e elitista. Ensino primário articulado com o ensino profissional destinado aos pobres e ensino secundário com continuidade ao superior, destinado à elite” (Lima, 2012, p. 968). Os pobres eram direcionados para o ensino profissional, devido a necessidade de preparar mão de obra para a realização de atividades operacionais de baixa complexidade, o que consistia em ensino meramente informativo, que não exigia um pensamento crítico e reflexivo.

Com a Revolução de 1930 dando fim à Primeira República, começa a Era Vargas (1930 a 1945), com novas reformas educacionais, por conta da emergência do desenvolvimento industrial. O principal objetivo do governo era formar uma elite mais ampla e intelectualmente mais bem preparada. Assim, foi criado o Ministério da Educação e Saúde, em novembro de 1930 (Fausto, 1995). A partir daí surgiram várias universidades, como a de São Paulo em 1934 e a do Distrito Federal, em 1935, influenciando, segundo Pavanello (1993) o curso secundário, pois essas universidades passaram a oferecer cursos destinados à formação de professores das diversas disciplinas do ensino secundário. Entendemos que a criação dessas universidades foi um avanço, especialmente na sua função de formação de professores. Entretanto, apesar desse avanço, como se pode perceber, o Ministério criado deveria se dividir para cuidar de duas importantes áreas: a educação e a saúde, o que retrata o grau de importância da educação, nesse período.

No período de 1930 a 1955, o Brasil se concentrava em todos os setores produtivos para aumento do investimento em capital físico e social, ficando para o segundo plano o investimento em desenvolvimento tecnológico e em recursos humanos, ou seja, a mão-de-obra não havia ainda sido incorporada ao setor produtivo, como capital (Souza, 2007).

Em 1953 foi criado o Ministério da Educação e Cultura, com a sigla MEC e somente em dezembro de 1961, depois de treze anos de acirradas discussões, foi promulgado um texto único para tratar da legislação educacional: a Lei de Diretrizes e Bases, que entrou em vigor em 1962, data em que aconteceu a instalação do Conselho Federal de Educação (CFE).

Segundo Brighente e Mesquida (2013), as reformas do ensino, ocorridas entre 1960 e 1970, atenderam às necessidades do regime vigente, ou seja, a vontade particular dos grupos ligados

ao governo, que sempre esteve acima da vontade geral do povo. Segundo Saviani (2004), a década de 1960 foi fértil em experimentação educativa, consolidaram-se os colégios de aplicação, surgiram os ginásios vocacionais, como também, ocorreu um grande impulso à renovação do ensino de matemática e de ciências. Porém, no final da década de 60, o Centro Brasileiro de pesquisas Educacionais e os Centros Regionais a ele ligados foram fechados e após o golpe militar de 1964, o ensino do país foi reorientado.

A partir de 1964, com as diretrizes para o desenvolvimento do país, investimentos passaram a ser fundamentais para a busca do ideal de modernidade estabelecido pelo Estado brasileiro. Dessa forma, percebe-se a importância da educação e da tecnologia nesse período.

Em março de 1985 encerra o período da ditadura militar. Com a Constituição brasileira de 1988, todos os cidadãos têm direito à educação no Brasil. Trata-se de um direito fundamental, porque inclui um processo de desenvolvimento individual próprio à condição humana, ou seja, quem não tem acesso à educação não é capaz de exigir e exercer direitos civis, políticos, econômicos e sociais, o que prejudica sua inclusão na sociedade moderna (Constituição da República Federativa do Brasil, 1988).

Todavia, a educação no Brasil continua com inúmeros problemas, especialmente de infraestrutura. No Plano Nacional da Educação (PNE) foi instituída a obrigatoriedade de “padrões mínimos de infraestrutura para o funcionamento adequado das instituições de educação” infantil (creche e pré-escolas), ensino fundamental e ensino médio. Ao final do quinto ano todas as escolas deveriam ter alcançado o padrão mínimo estabelecido. A abrangência dos padrões de infraestrutura física seria, de acordo com o PNE, quanto à adequação do espaço interno às necessidades dos educandos, com garantia do saneamento básico, instalações adequadas, espaços que atendam às necessidades do desenvolvimento das atividades pedagógicas, conforme as diretrizes curriculares (Plano Nacional de Educação, 2001). Entretanto, apesar da obrigatoriedade do poder público dotar as escolas de padrões mínimos de infraestrutura, esse problema não foi resolvido e as escolas continuam até hoje com instalações inadequadas.

Segundo Carreira e Pinto (2006), a situação é crítica em todos os níveis da educação básica. Estes autores destacam que existe carência de bibliotecas, laboratórios de ciência e de informática. A existência de pontos de internet é insignificante no ensino fundamental e muito abaixo do desejável nas escolas de ensino médio. Esta situação demonstra a precariedade das instituições de ensino brasileiras, traduzida nos resultados das avaliações oficiais.

É fundamental se pensar na estrutura física de uma escola, na disponibilidade de recursos tecnológicos por aluno, bibliotecas, pois uma situação onde a infraestrutura é inadequada pode criar no aluno um quadro mental de abandono ou de desvalorização da educação pelo Estado e até mesmo pela sociedade e interfere na prática pedagógica do professor.

No início do novo milênio, o sistema educacional é considerado o responsável pelas transformações sociais. São muitas as tarefas e responsabilidades e o professor, que já era um

“faz-tudo” na escola, passa a fazer parte da força tarefa ideológica, em que ser professor é uma atividade honrosa, mas não imprime na sequência políticas públicas que assegurem condições de trabalho e de vida a esse profissional para assumir tamanho papel na sociedade (Santos, Melo & Lucimi, 2012). Nesse novo milênio o magistério público é a carreira que conta com o maior número de profissionais em todo o país. São esses profissionais que estão todos os dias, com milhões e milhões de crianças e adolescentes na educação infantil, nos ensinos fundamental e médio e educação profissional. A escola pública é o equipamento social mais difundido em todo o território nacional. O trabalho dos professores está longe de ser ameaçado pelas novas tecnologias, como a telemática, a informática e a robótica. São muitas as reclamações a respeito da profissão docente e de suas perspectivas diante da vida. As queixas giram em torno de alguns eixos básicos, como, salários, carreira, condições precárias de trabalho e desprestígio social do magistério (Costa, 2001).

Uma educação de qualidade não depende somente de adequada infraestrutura das escolas. Roitman e Ramos (2011) relatam que os desafios enfrentados pelo Brasil com relação à educação de qualidade passam necessariamente pela valorização da carreira docente. Nos países que obtiveram excelência na educação, os melhores alunos do ensino médio desejam seguir a carreira docente. Nesses países, o salário inicial é atraente, a carreira é promissora com base no desempenho docente, a formação inicial é sólida e são oferecidas boas condições de trabalho. No Brasil, o magistério precisa ser objeto do desejo para os jovens e para isso é necessário resgatar o valor do professor na sociedade.

A Lei de Diretrizes e Bases de 1996 trouxe inovações estabelecendo, por exemplo, no artigo 62, que “a formação de docentes para atuar na educação básica far-se-á em nível superior, em curso de licenciatura, de graduação plena, em universidades e institutos superiores de educação” (Leis de Diretrizes e Bases da Educação Nacional, 2010, p. 46). Atualmente, muitos cursos continuam formando professores, que estavam atuando no ensino básico sem a devida formação docente.

Ao longo do tempo a Educação pública passou por muitas transformações e atualmente vem sofrendo cortes orçamentários que inviabilizam a construção de uma escola que se adeque às novas exigências da sociedade. Com isso, são muitos os problemas, dentre eles, a evasão e a formação deficiente e a necessidade de investimentos na infraestrutura e na valorização do professor.

3. Infraestrutura tecnológica das escolas e qualidade do ensino

Esta secção apresenta as evidências resultantes da recolha de dados nas escolas em estudo, baseada na percepção de gestores, professores e alunos. Buscamos verificar os reflexos das ações governamentais, no desenvolvimento tecnológico das escolas públicas na Bahia. Neste percurso, buscamos compreender, também, aspectos que evidenciassem a valorização da docência e a formação de professores.

Constatamos, através do levantamento por inquérito, junto a professores, alunos e gestores, que a infraestrutura física de grande parte das escolas pesquisadas é deficitária, principalmente aquelas localizadas nas periferias. Todavia, em todas as escolas a infraestrutura tecnológica é precária, mesmo naquelas mais centralizadas. Exemplo disso é que 100% delas não possuem *wi-fi* nas salas de aula, o que dificulta a utilização das Tecnologias da Informação e Comunicação (TIC) e, conseqüentemente, a preparação dos alunos para os avanços tecnológicos da sociedade.

O professor pode até ter as competências e habilidades essenciais para a utilização de práticas pedagógicas capazes de estimular o processo de ensino-aprendizagem, mas, sem condições de trabalho adequadas, boa infraestrutura física e tecnológica, materiais didáticos disponíveis, apoio pedagógico, etc., não conseguirá ter bom desempenho e atingir os objetivos a que se propôs.

A falta de infraestrutura adequada desmotiva o professor e os alunos, gerando um sentimento de abandono – conforme já dito – e de descaso com tão importante função dessa instituição na sociedade. Neste sentido, a situação de precariedade dessas escolas compromete a realização das práticas pedagógicas e a qualidade do ensino.

A infraestrutura é essencial para dar suporte ao desempenho do professor, principalmente a infraestrutura tecnológica. As TIC fazem parte do cotidiano dos jovens e devem fazer parte do dia a dia da escola, pois é importante que ocorra a integração dos recursos tecnológicos com o ensino e aprendizagem (Ribeiro & Ribeiro, 1990). Para que o processo de ensino-aprendizagem alcance os objetivos propostos, é necessário que as escolas estejam equipadas com todos os equipamentos necessários para facilitar e auxiliar professores e alunos nesse processo, como também, professores com formação adequada e capacitados para utilizar todos os recursos tecnológicos e facilitar a aprendizagem do aluno. As Instituições de Ensino não podem ficar alheias à necessidade de integrar as TIC ao processo de ensino-aprendizagem. Entretanto, em todas as escolas pesquisadas, neste trabalho, os laboratórios são inadequados e abaixo da capacidade para atender as demandas da escola; em muitas delas os computadores estão obsoletos ou quebrados e os diretores alegaram falta de recursos para manutenção; as escolas investigadas não oferecem infraestrutura adequada aos alunos e professores para utilização das TIC como recurso pedagógico.

Aliado ao problema de infraestrutura, a pesquisa evidenciou, também, que os professores recebem baixos salários e, em decorrência disso, assumem carga horária maior, para melhorar seus rendimentos. Um professor de 40 horas tem que trabalhar 26 horas em sala de aula. As 14 horas restantes devem ser destinadas a atividades complementares (AC), sendo 10 horas para atividades pedagógicas na escola e 4 horas de atividades de livre escolha. Considera-se Atividade Complementar - AC, a carga horária destinada à preparação e avaliação do trabalho didático, às reuniões pedagógicas e ao aperfeiçoamento profissional, de acordo com a proposta pedagógica de cada Unidade de ensino, com participação coletiva dos docentes, por área de conhecimento, sem prejuízo da carga horária destinada à efetiva regência de classe.

Os professores de matemática, com carga horária de 40 horas, podem assumir um total de 09 até 14 turmas semanais, dependendo da carga horária da disciplina em cada unidade escolar no ensino médio ou no curso profissionalizante, que poderá ser de 02 a 03 horas aulas semanais. Esta quantidade de turmas exige do professor grande dedicação no planejamento, preparação de material didático, exercícios, correções de provas, etc. Diante disso, muitas vezes esses professores não terão tempo disponível para elaborar aulas inovadoras, utilizando metodologias que despertem o interesse do aluno. Assim, a qualidade dos processos educacionais pode cair significativamente, pois, como poderá o professor passar atividades para os alunos, se ele não terá tempo de corrigir adequadamente tais trabalhos, para dar feedback? A maioria dos professores investigados afirmaram que o excesso de trabalho dificulta o uso de metodologias inovadoras, somente 7,7% disseram que **não**. Também afirmaram que compromete o ensino (somente 5,6% disseram que não) e que desestimula a utilização das TIC (18,2% afirmaram que não).

Outro problema que o professor enfrenta é a superlotação das salas, em algumas escolas, por conta de maior procura, a depender do curso, da região e do bairro. Nesta pesquisa a maioria dos gestores falou que são em média 40 alunos por sala, dependendo do curso e do perfil da turma, o que sobrecarrega o trabalho do professor, principalmente o trabalho do professor de matemática.

Todos esses fatores comprometem a saúde do professor. Muitas pesquisas feitas nos últimos anos, com relação à saúde do professor, mostram diagnóstico de estresse, inflamações nos braços (tendinites), doenças como a depressão e essas são as mais comuns.

Outro fator evidenciado nesta pesquisa foi a precariedade dos vínculos de trabalho, em decorrência de contratação provisória de alguns professores, feita com base em Regime Especial, com prazo de finalização. Grande parte das escolas pesquisadas possui, no seu quadro, profissionais que não foram contratados via concurso o que, “pela falta de estabilidade, pode comprometer a aquisição de experiência e constituição de formação de equipe na escola” (Carissimi & Trojan, 2011, p. 67).

O Plano Nacional de Educação (PNE) diz que a melhoria da qualidade do ensino – um de seus objetivos centrais – só será alcançada se for promovida, ao mesmo tempo, com a valorização do magistério (Plano Nacional de Educação, 2001). Entretanto, entre o discurso e a prática continua havendo grande lacuna, devido à falta de políticas educacionais orientadas para a valorização da educação.

A busca por uma educação de qualidade passa pela valorização e qualificação dos professores. Segundo Perrenoud e Thurler (2002, p. 15), “a qualidade de uma formação depende, sobretudo, de sua concepção”. O professor necessita de uma formação que lhe possibilite desenvolver de fato o seu trabalho, que é de preparar o aluno para a vida, fazê-lo aprender a aprender, de forma competente, com atividades diferenciadas, estimulando a articulação entre saberes e competências (Pedreira, Correia & Escola, 2015).

O Parecer CNE/CP 9/2001 destaca os desafios que a educação vem enfrentando ao longo dos anos no País e chama a atenção para o preparo inadequado dos professores com relação a sua formação, pois os cursos de formação de professores não contemplam muitas das características consideradas, na atualidade, como inerentes à atividade docente (Parecer CNE/CP 009, 2001).

Esta pesquisa evidenciou que, além da falta de infraestrutura tecnológica, os professores não possuem na sua formação, as competências para utilização plena das TIC. Tal fato é relatado por Pedreira, Correia e Escola (2016) que, em pesquisa desenvolvida num curso de formação de professores de matemática, de uma universidade pública, constataram que, devido à falta de infraestrutura tecnológica, os graduandos não possuem, na sua formação, as competências para utilização plena das TIC. Conforme um dos professores entrevistados, as TIC não são utilizadas em sala de aula porque a universidade não dispõe de *wi-fi* em sala de aula para os alunos usarem seus equipamentos. Essa universidade, assim como as escolas investigadas, vivencia problemas de falta de investimento em tecnologia. Desta forma, se em sua graduação os professores não utilizaram as TIC, certamente terão mais dificuldades de utilizarem na sua prática pedagógica.

Assim, a deficiência no desenvolvimento tecnológico das escolas continuará afetando a qualidade do ensino e dificultando o trabalho do professor, até ocorrerem mudanças nas estruturas de pensamento dos políticos que concebem e se responsabilizam pelo financiamento da educação.

4. Conclusões

Após entender o processo histórico da educação no Brasil, buscamos compreender em que medida as concepções sobre a educação, ao longo do tempo, refletidas nas ações e políticas públicas sobre educação, afetam o desenvolvimento tecnológico das escolas públicas do ensino médio na Bahia.

A pesquisa realizada nas escolas públicas evidenciou a precariedade de muitas escolas, principalmente na periferia, contradizendo o que é determinado como obrigatório, no PNE. As escolas pesquisadas, de acordo com professores e gestores, não possuem infraestrutura tecnológica básica necessária para dar suporte aos professores, para utilização das TIC em sala de aula, o que compromete a qualidade do ensino e aprendizagem e é um vetor de desmotivação de professores e alunos.

A educação historicamente foi preterida no Brasil e este fato se perpetua, refletindo atualmente nas escolas investigadas, nas dificuldades que vivenciam, na falta de investimento do poder público, tanto na infraestrutura das escolas quanto na valorização do professor, traduzida no excesso de carga horária e na conseqüente sobrecarga de trabalho desse profissional.

A falta de prioridade na educação, pelos governantes, demonstra que suas concepções sobre a educação não diferem daquelas do colonizador, que serviam aos interesses da classe

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O cerimonial público e suas práticas nas duas maiores instituições federais de ensino do Distrito Federal: Instituto Federal de Educação, Ciência e Tecnologia de Brasília - IFB e Universidade de Brasília - UnB

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Resumo

O cerimonial público é a aplicação do conjunto de formalidades, ou seja, as regras e normas estabelecidas pelo protocolo, definindo a sequência lógica e regulando os diversos atos da cerimônia. Todas as atividades correlatas a eventos onde se exige a normatização, programação, rotina, precedência, são desenvolvidas pela equipe de cerimonial. A qualidade do trabalho desenvolvido em um evento, reflete no sucesso do mesmo, assim como na satisfação de todos os envolvidos direta e indiretamente. O presente artigo teve como objetivo conhecer a prática do cerimonial público no âmbito universitário e dos Institutos Federais de Educação, bem como o perfil e atribuições do profissional que atua na organização de solenidades, buscando conhecer os procedimentos teóricos e práticos utilizados e as principais dificuldades enfrentadas pelos responsáveis pelo planejamento e execução das cerimônias. A metodologia aplicada foi a pesquisa bibliográfica e a pesquisa de campo de caráter quantitativo e qualitativo que descreveu e analisou questionários aplicados aos setores responsáveis pelo cerimonial do IFB e da UnB. A pesquisa demonstrou que ambas as instituições possuem setor destinado a organização dos eventos, ambas contam com equipe reduzida para o setor, contando inclusive com a colaboração de estagiários e terceirizados, para além de outras considerações destacadas pela pesquisa.

Palavras-chaves: *Eventos, Cerimonial público, Instituições de Ensino.*

Introdução

Os eventos estão presentes na sociedade desde a antiguidade, tendo início nas comunidades tribais com rituais marcantes, passando pelas feiras medievais, e tendo forte expressão durante os jogos olímpicos iniciados na Grécia. Essas observações indicam que a sociedade vem ao longo dos tempos, criando formas de marcar um acontecimento, através da celebração de seu significado, falar sobre eventos, atualmente é falar de uma atividade entregue a profissionais especializados em seu desenvolvimento. A organização de eventos é uma das formas encontradas pelas instituições públicas ou privadas de se comunicar com seus colaboradores internos, externos, público alvo e público em geral. Um evento deve objetivar levar aos participantes, para além do produto já esperado, emoções e experiências positivas memoráveis. Essa tarefa é em grande parte responsabilidade da equipe de planejamento, organização e execução do evento, assim como dos responsáveis pelo cerimonial. Os eventos também se caracterizam como uma importante fonte de riqueza e gerador de empregos, diretos e indiretos.

Desta forma, é necessário cada vez mais profissionais na gestão desses eventos, de modo a fazer jus ao que esta área representa para a economia nacional. Tal profissionalização será alcançada com formação adequada e estudos que contemplem as necessidades desse setor, tarefa à qual a presente pesquisa pretende contribuir.

O objetivo do artigo é conhecer a prática do cerimonial público no âmbito universitário e dos Institutos Federais de Educação, bem como o perfil e atribuições do profissional que atua na organização de solenidades, buscando conhecer os procedimentos teóricos e práticos utilizados e as principais dificuldades enfrentadas pelos responsáveis pelo planejamento e execução das cerimônias. A motivação para o desenvolvimento da pesquisa surgiu da prática docente na área de eventos, assim como da constante necessidade dos professores de diferentes áreas, em realizar solenidades em seus respectivos *campi* de atuação, instigando a curiosidade pelo tema e a necessidade de um maior aprofundamento das orientações legais, das atribuições, entre outras características mencionadas anteriormente.

A artigo apresenta um embasamento teórico sobre o cerimonial, seu histórico, funções e ritos; demonstra a metodologia utilizada no estudo; analisa os resultados apresentados nos questionários aplicados; e apresenta as considerações finais sobre o estudo.

1. Histórico de eventos e cerimonial

Existem muitos autores que falam sobre a origem dos eventos, porém, ainda assim, ficam dúvidas a respeito da data cronológica que marca o seu início. Para definir esta data, primeiramente os estudiosos partem do princípio que é necessário definir o que é evento e então vão em busca das informações. De acordo com Campos, Wyse e Araújo (2002), evento vem do termo eventual, o mesmo que casual, um acontecimento, que foge à rotina e sempre é programado para reunir um grupo de pessoas.

Complementando a ideia anterior, consideramos a definição de Andrade que diz que,

Evento é o conjunto de ações definidas previamente, gerando um acontecimento. Nas suas mais diferentes formas, o evento pode desempenhar funções importantíssimas como disseminar o conhecimento, oferecer lazer e entretenimento, estimular negócios, conscientizar comunidades e contribuir para o entendimento entre os povos (1999).

Considerando essas duas definições sobre a origem da palavra eventos, entendemos que a criação de um evento gera a possibilidade de despertar a atenção de um determinado público com interesses semelhantes. O que vai ao encontro com a declaração de Brito e Fontes, que definem:

O evento é muito mais do que o planejamento, a programação, a execução e o monitoramento de uma sequência de atividades destinadas a um público específico e realizadas em local apropriado. O evento deve ser pensado como uma atividade econômica e social que gera uma série de benefícios para os empreendedores, para a cidade promotora, para o comércio local, restaurantes, hotéis e para a comunidade (Britto & Fontes, 2002, p. 28).

Pensando na complexidade do estudo efetuado, consideramos ainda a argumentação da autora Cesca (1997), quando diz que a prática de rituais religiosos e as comemorações realizadas pelos ancestrais, aproximadamente até 3.500 a.C., já podem ser consideradas eventos, pela própria estrutura que envolviam esses atos. Para Nora (2016), a primeira vez que um grupo de pessoas viajou para participar de um acontecimento, sendo este o primeiro registro histórico, ocorreu em 776 a.C., na Grécia e aconteceu durante os Jogos Olímpicos.

Para Matias (2002), a primeira manifestação relevante foi um Baile de Carnaval que se realizou em 7 de fevereiro de 1840, nos salões do Hotel Itália, o primeiro registro do qual se tem conhecimento, ocorrido em espaço destinado à realização de eventos. Também no Rio de Janeiro, naquele mesmo período, o Café Neville, anunciava seus bailes, porém, o Brasil ainda não tinha experiência na organização de eventos técnicos e científicos, feiras e exposições. Ainda segundo o autor, o Brasil só se firma como organizador de eventos, em 1922, ao comemorar o aniversário de cem anos da Independência do Brasil, realizando a Exposição Internacional do Centenário, no Palácio de Festas, também no Rio de Janeiro.

Quando falamos em evento é praticamente impossível não o associar a cerimonial. A palavra cerimonial vem do latim *caerimoniale* e refere-se às cerimônias religiosas. Nas civilizações antigas, como gregos e romanos, o cerimonial era rigidamente praticado pelos povos e era embasado na cultura de cada um deles, sendo assim, tiveram grande influência na criação dos costumes cerimoniais.

Percebemos que desde antigamente já havia uma preocupação em criar regras para reger reuniões e cerimônias, pois era necessário explicitar a relação de hierarquia e deixar claro para os indivíduos quem detinha o poder. As instituições públicas, governamentais, judiciais e religiosas também mantiveram a prática do cerimonial durante anos de suas histórias e serviram de referência no decorrer dos tempos. Atualmente, existem decretos, normas e leis

para que as orientações sejam seguidas à risca. Certas regras foram adaptadas ao cerimonial privado para que existisse um parâmetro e fosse estabelecida uma sequência lógica do cerimonial, empresarial ou universitário.

2. Cerimonial e protocolo na atualidade

Os eventos são promovidos por alguma razão, cada tipo de evento tem um propósito, um significado, uma mensagem que pretende passar a um público alvo. A execução de um evento deve iniciar-se pelo planejamento detalhado buscando distribuir as atividades, conhecer o objetivo do evento, estudar as possibilidades de realização em consonância com o cliente, gerenciar os recursos disponíveis, implantar e avaliar o projeto, respeitando a dinâmica social local e suas legislações.

Em se tratando de organização de eventos, Meirelles explica que:

A organização é a parte mais complexa do processo de preparação e montagem de um evento, exigindo condições de comando do profissional responsável pelo projeto para coordenar e controlar todas suas etapas. Cada evento tem sua peculiaridade própria e cabe ajustá-la aos meios disponíveis à sua implantação (2003, p.147).

Entendendo as principais etapas de um evento chega-se no papel do cerimonial que obrigatoriamente estará presente em todos os momentos desde a concepção da ideia do evento. Cabe ao cerimonial incumbir de funcionalidade os eventos, dando a eles a formalidade necessária. Para Meirelles (2001, p.29) “o cerimonial tem sob sua responsabilidade atuar nas fases de planejamento, organização, coordenação, controle e execução dos eventos”. A equipe de cerimonial de um evento precisa trabalhar para que as hierarquias presentes sejam respeitadas, estabelecendo uma lógica das atividades, transmitindo dessa forma ao público a ideia de ordem no evento.

Existe uma certa incerteza entre os leigos, a respeito da diferença entre o cerimonial e o protocolo, em muitos momentos parece que ambos se confundem, mas são diferentes. Lins (1991, p.29) diz que “do ponto de vista da semântica, protocolo e cerimonial não tem exatamente o mesmo sentido. Ao dizermos que algo é protocolar, damos ao termo o sentido de algo artificialmente formal”. Pois o protocolo engloba as regras referentes à ordem de precedência nos eventos, já o cerimonial é mais amplo, ele marca a forma como uma cerimônia deve ser dirigida.

Pode-se dizer que o protocolo é a representação escrita do que será executado pelo cerimonial que pode ser definido como um ritual onde são estabelecidas, entre outras questões, as hierarquias dos participantes do evento, definição dos convites, organização da recepção dos convidados, as normas de precedência, estando atento a todos os detalhes de um evento e promovendo a integração organizada entre as pessoas. Para reforçar esse posicionamento, Meirelles (2001, p. 16) diz que o cerimonial possibilita:

[...] realizar uma cerimônia, fazendo que as personalidades tenham, de um lado, a posição e o tratamento de direito e, de outro, os participantes compreendam essa diferenciação. Isso permite administrar, em uma solenidade, as vaidades, a guerra do poder, a batalha pelo ser, entre aqueles que efetivamente são, ou pensam que são. Enfim, o uso adequado do cerimonial, traz ao evento a pompa, a circunstância e a magia, que marcaram e emocionaram os participantes com a chancela do saber, do belo, do correto, do planejado.

Dessa maneira, pode-se entender o cerimonial como uma forma de comunicação, inserida no setor de eventos com foco na organização da sociedade envolvida no respectivo evento, norteando seu comportamento, levando em consideração as diferentes culturas. Diante de tal perspectiva o chefe de cerimonial possui em suas mãos a responsabilidade de manter todos os convidados dentro das normas protocolares, porém exercendo o bom senso e a maleabilidade necessária a ocasião.

2.1 Cerimonial Público

A base legal no Brasil é o Decreto Federal 70.274, de 9 de março de 1972, que “Aprova as Normas de Cerimonial Público e a Ordem de Precedência pela Presidência da República”. A legislação supracitada, em muitos casos não corresponde com a atual administração pública estabelecida no Brasil, algumas leis específicas, foram criadas posteriormente, como é o caso do Decreto 150/87 que se refere ao uso da bandeira nacional. Porém no que se refere a precedência, e outros temas, o Decreto 70.274 é válido até os dias atuais.

Na medida em que o cerimonial se preocupa em ordenar e elaborar, de maneira eficiente, seu trabalho, estará representando o zelo do órgão ou empresa para com sua imagem e para além dessa questão, demonstra a organização e o conhecimento dos membros das instituições.

O Cerimonial Público é utilizado dentro das esferas federal, estadual e municipal, norteando a execução dos eventos em órgãos públicos o que é fundamental, pois neste universo existem muitas autoridades e a hierarquia entre elas precisa ser estabelecida pelo grau de importância do cargo ocupado, promovendo uma harmonia entre os envolvidos. Tomelin e Batista (2003, p. 71) diz que no Brasil o cerimonial público é:

A conduta, norteadas por legislações, que resguarda as características culturais do País. Nada mais é, portanto, do que uma linguagem própria – formal, internacional e diplomática de uma determinada sociedade – que corresponde ao tratamento e a fórmulas de cortesia, de expressões oficiais.

O cerimonial pode ser considerado a coluna vertebral do evento, pois sustenta toda a estrutura gerada em um evento e pode ser classificado em três categorias:

Cerimonial Público – agrega o cerimonial dos Poderes Executivo, Legislativo e Judiciário, pertencente às esferas federal, estadual e municipal. Respeita as normas estabelecidas no Decreto 70.274/72.

Cerimonial Privado – ocorre em instituições privadas, como entidades de classe, sindicatos, órgãos institucionais e sociais. Este cerimonial baseia-se no Decreto 70.274/72, porém o chefe de cerimonial tem maior liberdade de atuação, devendo estabelecer uma lógica entre o decreto e a realidade da instituição promotora do evento.

Cerimonial Universitário – consiste na realização de eventos no âmbito universitário, tanto em instituições públicas quanto privadas. Entre os principais eventos estão a colação de grau e a aula magna.

2.2 Ritos acadêmicos - colação de grau

A origem das universidades foi em Salerno, na Itália, no ano de 1.080 d.C., em seguida, surgiram, segundo Viana (1998 *apud* Hasckell & Riffel, 2011) as universidades Bolonha (1158) – Paris (1170), Salamanca (1218), Pádua (1222), Nápoles (1224), Coimbra (1290) e Pisa (1343).

A renomada Universidade de Sorbone (antiga Universidade de Paris) foi a responsável pela implantação definitiva do cerimonial rígido e correto, envolvendo todas as pessoas que trabalhavam na instituição, obrigando o uso das vestes talares e introduzindo a cadeira em formato de trono, com o brasão entalhado no espaldar, utilizada pelo reitor que era considerado autoridade máxima.

De acordo com Viana (1998 *apud* Hasckell & Riffel, 2011) o Brasil adotou as tradições dos rituais do cerimonial universitário da Universidade de Coimbra. As solenidades como Colação de Grau, Posse Reitoral, Aula Magna, Concessão de Títulos são ritos universitários que ainda são preservados, e utilizam uma padronização da linguagem, ou seja, do formato da cerimônia, isso possibilita que todos assimilem o verdadeiro significado da solenidade em especial a Colação de Grau.

3. Metodologia

O presente estudo caracteriza-se quanto aos objetivos por pesquisa descritiva que de acordo com Gil (2008) visa a descrição de características de determinadas populações ou fenômenos, tendo como uma de suas peculiaridades a utilização de técnicas padronizadas de coleta de dados, como o questionário.

Quanto ao procedimento realizou-se a pesquisa bibliográfica, realizada a partir do levantamento de referências teóricas já analisadas, e publicadas por meios escritos e eletrônicos, como livros, artigos científicos, páginas de sites (Fonseca, 2002, p. 32)

A técnica de coleta de dados realizada na pesquisa de campo, foi através da construção de um Formulário de Pesquisa, denominado questionário, estruturado em questões de múltipla escolha e questões abertas. As respostas foram contabilizadas através do Sistema Online Google Drive. A pesquisa aconteceu nos meses de maio e junho de 2016 e foi aplicada aos responsáveis pelo Cerimonial nas instituições pesquisadas.

4. Resultados

Após coleta e análise da pesquisa, foi denominada pela letra A, a respondente responsável pelo setor na UNB e letra B, a do IFB. Percebe-se como fatores em comum no que se refere ao perfil profissional, que os dois setores são coordenados por servidoras públicas, mulheres, que estão no cargo por mais de seis meses, e a principal diferença é que a respondente A não possui curso superior, porém possui formação técnica na área de eventos e que a respondente B possui curso superior e especialização na área de atuação. Em relação a experiência na área, a respondente A, possui de 05 a 10 anos e a B, acima de 10 anos.

De acordo com a responsável do setor do IFB, são funções do cerimonial:

“Conduzir as solenidades oficiais, promovendo o planejamento do evento, elaboração de roteiro, envio de convites e recebimento de confirmação de presença; elaborar e acompanhar os processos licitatórios de serviços especializados em eventos; planejar, organizar e executar os principais eventos institucionais; dar apoio nos eventos dos 10 campi IFB; preparar script de cerimonial; definir sequência da solenidade; credenciar os participantes; registrar autoridades; orientar as equipes de cerimonial”.

Segundo a responsável A, o planejamento das cerimônias acontece através da “elaboração de roteiros e coleta de informações do formato dos eventos que precisam da presença do Cerimonial”. Já para a respondente B, o “gabinete da Reitoria ou Pró reitoria demandam a reunião prévia para contextualização e providências, seguido do registro pelo SGI Institucional”. No que tange a relação das atribuições do Cerimonial, na UNB se faz com a condução do evento como mestre de cerimônias, na confirmação e registro de presença de autoridades confirmadas, no envio de convites e na confirmação de presença de convidados. Já no IFB, são atribuições o repasse do script da solenidade, o informe das confirmações de presença de autoridades, a preparação de informes (dados técnicos) para subsidiar o pronunciamento e nos informes do tempo de falta e orientação quanto ao traje.

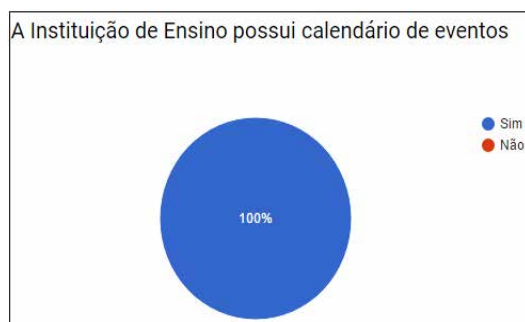


Figura 1 - Calendário de eventos. Fonte: Dados da pesquisa

No que se refere aos procedimentos teóricos e práticos utilizados pelas instituições de ensino pesquisadas, observa-se na figura 1, que ambas as instituições possuem calendário de eventos, o que caracteriza o planejamento das atividades anuais desenvolvidas pela equipe responsável.



Figura 2 - Média de eventos por mês. Fonte: Dados da pesquisa

A média de eventos executados pelas instituições respondentes, não difere substancialmente de acordo com a figura 2, a Universidade de Brasília - UnB, declara que realiza uma média de 10 a 15 eventos por mês, e o Instituto Federal de Brasília - IFB, informa que realiza entre 5 a 10 eventos. Contudo, é importante ressaltar que a UnB, possui mais de 40 anos no Distrito Federal, já o IFB, iniciou suas atividades em 2008 e atualmente possui dez campi. Dessa forma, pode-se inferir que uma das causas da diferença entre o quantitativo de eventos realizados, entre as instituições, esteja diretamente relacionada com o tamanho da demanda de trabalho existente.

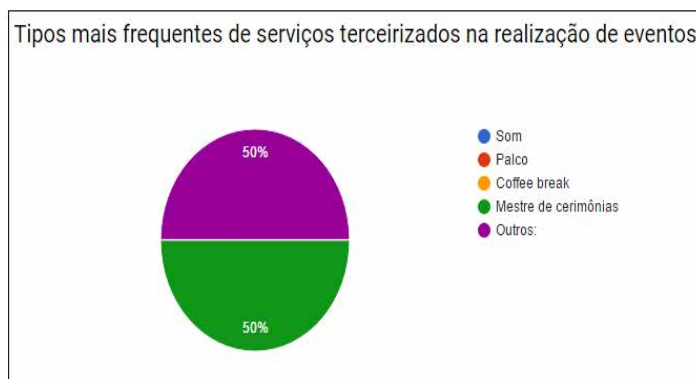


Figura 3 - Tipos mais frequentes de serviços terceirizados na realização de eventos. Fonte: Dados da pesquisa

Quando questionadas sobre os tipos de serviços terceirizados mais frequentemente contratados, destaca-se na figura 3, que a UnB terceiriza o serviço de mestre de cerimônias, e o IFB não especificou o serviço contratado. O setor de eventos, tem como característica singular, a multidisciplinaridade, ou seja, utiliza-se de diversas áreas e profissionais. Essa característica impõe à atividade a necessidade constante de pessoas com habilidades em alguns casos muito específicas.



Figura 4 - Ocasões são utilizadas a bandeira do Brasil, do GDF e da Instituição de Ensino. Fonte: Dados da pesquisa

No setor de eventos, uma das áreas que atualmente demandam um conhecimento técnico específico é o de Cerimonial e Protocolo, pois o mesmo é baseado em regras estabelecidas pelo Decreto nº 70.274 de 09 de março de 1972, que aprova as normas de cerimonial público e a ordem geral de precedência nos Estados e no Distrito Federal. Dessa forma, mesmo as instituições privadas baseiam-se no respectivo decreto federal para a organização de seus eventos e na elaboração de seus manuais. Sendo assim as universidades e institutos federais também utilizam como referência a mesma legislação, que no caso do Brasil é muito antiga e no decorrer de todo esse tempo, foram poucas as atualizações realizadas.

A disposição das bandeiras, a execução do hino nacional, a distribuição das autoridades na mesa de honra, entre outras atividades, fazem parte do cerimonial em uma solenidade.



Figura 5 - Execução do Hino Nacional. Fonte: Dados da pesquisa

Quando perguntadas em que tipo de evento é executado o hino nacional, conforme figura 5, as respondentes se dividiram em duas ocasiões, nas formaturas (solenidade em que a execução é obrigatória) e em todas as aberturas de eventos.

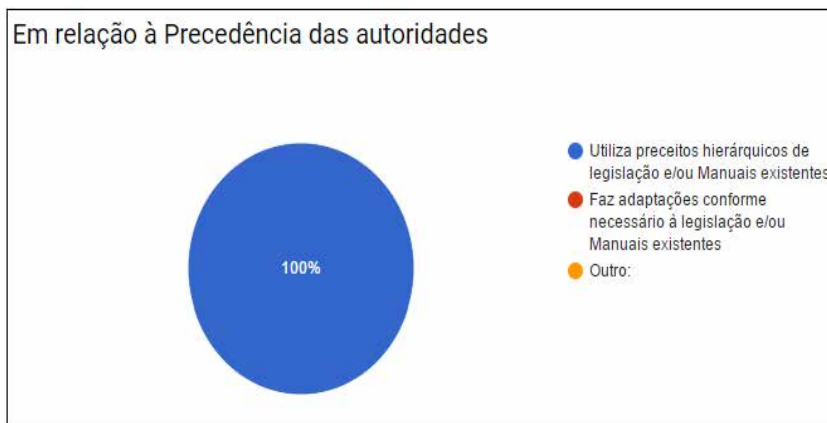


Figura 6 - Precedência das autoridades. Fonte: Dados da pesquisa

A precedência entre as autoridades, é uma das regras mais polêmicas do cerimonial público e também a que mais causa constrangimentos entre os participantes e a equipe organizadora das solenidades, isso porque, existem casos extremamente específicos que muitas vezes escapam às regras. Nesses casos, o chefe de cerimonial responde protocolarmente pelas decisões tomadas durante o evento. As duas instituições pesquisadas são unânimes (figura 6) em dizer que ambas utilizam os preceitos hierárquicos de legislação.



Figura 7 - Possui estagiários de cursos técnicos ou tecnólogo em eventos. Fonte: Dados da pesquisa

De acordo com a figura 7, a UnB não possui em sua equipe a presença de estagiários, tendo um total de 5 pessoas na equipe, sendo que o IFB, relata que conta com a participação de estagiários em sua equipe, atualmente com 14 colaboradores.

Um ponto questionado e que merece destaque na análise foi em que contexto o cerimonial e o protocolo são aplicados nas instituições de ensino pesquisadas. Tanto a responsável pelo cerimonial da UnB como a do IFB, afirmam que a valorização da imagem institucional e de seus gestores, assim como a defesa do uso correto da marca, são exemplos da aplicabilidade do cerimonial nas instituições de ensino.

Diante da análise apresentada, detectou-se que as duas Instituições de ensino possuem pessoas habilitadas para condução dos eventos realizados e demandados a eles. Outro ponto favorável é a experiência na área das entrevistadas. Ambas as responsáveis pelo setor seguem as normativas, o que resulta em eventos bem organizados e dentro das normas de cerimonial e protocolo.

5. Considerações Finais

O objetivo principal do trabalho foi conhecer a prática do cerimonial público no âmbito universitário e dos Institutos Federais de Educação, bem como o perfil e atribuições do profissional que atua na organização de solenidades, buscando entender os procedimentos teóricos e práticos utilizados e as principais dificuldades enfrentadas pelos responsáveis pelo planejamento e execução das cerimônias. Verificou-se que as duas instituições de ensino público federal pesquisadas no Distrito Federal, são coordenadas por servidores públicos, mulheres e que já possuíam experiências na área de eventos e cerimonial, anteriormente ao ingresso nesses setores. Percebeu-se também que as atribuições desses setores estão diretamente relacionadas à condução e organização de eventos demandados pelos reitores e pró-reitores, sendo na maioria formaturas e inaugurações. Ressalta-se que são seguidas as normas de cerimonial público para as solenidades, de acordo com o Decreto e manuais internos, que por sua vez, tem como base esse decreto.

Notou-se que as dificuldades da participação em eventos organizados por pessoas dos *campi*

ou departamentos, que não tem habilidade na área, acaba dificultando a execução das normas. Foi percebido também, como barreiras na condução dos eventos a falta de um sistema de confirmação de presença, que facilitaria a composição de mesa e a chamada dos convidados que precisam ser destacados.

Finalmente, detectou que, entre todas as funções de um evento, mencionadas na pesquisa, algumas já muito conhecidas por gestores do setor, destaca-se como principal diferencial, a utilização do cerimonial como uma ferramenta de valorização e difusão da imagem institucional e de seus gestores perante a sociedade.

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Jogos Sérios para aprendizagem em segurança

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Abstract

The lack of a good knowledge and risk conscience is pointed as one of the reasons for workers' unsafe behaviors. Considering this, it is important to improve safety training tools using new technologies and ways of thinking. Games are becoming an important tool for education. Technical features of serious games are directly connected with human desires: reward, status, altruism, self-expression, challenge and others. All these facts lead us to consider serious games as a feasible tool to improve safety education. Other potential instrument which could be used in safety education is Immersive Virtual Reality. Here, the information is totally presented in a 360° environment making possible a great feeling of presence and a body-mind experience. Also, avoids trainees to be exposed to risky situations, the "feeling" of the impact of a bad action, and the construction of a smart and flexible learning environments.

Taking in consideration both serious game and virtual reality potential for safety learning this paper we will analyze the previous works that combine these elements and propose some examples of the application of these technologies

Keywords: *safety, safety learning, education, games, serious games.*

Resumo

A ausência de bons conhecimentos e consciência de risco são apontados como uma das razões para comportamento inseguro dos trabalhadores. Considerando isto, é importante melhorar as ferramentas de treinamento de segurança e formas de pensamento. Jogos estão se tornando uma importante ferramenta para educação. As características técnicas dos jogos sérios estão diretamente relacionadas com os desejos humanos: recompensa, altruísmo, status, expressão pessoal, desafio e outros. Todos esses fatores nos levam a considerar jogos sérios como uma ferramenta plausível para melhorar educação de segurança. Outro potencial instrumento que pode ser usado para treinamento de segurança é a Realidade Virtual

Imersiva. Aqui, a informação é totalmente apresentada em um ambiente 360º tornando possível uma forte sensação de presença e experiência de corpo e mente. Também, evita exposição ao risco durante o treinamento, a sensação de impacto de uma ação errada, e a construção de ambientes de aprendizagem flexíveis e inteligentes.

Levando em consideração tanto os jogos sérios como a realidade virtual imersiva como potencializadores para educação em segurança este trabalho irá analisar os trabalhos anteriores com estes elementos e propor alguns exemplos da aplicação dessas tecnologias.

Palavras-chaves: *segurança laboral, treinamento de segurança, educação, jogos, jogos sérios.*

Introdução

O número de usuários de jogos tem aumentado muito nos últimos anos. A razão disso é, além do barateamento proporcionado pelos avanços tecnológicos, o fato dos jogos estarem se tornando cada vez mais envolventes e estimulantes. As características que aumentam o grau de motivação como os desafios, as regras claras e as recompensas podem se tornar uma forte ferramenta para diversas áreas como a educacional. Baseado nessa realidade emergem os jogos sérios (Serious Games – SGs), que são os jogos cujo objetivo principal é a educação mais do que o entretenimento (Miller et al, 2011). Os SGs têm por premissa principal treinar e educar fazendo uso de elementos divertidos. Migrando desde o uso para fins militares (Deterring et al., 2011), os jogos sérios têm sido usados com sucesso em áreas como turismo, negócios, saúde e outras, uma vez que permite treinamento contínuo, intensivo, efetivo, com segurança e complacência. Porém, para que seja eficaz faz-se necessário dar especial atenção ao denominado simulação de jogos tais como fidelidade, interatividades, imersão (Rocha y Araujo ,2013).

Quando se trata de imersão um forte potencializador desta característica é a denominada Realidade Virtual Imersiva. Sua introdução no âmbito da educação se deu em 1990 com projetos como Science Space, Safety, Atom world e outros que faziam uso do CAVE (Merchant et al., 2014) . O fato de se sentir mais presente em um ambiente virtual do que no plano real (sensação de presença) permite promover experiências emocionais positivas no usuário, e até mesmo transformar obstáculos em mudança comportamental ou emoções negativas em experiências positivas através da persistência.

Educação, aprendizagem e treinamento são considerados essenciais para a segurança e saúde no ambiente de trabalho (Lin et al., 2011). A deficiência nessa área é apontada como uma das principais razões pela qual os trabalhadores desempenham comportamento de risco (Cavalcanti, et al, 2017). O presente trabalho tem por objetivo introduzir aspectos teóricos de jogos sérios associados à realidade virtual imersiva e seus potenciais impactos para o

aprendizado e treinamento em segurança laboral e propor alguns exemplos da aplicação das mesmas visando a um incremento dessa área.

O artigo está assim organizado: a principio destacamos os aspectos considerados importantes para treinamento de segurança, além de como os jogos sérios imersivos podem contribuir para eles, e trabalhos presentes na literatura que avaliaram a relevância dos referidos itens. Na segunda seção apresentamos sugestões de características a ser usadas no entorno imersivo do jogo serio e ao final uma breve conclusão do que foi exposto.

1. Estado da arte

Treinamento de prevenção e risco é um tema de grande importância social, mas poucos indivíduos adotam uma conduta considerada segura. Pensando em analisar se os jogos poderiam influenciar na adoção de um comportamento seguro foi desenvolvido um estudo na área de trafego (Backlund et.al, 2007). Para tanto dois grupos foram imersos em realidade virtual, sendo que um deveria conduzir desempenhando tarefas que faziam parte de uma plataforma de jogo serio, enquanto que para o outro grupo não foram apontadas características de jogo. Os resultados mostraram que, quando submerso em um jogo, o individuo desprende total atenção a sua conduta, e assim desempenha ações consideradas seguras. Mas o que leva um individuo a se comportar dessa maneira? A seguir apresentamos uma série de pontos considerados de fundamental importância quando se trata de treinamento e apontamos de que maneiras os jogos podem aguçá-los.

1.1. Motivação

Os jogos sérios são comumente apontados como mais importante e influente meio para estudantes de colégio e tem o poder de envolver indivíduos de todas as idades. As características que trazem o comprometimento com o aprendizado não são apenas desejáveis; elas são necessárias (Dickey, M.D., 2005). Tendo isso em consideração e tomando como base as características apontadas por Sherif and Mekawwi como efetivas para a aprendizagem assistida por computador, (Lin et al., 2011) criou e analisou um jogo 3D para estudantes de engenharia. Tendo em consideração realismo, autoaprendizagem, interatividade, grau de orientação, incerteza e novidade, avaliação do desempenho do usuário, prazer e ambiente de aprendizagem em segurança, a pesquisa em questão demonstrou que o ambiente virtual é suficientemente rico em informações e capaz de facilitar a aprendizagem no âmbito de prevenção de riscos, além de mais prazeroso se comparado ao método tradicional.

Se somarmos a isso a premissa de que a experiência de jogar em primeira pessoa (Riddle, 2002) incrementa a motivação, concluímos que a total imersão no ambiente pode ser capaz de proporcionar um maior grau de realismo e naturalismo, pontos considerados como merecedores de revisão do trabalho de Dickey (2005) e comprovados por (Backlund et.al, 2007). Nesse ultimo projeto, um jogo virtual imersivo foi utilizado para treinar bombeiros

fazendo uso do CAVE como complemento do treinamento tradicional, e os resultados da mostra de 31 bombeiros estudantes apontou para um alto grau de diversão, motivando os indivíduos a treinarem de maneira voluntária e por muito tempo.

A possibilidade do uso da tecnologia móvel e head-mounted display quando comparada ao o CAVE, apresenta como pontos fortes: menor custo decorrente do barateamento dos aparatos celulares e a flexibilidade de não estar fixo.

1.2 Persuasão e auto-atitude

Em um movimento recente, ambientes virtuais vêm sendo alvo de exploração de pesquisadores no campo de persuasão (Chittaro, 2014). Uma das razões para isso é o fato da simulação proporcionar a visualização de causa e efeito de ações, podendo gerar mudança de atitudes das pessoas.

Além disso, a possibilidade de vivência e experiência proporcionada pelos jogos sérios imersivos contribuem para que o usuário tenha a oportunidade de adquirir experiência, e esta é considerada como maior contribuidor para a auto-atitude. Treinamento em segurança, atitudes seguras e auto-atitude foram positivamente correlacionadas pela literatura (Grau et.al, 2002 e Chittaro, 2012)

Pensando n uma maior familiarização dos bombeiros durante seu treinamento, em 1997 foi desenvolvido um grande programa de pesquisa pelo US Office Naval Research (Tate, Sibert & King, 1997). Nele, um grupo de bombeiros foram treinados com uso de realidade virtual imersiva, em um ambiente estressante, com a finalidade de incrementar o processo de decisão. Quando comparados com o treinamento tradicional, o grupo treinado na realidade imersiva apresentou um mensurável incremento de ações.

Além disso, como destacado por (Schwebel et.al., 2008) quando de seu estudo sobre a influencia da realidade virtual imersiva sobre a adoção de comportamento seguro por crianças e adultos pedestres, a realidade virtual permite que o individuo vivencie o treinamento por quantas vezes deseje ou seja necessária, e assim incrementa seu poder de auto-atitude.

1.3 Emoções

Estudos indicam que as emoções tem a capacidade de intensificar o conteúdo armazenado na memória (Sharot, et.al, 2004; Nielson and Arentsen, 2012), sendo que as emoções negativas (como o medo) podem ser especialmente eficientes (Kensinger, 2009), além de aumentar a percepção de risco (Slovic, 2006). A realidade virtual é uma potente ferramenta para indução de emoções. Em particular, acreditamos que a exposição a condições onde haja a presença de artifícios que induza ao stress pode vim a ser de grande utilidade, baseado no fato de que, já foi anteriormente comprovado que indivíduos treinados com exposição ao stress demonstraram bom rendimento quando expostos a ambientes diversos (Tichon y Limerick, 2011).

Vários estudos apontam variáveis que podem ser usadas com o intuito de induzir o medo e stress aos usuários. Assim temos estímulos gráficos (como redering de sangue como em Chittaro y Sioni, 2015) e realísticos (como sons não verbais gravados em Chittaro & Zangrando, 2010), que podem ser usadas por exemplo para destacar as consequências ruins, decorrentes de uma ação não desejada, esperada. Fazendo uso dessas variáveis (Chittaro & Buttussi, 2015), analisaram o uso de um jogo serio imersivo com o objetivo de treinar cidadãos para acidentes de avião. Comparado ao tradicional sistema de cartões, o jogo, que fazia uso de variáveis de indução emocional, apresentou maior eficácia com relação a retenção de memória.

1.4 Mobilidade

Os avanços tecnológicos atuais trouxeram uma série de vantagens como, por exemplo desenvolvimentos na tecnologia móvel, e estas tornaram possíveis a implementação da realidade virtual de forma mais barata. Além disso, possibilitam seu uso nos mais diversos locais. Isso, tendo em mente educação e treinamento, é de grande valia pois amplia a gama de usuários que podem utilizar e o numero de vezes que o mesmo é utilizado, podendo um individuo tomar varias decisões sobre um mesmo tema e conhecer as diversas consequências possíveis.

Também abre a possibilidade para que, um mesmo entorno, com pequenas alterações, possa ser utilizados para diversos fins, como nos mostrou (Rizzo et.al, 2006) que tomando como base um mesmo ambiente virtual desenvolveu um estudo de atenção com crianças, tratamento de ansiedade, e treinamento de indivíduos para terremotos.

2. Sugestões de aplicação

Em virtude dos fortes custos decorrentes de acidentes laborais torna-se importante dispensar atenção para ações que visam a persuadir os indivíduos a adotarem comportamentos adequados, além de educar para a adoção de posturas cientes quando expostos a situações incertas ou de riscos.

O principal objetivo de treinamento de segurança é uma maior pratica de comportamento seguro. Tendo isso em mente, acreditamos que a imersão em jogos sérios em um ambiente de risco eminente ou acidente, na qual o individuo tenha como objetivo maior a sobrevivência desperta um maior grau de atenção quando comparado a treinamentos comuns. O fato de que as decisões e ações tomadas neste ambiente serão capazes de definir as consequências que se obtém (se consegue êxito com ou sem dano, ou se não consegue finalizar com sucesso a tarefa pretendida, levando a fatalidade, por exemplo) produz forte interação permitindo que o usuário possa ver e analisar as diversas consequências que uma ação pode gerar. Adicionado a isso a visualização de imagem representacional de sangue, além de uma barra onde se possa visualizar o nível de sangue que ainda resta, e do grau do dano gerado pela ação, produzem um maior grau de stress que, neste caso, juntamente com

a imersão aumentaria a presença e flow e, conseqüentemente a persuasão ao comportamento desejado pelo treinamento. Também os usos de sons como as batidas de coração, de passos ao caminhar, de gritos ao redor, de faíscas poderão familiarizar o indivíduo com o cenário de um acidente e assim diminuir a dúvida de ações durante o novo. Outro ponto é o uso de dispositivos táticos (cyber glove, por exemplo) permitindo que o indivíduo possa sentir também através do tato, respeitando certas proporções, as conseqüências de estar aí, como por exemplo, um pequeno tremor produzido por luvas quando acontece uma descarga elétrica no ambiente, ou quando um avatar passa correndo pelo indivíduo.

Também é importante alto grau de realismo, incluso com sons como gritos, explosões , faíscas, isso com o objetivo de familiarizar o indivíduo com a situação e dessa maneira evitar a denominada “paralisia cognitiva”. De acordo com (Chittaro,2012) , esse fenômeno ocorre quando as pessoas diante de uma situação não tomam nenhuma atitude podendo levar a fatalidade. Para tanto, nos parece importante um prévio levantamento das possíveis atitudes diante de um ambiente, e sua posterior representação no entorno virtual, de maneira que os usuários possam vivenciar as variadas possíveis decisões de um ambiente.

3. Conclusão

O treinamento e a educação de segurança quando eficientes são capaz de levar a consciência sobre comportamento seguro em situações de risco tanto já eminentes como a em se tratando de prevenção de risco e assim, reduzir o numero de fatalidades nesta área.

Os jogos sérios imersivos, na medida em que apresentam aos indivíduos as conseqüências de suas atitudes, sejam elas certas ou erradas, de maneira sensorialmente rica, são capazes de imprimir um forte resultado de memória, sem provocar dano aos indivíduos.

O presente trabalho, visou com base na literatura, realizar um levantamento de possíveis pontos que podem ser aplicados no âmbito da educação de segurança laboral e prevenção de riscos. Uma vez analisados tais pontos, pretendemos elaborar um entorno virtual imersivo e avaliar a eficiência do mesmo sobre todos os aspectos.

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Ensino de combinatórias lexicais através de corpus

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Resumo

O ato de utilização da linguagem verbal não é exclusivamente criativo, uma vez que o falante usa, frequentemente, estruturas lexicais pré-construídas, ou seja, combinatórias lexicais. De facto, a investigação sobre corpora tem revelado que as combinatórias lexicais constituem uma parte com elevada representatividade na arquitetura lexical da língua. Por conseguinte, no contexto pedagógico-didático de promoção da competência lexical, no âmbito do ensino do Português, tanto como língua materna como língua não materna, é fundamental adotar metodologias de trabalho renovadas, que conduzam os alunos à descoberta dessas associações lexicais, promovendo a ampliação do capital lexical dos estudantes de Língua Portuguesa. Este trabalho fundamenta-se nos referenciais teóricos da “Lexical Approach”, de Michael Lewis, e da “Lexical Priming”, de Michael Hoey, e possui como principal objetivo apresentar propriedades das combinatórias lexicais que podem ser observadas em contexto de ensino-aprendizagem do Português através de corpus. Nesse sentido, extrairemos do “Corpus do Português”, disponível online em www.corpusdoportugues.org, concordâncias de combinatórias lexicais, cuja observação e análise concedem aos alunos a profícua oportunidade de aprendizagem das estruturas e padrões de combinatórias lexicais.

Palavras-chave: Combinatórias lexicais, ensino do português como língua materna e não materna, corpus, concordâncias.

Introdução

A primeira parte deste trabalho incide sobre o conceito de combinatórias lexicais, bem como sobre a lexicalização e a construção de significados. Na segunda parte, apresentam-se as abordagens “*Lexical Approach*”, de Michael Lewis (2000), e “*Lexical Priming*”, de Michael Hoey (2005), enfatizando a sua relevância para o ensino-aprendizagem do léxico. Na última parte, referem-se propriedades ao nível da estrutura gramatical de combinatórias lexicais que podem ser observadas em contexto de ensino-aprendizagem do Português através de corpus.

1. Combinatórias lexicais

No ato de interação comunicativa real, os interlocutores têm expectativas sobre o surgimento dos itens linguísticos, uma vez que, intuitivamente, preveem os contextos associados a determinadas formas linguísticas. De facto, os falantes usam estruturas lexicais pré-construídas, que demonstram os padrões léxico-gramaticais que formam a arquitetura da linguagem humana. Como afirma Sanromán (2001), “falamos, pois, por conjuntos de palavras, fazendo um uso limitado das possibilidades combinatórias — teoricamente ilimitadas — da língua” (p. 161).

Esses “*conjuntos de palavras*” que o autor refere são as combinatórias lexicais, que consistem em “padrões associativos de palavras apresentando diversos graus de fixidez e composicionalidade, desde expressões idiomáticas e fixas a co-ocorrentes privilegiados” (Antunes et al., 2008, p. 33). Sinclair (1991) designa essa forma de verbalizar o real, através de sequências sintagmáticas pré-construídas, por princípio idiomático e define combinatória da seguinte forma:

the occurrence of two or more words within a short space of each other in a text. The usual measure of proximity is a maximum of four words intervening. Collocations can be dramatic and interesting because unexpected, or they can be important in the lexical structure because of being frequently repeated (Sinclair, 1991, p. 170).

Existem diversas denominações metalinguísticas para designar estas unidades lexicais, por exemplo, através de oposições: “*lexically composite phrasal expressions*” e “*lexically simple phrasal expressions*” (Lyons, 1995, pp. 50-52); “*open choice principle*” e “*idiom principle*” (Sinclair, 1991, pp. 109-115); “*sintagma livre*” e “*sintagma fixo*” (Carvalho, 1979, 495-496; 504-525); outros autores falam em “*lexias complexas e lexias textuais*” (Pottier, 1978, pp. 269-270), “*frasema*” (Mel’chuk et al., 1995, pp. 56-57) e “*formulaic sequences*” (Wray, 2002, p. 9).

As estruturas da língua “pré-fabricadas” (Casares, 1992, p. 225) revelam que “falar não é um ato puramente criativo, no sentido de que cada vez que utilizamos a linguagem combinamos livremente (utilizando as regras do sistema) e de maneira inovadora os signos, as unidades, de que dispomos” (Sanromán, 2001, p. 161).

As palavras e grupos de palavras edificam a sua significação no discurso, isto é, muitos dos sentidos dos objetos linguísticos concretizam-se nas relações lexicais sintagmáticas. Nesse sentido, Sanromán (2001) chama a atenção para o facto de os dicionários “não só não registarem significados provenientes de combinações de palavras, mas também [não] considerarem como sendo uma aceção de uma palavra o que, em rigor, é o significado dessa palavra juntamente com outros elementos com os quais co-ocorre” (p. 302).

O conceito de “collocation” remete-nos para Firth (1957), que foi o primeiro a usar o termo e a explicá-lo com a sua famosa frase: «you shall judge a word by the company it keeps» (Firth, 1957, p. 11), definindo colocação como “actual words in habitual company”. Firth (1957) reconheceu que os interlocutores, no ato de interação verbal, preveem os cotextos dos itens linguísticos. Assim, a linguagem baseia-se em padrões léxico-gramaticais, sabidos e partilhados pelos falantes.

Na senda de Wray (2002), Rodrigues (2015, p. 37) usa o termo “fórmula” para denotar as unidades linguísticas multilexicais e salienta que “os falantes usam as fórmulas frequentemente e com propriedade, denotando o conhecimento implícito acerca da sua utilização que caracteriza qualquer item linguístico. Não podem, por isso, relegar-se ao domínio da marginalidade descritiva” (Rodrigues, 2015, p. 37).

Também Nascimento (2013) conclui que as combinatórias lexicais não constituem fenómenos linguísticos marginais, uma vez que representam “uma parte importante da produção lexical, como diversos estudos sobre corpora têm demonstrado: não só são muito recorrentes no discurso, mas também é linguisticamente significativo o seu estatuto na gramática e no léxico mental dos falantes” (p. 246). Fundamentando-se nos estudos de Sinclair, a autora refere que os estudos efetuados em corpus ingleses demonstram que somente 20% das escolhas dos falantes serão independentes, uma vez que as cosseleções verificam-se em 80% das ocorrências linguísticas.

1.1. A lexicalização e a construção de significados

Maria Fernanda Bacelar do Nascimento (2013) define lexicalização “como um processo gradual de fixação de sequências de palavras em grupos formal e semanticamente coesos, com um comportamento semelhante ao de uma unidade do léxico” (p. 215).

Essas sequências de palavras podem possuir um significado não composicional, quando não é possível aceder ao significado da expressão a partir de cada uma das palavras que integram a sequência, como por exemplo, “Pão, pão, queijo, queijo”, que o dicionário (Disponível em: <https://www.infopedia.pt/dicionarios/lingua-portuguesa/pão>) define como “com clareza, francamente”¹.

¹ in Dicionário infopédia da Língua Portuguesa com Acordo Ortográfico [em linha]. Porto: Porto Editora, 2003-2017. [consult. 2017-06-23 16:30:17]. Disponível na Internet: <https://www.infopedia.pt/dicionarios/lingua-portuguesa/pão>

No entanto, há expressões, como “vestir a camisola”, que podem veicular um significado composicional, através da significação literal de cada uma das palavras que as compõem, bem como um significado não composicional totalmente idiossincrático, ou seja, a expressão referida pode significar “Empenhar-se incondicionalmente numa causa, numa tarefa ou num projecto”², revelando, portanto, um processo de lexicalização com um forte grau de congelamento semântico.

Segundo Nascimento (2013, p. 217), “a lexicalização cria unidades multilexicais cuja estrutura apresenta um maior ou menor grau de coesão interna, falando-se, concomitantemente, de “lexicalização (mais ou menos) forte ou fraca”. Assim, os aforismos, as expressões de saudação e de delicadeza, as siglas e os acrónimos, tal como unidades multilexicais constituídas por compostos morfossintáticos e por grupos sintagmáticos, apresentam um forte grau de lexicalização.

Nesse sentido, a mesma autora destaca também

coocorrências sistemáticas de palavras, com menos coesão interna, que mantêm o sentido literal de alguns ou mesmo de todos os seus elementos e que formam uma unidade de uso (cf. *fogo posto, estado lastimoso, politicamente correto* ou *induzir em erro*). Estes grupos [...] são chamados colocações, combinatórias ou coocorrentes privilegiados [...]. O que têm em comum estes diversos tipos de sequências de palavras é o facto de, em todas elas, se terem estabelecido progressivamente relações combinatórias (mais ou menos) fortes entre os seus elementos (Nascimento, 2013, p. 217).

Assim, os falantes usam, de modo inconsciente e automaticamente, esses conjuntos de palavras “pré-construídos”, combinadas de forma mais ou menos fixa e muito frequentes no uso.

² "vestir a camisola", in Dicionário Priberam da Língua Portuguesa [em linha], 2008-2013, <https://www.priberam.pt/dlpo/vestir%20a%20camisola> [consultado em 23-06-2017].

2. Abordagens lexicais: “Lexical Approach” e “Lexical Priming”

No âmbito dos métodos mais relevantes do ensino do léxico de línguas estrangeiras, encontram-se as abordagens lexicais “*Lexical Approach*”, de Michael Lewis (2000), e “*Lexical Priming*”, de Michael Hoey (2005). Os autores aplicaram os seus modelos ao ensino da língua inglesa como língua estrangeira. No entanto, a aplicação das propostas revela-se extensível ao ensino do léxico de qualquer língua.

O “*Lexical Approach*” baseia-se em colocações “collocations [...] co-occur naturally, and the first task of the language teacher is to ensure that they are not unnecessarily taken apart in the classroom” (Lewis, 2000, p. 132).

Na abordagem da “*Lexical Priming*”, de Hoey (2005), o ensino do léxico também assume toda a centralidade no ensino das línguas, pois o léxico revela a forma como a língua se encontra organizada.

Hoey (2005) preconiza que léxico e gramática possuem uma relação indissociável, opondo-se às conceções tradicionais de léxico: “The theory reverses the roles of lexis and grammar, arguing that lexis is complexly and systematically structured and that grammar is the outcome of this lexical structure” (p. 1).

Realçando a dimensão lexical da arquitetura textual, Hoey (2005) revela que o ensino das combinatórias lexicais promove a ampliação do capital lexical dos estudantes, levando-os a descobrir padrões lexicais e gramaticais, resultantes de associações no nível do léxico, no nível gramatical e no nível semântico, isto é, a relação que as palavras estabelecem entre si permite identificar três tipos de associações: colocações (Hoey, 2005, pp. 5-8), coligações (Hoey, 2005, p. 38) e associações semânticas (Hoey, 2005, p. 24).

A importância do estudo das combinatórias lexicais é referida no *Quadro Europeu Comum de Referência para o Ensino das Línguas* (2001), em que se recomenda o desenvolvimento de atividades facilitadoras da aquisição lexical por parte do aluno de língua estrangeira: “pela simples exposição às palavras e expressões fixas usadas nos textos autênticos orais e escritos; pela apresentação das palavras em contexto [...]; pela explicação do funcionamento da estrutura lexical e consequente aplicação (p. ex.: palavras compostas, combinatórias, expressões idiomáticas)” (p. 209).

De igual modo, os *Programas e metas curriculares de Português do Ensino Básico* (Buescu, Morais, Rocha & Magalhães, 2015) fazem referência à importância do estudo das combinatórias lexicais, preconizando que o aluno deve “identificar, pelo contexto, o sentido de palavras, expressões ou fraseologias desconhecidas, incluindo provérbios e expressões idiomáticas” (p. 70).

3. Ensino-aprendizagem de combinatórias lexicais através do “Corpus do Português”

No âmbito da Linguística de Corpus, existem inúmeras investigações e muito diversificadas. No entanto, é possível identificar alguns traços de identidade partilhados pelos trabalhos realizados no escopo desta área (Sardinha 2000): são empíricos e investigam os padrões reais de uso em textos naturais; a investigação baseia-se na utilização de conjuntos grandes e criteriosos de textos naturais, denominados por corpus; utilizam os computadores para realizar a análise, aplicando técnicas automáticas e interativas; usam técnicas quantitativas e qualitativas.

A partir da análise de concordâncias, a observação das palavras no seu contexto de ocorrência configura uma prática recorrente na Linguística de Corpus. Essa prática possibilita o acesso ao significado e ao uso contextualizado das palavras.

As concordâncias também assumem uma enorme relevância na análise das colocações, ou seja, das palavras que “ocorrem ao redor do nóculo ou da palavra de busca, em posições relativas (primeira à esquerda, segunda à esquerda); diferem, portanto, de “palavra de contexto” pois esta é opcional, definida pelo usuário no momento da busca” (Sardinha, 2004, p. 188).

Através da listagem, a concordância fornece todos os cotextos de ocorrência de todos os itens linguísticos do corpus. Por conseguinte, é possível verificar se determinado cotexto em que certo item lexical ocorre é uma colocação, ou seja, se é frequente determinados itens surgirem contíguos em contextos linguísticos específicos.

A análise das concordâncias, realizada a partir da coluna do nóculo, fazendo a leitura tanto para a direita como para a esquerda, permite a identificação do “ambiente mais típico do nóculo” (Sardinha, 2004, p. 272), assim como aceder aos seus diversos significados e padrões de uso convencionais.

A observação de corpora permite-nos constatar que as línguas naturais, a nível sintagmático, repousam em estruturas padronizadas, cujo reconhecimento concede a possibilidade de averiguação das aceções e do uso real de determinada forma linguística que intervém em combinatórias lexicais, ou seja, uma dimensão fundamental do significado de determinada palavra reside no grupo de palavras que se combinam com essa palavra.

O “*Corpus do Português*” (Davies, 2016), criado por Mark Davies, é um corpus com cerca de um bilhão de palavras da Língua Portuguesa que foram extraídas de aproximadamente um milhão de páginas da Web do Brasil, de Portugal, de Angola e de Moçambique, encontra-se disponível online em www.corpusdoportugues.org e permite-nos efetuar pesquisas em que observamos as palavras no seu «habitat» natural.

Por conseguinte, Kennedy (1991) denomina esta forma de pesquisa por “*ecologia linguística*” (p. 98), uma vez que a mesma se centra no comportamento de itens lexicais ou de estruturas gramaticais no meio linguístico de ocorrência.

O conhecimento intuitivo dos falantes, por si só, não permite a identificação cabal das diversas combinatórias lexicais que integram as tipologias discursivas como unidades multilexicais. Essa identificação é possível, através de análises lexicométricas que identificam as tendências associativas das palavras e as suas cosseleções preferenciais (Nascimento, 2013, p. 244). As análises quantitativas de corpus de grandes dimensões possibilitam a verificação da frequência de ocorrência de cada uma das formas da combinação em análise, bem como a frequência de ocorrência da combinação no corpus, permitindo, através desses dados, obter o Índice Combinatório, que consiste num resultado estatístico que “permite avaliar se, num dado *corpus*, a frequência da sequência é maior do que seria previsível relativamente à frequência de cada um dos seus elementos; [...] permite também medir a força da associação lexical existente entre os componentes da sequência” (Nascimento, 2013, p. 245).

Prosseguindo a referência à importância da determinação do Índice Combinatório para estabelecer o grau de tendência associativa existente entre os elementos que constituem as unidades multilexicais, Nascimento (2013, p. 245) acrescenta que

o Índice Combinatório permite, ainda, avaliar se os elementos da expressão têm tendência para ocorrer apenas ou quase exclusivamente juntos ou se também ocorrem com uma grande variedade de outras palavras que não aquelas que compõem a expressão em análise. Se uma determinada palavra ocorrer maioritariamente na expressão em causa e se a sua frequência junto de outras palavras for reduzida, isso aponta para uma alta probabilidade de a expressão ter um grau forte de lexicalização (Nascimento, 2013, p. 245).

Considerando que os resultados das análises estatísticas remetem para a frequência de tipologias de unidades multilexicais distintas e que essa distinção se verifica ao nível da estrutura gramatical das unidades multilexicais, sendo, sobretudo, as estruturas “Nome + adjetivo”, “Nome + de + nome” e “Sintagmas verbais com verbos leves” as mais frequentes (Nascimento, 2013, p. 246), em contexto de ensino-aprendizagem de combinatórias lexicais, o professor deve rentabilizar as potencialidades pedagógicas que as novas tecnologias oferecem e propor aos alunos a observação e análise de concordâncias de combinatórias lexicais acessíveis no “*Corpus do Português*” (Davies, 2016), como se exemplifica na figura 1, que revela como, a partir da palavra de busca “cultura”, os alunos podem identificar combinações lexicais previstas pelo professor e descobrir outras.

Source	Language	Text Snippet	Tags
1 B AO rgvurulmakatuka.wordpress.com	A B C	enveredarem pelo -- CAMINHO DE A PAZ - não chamo	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
2 B PT radiogice.com	A B C	cumo Conjunto de Interesse Público A Secretaria de Estado da	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
3 G BR direitounin.wordpress.com	A B C	país. Quer se situar em veículo de divulgação de a	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
4 B BR cidadanoticia.com.br	A B C	o Campo da Desportiva -- onde hoje o Centro de	Cultura, Adonias, Filho, e assistir aos jogos de Futebol. Flamengo
5 B BR contee.org.br	A B C	rede de ensino a obrigatoriedade da História e	Cultura, Afro-Brasileira, Coloca como conteúdo o estudo da hi
6 B BR qdgopteroleo.com	A B C	Comportamental | buscamos jovens profissionais	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
7 B AO havemosdevotar.wordpress.com	A B C	!!! Em a minha opinião não sauboram respeito a	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
8 G BR teosofaoriginal.com	A B C	-- Prato típico do sul de a Índia ; A	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
9 G BR triplov.com	A B C	de esta categoria de direitos. Aqui o choque entre a	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
10 B BR saberepreciso.com	A B C	e retirada sem escolha ou hora ! A sociedade ; a	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
11 B BR elysandes.blogspot.com	A B C	for como a pessoa aqui , que apaixonada por a	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
12 G PT mundoptugues.org	A B C	1096627 Cultura Ministro da	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
13 G BR zemanbeiro.com	A B C	e como ideia legítima do que a gente requirita como "a	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
14 G BR oesanteriores.jornalagora.com.br	A B C	de pai ". Geralmente, vejo que ; em a	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
15 G BR leivabiblia.blog.br	A B C	, ele é o pai da mentira ; Esse pago de	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
16 G PT ciencia20.up.pt	A B C	quando contactam com cientistas. Entende que um indivíduo com	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2
17 B BR luizberto.com	A B C	dispor de instituições fortes capazes de formar políticos com	Cultura, Acaba, de, classifica, Trimestral, cons ISSN 0080-2

Figura 1. Contextos de ocorrência da palavra cultura

Estrutura “Nome + adjetivo”: Tendo como palavra de busca o nome “cultura”, os alunos poderão descobrir no corpus adjetivos que podem coocorrer à sua direita, identificando combinatórias lexicais, como por exemplo, “cultura geral”, “cultura física” e “cultura especializada”. O mesmo procedimento poderá ser adotado para identificar no corpus combinatórias como “fonte fidedigna”, “fonte limpa”, “fonte hospitalar”, “fonte bibliográfica” e “fonte batismal”, partindo da palavra de busca “fonte”.

Estrutura “Nome + de + nome”: no “Corpus do Português”, os alunos poderão descobrir combinatórias lexicais com a estrutura “Nome + de + nome”, a partir da análise das palavras que surgem à direita do nome, como por exemplo, a partir dos nomes “dia”, “caixa”, “paz”, “esfera” e “prazo”, poderão identificar combinatórias lexicais como “dia de anos”, “caixa de óculos”, “paz de alma”, “esfera de ação” e “prazo de garantia”, respetivamente.

Estrutura “Sintagmas verbais com verbos leves”: o professor poderá propor aos alunos como palavras de pesquisa no “Corpus do Português” os verbos “ter”, “dar” e “fazer”, tendo como objetivo a identificação de combinatórias lexicais como, por exemplo, “ter medo”, “ter necessidade”, “ter pena”; “dar um abraço”, “dar um passeio”, “dar origem”; “fazer críticas”; “fazer queixa”; “fazer a barba”.

Este tipo de atividades configura uma possível alternativa ao ensino tradicional, concedendo aos alunos a desafiante oportunidade de aprendizagem das estruturas e padrões de combinatórias lexicais com um suporte tecnológico.

4. Considerações finais

O ato de utilização da linguagem verbal não é exclusivamente criativo, uma vez que o falante usa, frequentemente, estruturas lexicais pré-construídas, ou seja, combinatórias lexicais. De facto, a investigação sobre corpora tem revelado que as combinatórias lexicais constituem uma parte com elevada representatividade na arquitetura lexical da língua, isto é, somente 20% das escolhas dos falantes serão independentes, uma vez que as cosseleções verificam-se em 80% das ocorrências linguísticas. Por conseguinte, no contexto pedagógico-didático de promoção da competência lexical, no âmbito do ensino do Português, tanto como língua materna como língua não materna, é fundamental adotar metodologias de trabalho renovadas, que conduzam os alunos à descoberta dessas associações lexicais, promovendo a ampliação do capital lexical dos estudantes de Língua Portuguesa.

Do que aqui se expôs, por fim, depreende-se que, como afirmam Rio-Torto e Ribeiro (2010), as “unidades compósitas, a estrutura interna, nas suas várias dimensões, e as funções da linguagem que elas agenciam, transformam-nas em inesgotáveis instrumentos de trabalho em sala de aula, que importa valorizar”; as “combinatórias de várias unidades lexicais — em que cada uma é portadora de diferentes propriedades semântico-conceptuais —, representam uma fonte de singularidade e de plasticidade do léxico, e portanto uma inestimável área de promoção do conhecimento linguístico e cultural dos falantes” (Rio-Torto e Ribeiro, 2010, p. 15).

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Atitudes de futuros educadores/professores face à Inclusão de alunos com Necessidades Educativas Especiais: Um estudo comparativo entre Portugal e Tailândia

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Resumo

Globalmente, a filosofia e a prática da inclusão de alunos com necessidades educativas especiais (NEE) em salas de aula regulares têm vindo a ser implementadas. Se em Portugal a inclusão começou nos anos 70, na Tailândia ainda se dão os primeiros passos na sua implementação. Assim, na presente comunicação apresentam-se resultados dum estudo que teve por objetivo conhecer e comparar as atitudes de futuros educadores e professores portugueses e tailandeses acerca da inclusão de alunos com NEE. Recolheram-se dados através dum questionário junto duma amostra de 333 futuros educadores e professores de duas instituições de ensino superior, uma Portuguesa e uma Tailandesa. Cento e doze são alunos portugueses (92 raparigas e 20 rapazes) e 221 são tailandeses (154 raparigas e 66 rapazes). A análise descritiva dos resultados mostra que: a) cerca de 60% dos portugueses e 80% dos tailandeses concorda e concorda plenamente com a educação dos alunos com NEE em turmas regulares; b) a severidade da NEE parece ter influência na atitude dos participantes, sendo que 95% dos portugueses e 90% dos tailandeses concorda e concorda plenamente que a inclusão de alunos com NEE ligeiras nas turmas regulares pode beneficiá-los, enquanto 30% dos portugueses e 40% dos tailandeses concorda e concorda plenamente que há benefícios para os alunos com NEE severas; c) existe uma atitude muito positiva em relação à ideia de que as pessoas com necessidades especiais têm o direito de serem incluídas na comunidade, com cerca de 97% de participantes de ambos os países a acordam e concordam totalmente. A análise inferencial mostra diferenças estatisticamente significativas entre portugueses e tailandeses em vários itens, nomeadamente naqueles sobre os benéficos da inclusão. Por fim, são discutidas as implicações destes resultados para a

formação de professores e para a qualidade da educação dos alunos com NEE numa perspetiva internacional.

Palavras-chave: *inclusão, percepções, futuros professores, necessidades educativas especiais.*

Educação para o empreendedorismo na integração intercultural

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Resumo

O projeto Rotas Científicas para uma integração intercultural é uma iniciativa do Centro Ciência Viva de Bragança, no âmbito do programa INTEGRA, apoiado pela Agência Nacional para a Cultura Científica e Tecnológica - Ciência Viva, que visa a criação de oportunidades de aprendizagem e de inclusão social pela via do conhecimento, da ciência e da cultura, a jovens provenientes de PALOPS residentes em Bragança ($n_{total}=417$). Este projeto consiste na integração social deste público-alvo através de três ilhas de conhecimento fundamentais: Ciência e Tecnologia; Multiculturalidade e Diversidade Cultural e Pedagogia e Educação na exploração de novos desafios, esta última explanada neste artigo. Assim, trabalharam-se questões prévias necessárias para despertar e contextualizar o seu espírito empreendedor, seguindo-se um conjunto de atividades que almejou estimular esse mesmo espírito nos participantes, bem como desconstruir conceitos de criatividade, de inovação e de empreendedorismo, promovendo a compreensão do papel dos empreendedores na sociedade. Posteriormente, as principais técnicas de geração de ideias e ferramentas para a sua representação foram exploradas, de forma a compreender e utilizar a Estratégia de Criatividade Disney. Por último, cada grupo de formandos projetou o seu micronegócio e promoveu sessões de dinamização de atividade comercial (numa escala micro e para produtos/serviços simples- “Banca na Praça do Município de Bragança”). Os resultados dos inquéritos obtidos através dos questionários aplicados aos participantes durante as sessões de formação foram avaliados, e estes auscultados de modo a perceber o trabalho futuro.

Palavras-chave: *Empreendedorismo, integração intercultural, tecnologia para empreendedores, Estratégia de Criatividade Disney.*

Introdução

Atualmente, as Universidades e Institutos Politécnicos têm vindo a apostar na internacionalização das suas atividades e na mobilidade de estudantes de diferentes países recebendo, cada vez mais, alunos oriundos dos Países Africanos de Língua Oficial Portuguesa (PALOP). Nos últimos anos, o Instituto Politécnico de Bragança tem atraído centenas de estudantes destes países para cursos tecnológicos superiores profissionais (CTeSP) e/ou cursos de licenciatura ou de mestrado (Nordeste, 2017). Apesar de se verem privados do convívio com as suas famílias e amigos durante muito tempo, podemos afirmar que, para muitos destes estudantes, Portugal é a porta de entrada para uma Europa sem fronteiras, onde muito ambicionam inclusivamente iniciar a sua vida profissional.

O projeto “Rotas Científicas para uma integração intercultural” (disponível em <http://83.240.167.45/integra>), apoiado pela Agência Nacional para a Cultura Científica e Tecnológica - Ciência Viva, no âmbito do programa INTEGRA, tem como pretensão promover e melhorar a integração destes estudantes não só nos contextos social e organizacional, mas também num nível mais alargado: científico, tecnológico e cultural. Assim, esta iniciativa do Centro de Ciência Viva de Bragança (CCVB), em estreita colaboração com a Escola Superior de Educação (ESE) do Instituto Politécnico de Bragança (IPB), visa a criação de oportunidades de aprendizagem e de inclusão social pela via do conhecimento da ciência e da cultura para esta comunidade estudantil residente em Bragança. De referir que o CCVB, associação científica e técnica sem fins lucrativos é, atualmente, uma referência regional no distrito de Bragança, não só ao nível da ciência e da educação, mas também da cultura pelo saber. Por um lado, o CCVB inscreve como missão central a construção de uma cidadania ativa assente na promoção do conhecimento científico e na divulgação e disseminação da ciência e tecnologia. Por outro lado, o IPB assume-se como uma instituição de referência regional e nacional que tem vindo a apostar crescentemente na internacionalização e que dispõe do potencial pedagógico, científico e tecnológico para dinamizar intervenções ao nível da comunidade envolvente e que se enquadram no âmbito do projeto referido.

Atualmente, a comunidade de estudantes PALOP no IPB ronda as quatro centenas de alunos, a saber: n=33 Angolanos, n=353 Cabo Verdeanos, n=15 Moçambicanos e n=45 São Tomenses, dos quais n=24 frequentam cursos técnicos Profissionais (CTeSP); n=360 cursam licenciaturas e n=62 encontram-se inscritos em mestrados.

Este projeto consiste na integração deste público-alvo através de três ilhas de conhecimento fundamentais: i) Ciência e Tecnologia; ii) Multiculturalidade e Diversidade Cultural e iii) Pedagogia e Educação na exploração de novos desafios, a qual especificamos neste artigo.

No contexto Internacional, a educação e a formação para o desenvolvimento do espírito empreendedor encontram-se integradas na estratégia da Comissão Europeia, no âmbito do procedimento “Competências-Chave de Aprendizagem ao Longo da Vida” (CE, 2005), e são

hoje amplamente reconhecidas como factores determinantes para o desenvolvimento económico e cultural de um país. Em linha com o preconizado, foram assim construídos um conjunto de orientações pedagógicas e de componente teórica, mas também de atividades práticas que pretendem ser mobilizadores de saberes nucleares e transversais, como sendo o desenvolvimento de competências analíticas e críticas, comunicacionais e de liderança, mas também proporcionando uma atitude empreendedora e geradora de ideias, através de uma aprendizagem que envolvesse atividades experimentais, de reflexão e de trabalho colaborativo. Porque formar cidadãos implica formar pessoas ativas, responsáveis, críticas, participativas, cooperantes e competitivas. A integração deste grupo particular de indivíduos por esta via, foi o objetivo nuclear desta componente do projeto.

1. O Projeto: Rotas Científicas para uma integração intercultural

Este projeto de integração intercultural consiste na integração social do público-alvo referido através de três ilhas de conhecimento fundamentais:

- 1. Ilha Ciência e Tecnologia** que inclui o seguinte conjunto de atividades: i) Oficinas de Saberes Tradicionais e Cultura Científica (oficinas de exploração e valorização dos valores naturais, culturais, patrimoniais e etnográficos); ii) Saídas de campo/*workshops* ambientais (atividades que assentam na realização de saídas de campo estruturadas onde se apresentam e interpretam os fenómenos associados à paisagem, à biodiversidade e à geodiversidade da Região do Nordeste Transmontano); iii) Oficina de Ciências (onde se pretende impulsionar a criatividade e curiosidade científicas); iv) Construção de uma Rota Científica (Museu Dinâmico Virtual e aplicação para smartphones onde constarão informações relevantes decorrentes das observações científicas); v) 3D thinking 3D printing (onde se pretendem concretizar modelos 3D a partir de sistemas que integrem imagens digitais, fotografias captadas no decorrer das atividades anteriores e/ou monumentos, sistemas ou marcos que definam a memória histórica e cultural).
- 2. Ilha Multiculturalidade e Diversidade Cultural** que visa trabalhar os domínios de identidade, autoestima, cooperação, solidariedade, respeito pela diferença, ciências naturais e humanas, conhecimento do ambiente natural e social e ainda o dinamismo das inter-relações naturais e sociais, através das seguintes atividades principais: i) Raízes do Conhecimento (alargar o conhecimento do e sobre o Mundo, materializado numa ‘árvore contadora de histórias’). ii) Atividade ‘Label me’ (construção de um protótipo do Homem Vitruviano onde os participantes (e futuros visitantes do CCVB), através da fixação de marcadores sociais diferenciativos, têm a oportunidade de discutir o significado dos mesmos, no sentido da perceção e reconhecimento da sua identidade social e diversidade assim como articular e analisar atitudes e valores que lhes permitam tornar-se cidadãos mais solidários e com espírito crítico).
- 3. Ilha da Pedagogia e Educação na exploração de novos desafios** que pretende melhorar e incentivar o desenvolvimento de uma atitude empreendedora e geradora de

ideias, através da realização de um conjunto de atividades experimentais, dinâmicas e de reflexão, baseada no método científico. As primeiras sessões incidem sobre o conhecimento dos formandos, tanto individualmente como em conjunto com o grupo de participantes das sessões para, posteriormente, procederem à escolha da sua equipa, e, com eles, planear e desenvolver o seu micronegócio. As sessões subsequentes visam estimular a criatividade, a inovação e o espírito empreendedor dos participantes, fornecendo-lhes os conteúdos e as competências necessárias para delinear, projetar e implementar efetivamente o seu micronegócio.

2. Metodologia

No contexto da ilha “Pedagogia e educação na exploração de novos desafios” realizaram-se, entre fevereiro e junho de 2017, sete sessões práticas com a duração de cerca de três horas cada. Nestas sessões participaram uma média de 15 estudantes do Instituto Politécnico de Bragança (a participação em algumas sessões ultrapassou os 20 estudantes, enquanto que noutras não eram mais do que 12 formandos), maioritariamente do género masculino, oriundos maioritariamente de Angola, mas também de Cabo-Verde, Moçambique e São Tomé e Príncipe. Refira-se que 25 estudantes correspondia ao número indicativo máximo de estudantes permitido nas sessões. Um outro ciclo de componentes formativas semelhantes está já prevista para o ano de 2018.

As primeiras duas sessões tiveram como foco a promoção do conhecimento dos diferentes elementos do grupo entre si, bem como o seu auto-conhecimento. Partindo-se da realização de diferentes dinâmicas de grupo promoveu-se a reflexão e a partilha em torno dos aspetos socioculturais dos países de origem dos participantes e do país de acolhimento (Portugal), para depois se procurar perceber quais as suas necessidades neste país e de que forma estas podem ser colmatadas.

Já o segundo conjunto de atividades incidiu de forma mais específica na aquisição de competências ao nível do empreendedorismo e organizou-se em cinco sessões. Assim, a terceira sessão incidiu na descoberta do perfil e das características do empreendedor, na compreensão do papel dos empreendedores na sociedade e na caracterização dos tipos de empreendedorismo que se identificam na bibliografia da área: Empreendedorismo do negócio, Empreendedorismo corporativo, Empreendedorismo social, Empreendedorismo feminino, Empreendedorismo ambiental. Na sessão seguinte, trabalhou-se a criatividade e inovação no processo empreendedor e introduziu-se o processo de geração de ideias (“Estratégia de Criatividade Disney” ou “Processo Criativo *Walt Disney*”) e algumas das técnicas de geração de ideias, bem como as formas de representação e comunicação das mesmas, tais como mapas mentais e mapas de conceitos. Deram-se a conhecer paralelamente ferramentas informáticas para representação de ideias e apoio à geração de negócios. Na quinta sessão especificou-se o processo de geração de um micronegócio e respetivas fases (Sonhador, Designer, Minucioso) para a sua realização de modo a organizar, planificar e

delinear a atividade: “Empreendedor por um dia”. Esta sessão culminou com a apresentação e discussão do Modelo Canvas do micronegócio proposto por cada grupo de formandos. Esse modelo permitiu a implementação do micronegócio no centro da cidade de Bragança na sessão seguinte. Concluído o período desta experiência comercial procedeu-se a uma reflexão sucinta sobre a aprendizagem da iniciativa “Empreendedor por um dia”. A última sessão teve como principais objetivos: refletir e avaliar a aprendizagem adquirida na atividade comercial da sessão anterior, identificado boas práticas de integração através da criação de projetos ou negócios na cidade de Bragança. Para além da autoavaliação do perfil de empreendedor, esta sessão incluiu também o diagnóstico das ferramentas de aprendizagem adquiridas por cada participante nas sessões anteriores com vista a discutir a possibilidade de adaptação e/ou aplicação deste tipo de modelos de negócio nos países de origem dos participantes.

Em termos metodológicos, este trabalho recorre à metodologia de projeto, utilizando técnicas quantitativas e qualitativas de recolha e análise de dados. Embora preliminares, os resultados obtidos, para além de permitirem fazer o ponto de situação do conjunto de atividades pertencentes à ilha da “Pedagogia e Educação na exploração de novos desafios”, desenvolvido em 2017, permitem também tirar algumas ilações sobre a prossecução das metas e objetivos previstos, para além de permitirem estabelecer estratégias para implementação de melhorias na concretização das ações futuras, inclusivamente na sua extensão a outros grupos-alvo.

3. Desenvolvimento do projeto

O primeiro conjunto de sessões e respetivas atividades incidiu sobre o desenvolvimento de competências analíticas, críticas e comunicacionais, nomeadamente acerca do conhecimento dos formandos de si mesmos e dos seus colegas, com os quais posteriormente criaram a sua equipa e respetivo micronegócio. Para que se tenha a possibilidade de tomar decisões, executar, errar, resolver problemas e implementar um micronegócio, devem ser criadas condições favoráveis, nomeadamente no que respeita ao conhecimento das nossas competências individuais. Assume particular importância também o conhecimento do espaço em que se inserem e das respetivas características.

Uma das atividades propostas consistiu na reflexão sobre si próprio e, mais especificamente, sobre as suas preferências pessoais, nomeadamente no que diz respeito a atividades de lazer, e também sobre as suas qualidades, defeitos, sonhos, medos, entre outros aspetos. Destacase, no contexto dos sonhos referidos, a vontade de ser bem-sucedido e no âmbito dos medos, o medo da perda de alguém, que emergem assim como características particulares muito positivas no contexto do que aqui se pretendia trabalhar – o empreendedorismo.

Uma outra atividade que importa destacar consistiu em identificar aspetos de que mais gostam e de que menos gostam no seu país de origem, bem como aquilo de que sentem mais falta.

Estas atividades, por um lado, funcionaram como ‘ice breaking’ e permitiram que os participantes se conhecessem melhor e pudessem discutir diversos temas em grupo e, por outro, permitiram a formação dos grupos de trabalho iniciais.

A atividade subsequente permitiu que os participantes conhecessem melhor a cidade que os acolhe (Bragança). Assim, num primeiro momento, apresentaram-se, com recurso a imagens, os principais espaços desta cidade, nomeadamente ao nível desportivo, cultural e religioso e, de seguida, cada participante comprometeu-se a visitar um espaço que ainda não conhecesse e a apresentá-lo aos colegas e formadores, na sessão seguinte, salientando uma característica ou um aspeto particular de destaque e um atributo a ser melhorado.

O segundo conjunto de atividades propôs trabalhar diversas competências/conhecimentos no âmbito da criatividade, da inovação e do empreendedorismo de modo a estimular o espírito empreendedor dos participantes.

Na sequência das atividades anteriores, propôs-se (auto)descobrir o perfil e as características empreendedoras de cada participante para melhor compreender o papel dos empreendedores na sociedade, em geral, e na cidade de Bragança, em particular. De seguida, sugeriu-se desmistificar o termo empreendedorismo, com vista a apresentar a sua tipologia: Empreendedorismo do negócio (Empreendedor *start-up* que cria negócios), Empreendedorismo corporativo (nem todos podem ser criadores de negócios, mas podem ser intra-empreendedores ou empreendedores no negócio de outrem), Empreendedorismo social (aquele que cria negócios que maximizam retornos sociais em vez de maximizar o lucro), Empreendedorismo feminino (enfatizando que os negócios não são só para homens) e Empreendedorismo Ambiental (aqueles empreendedores que apesar de maximizarem o lucro, evitam que o mesmo prejudique o meio ambiente). Posteriormente, propôs-se dar a conhecer as principais técnicas de geração de ideias (Brainstorming e SCAMPER) e as respetivas ferramentas para a sua representação (mapas mentais e mapas de conceitos), com vista a compreender e utilizar um dos processos de geração de ideias - Processo Criativo *Walt Disney*, ou simplesmente, modelo dos três Disney (Fig. 1).



Figura 1. Processo Criativo Walt Disney (adaptado de Mano (2013) e Marins (2014))

Para tal, foram apresentadas ferramentas informáticas para apoio à geração de negócios, tais como: Mind42 (<https://mind42.com>) para mapas mentais ou Cmap tools (<http://cmap.ihmc.us>) para mapas de conceitos, apresentação da proposta de valor enquadrado com mapa de empatia e *Business Model Fiddle* (<https://bmfiddle.com>) para perspetivar o modelo de negócio, ilustrando a apresentação com vários modelos (Fig. 2).

Exemplo de BMC Delta (The original Business Model Generation canvas by Alex Osterwalder)

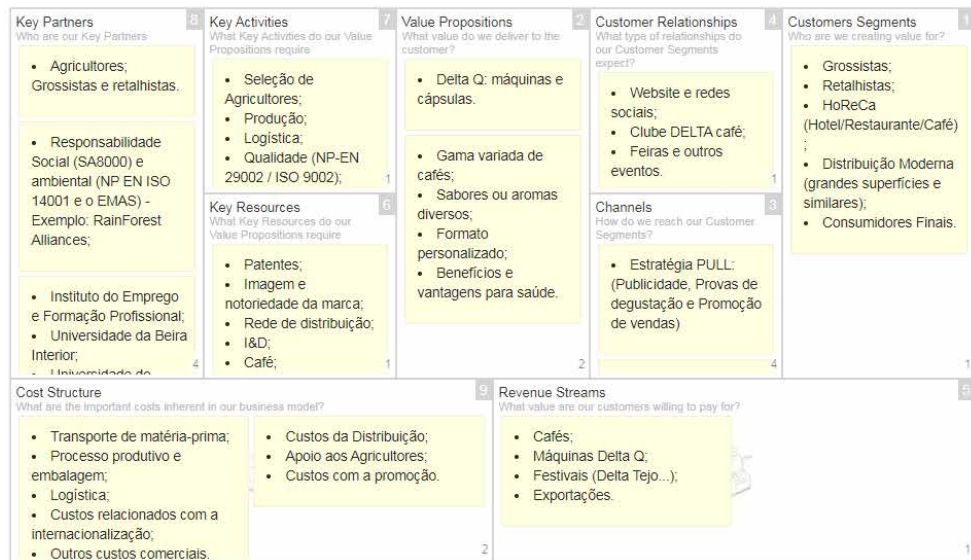


Figura 2. Exemplo Business Model Fiddle da DELTA (elaboração própria: <https://bmfiddle.com/f/#/tpdr4>)

Estes instrumentos permitiram a cada um dos grupos planear o modelo do micronegócio que pretendiam avaliar através do *Business Model Canvas* (Osterwalder & Pigneur, 2010) e que, posteriormente, desenvolveram e apresentaram à sociedade brigantina durante um dia, na atividade “Empreendedor por um dia: Micronegócio na Praça da Sé”. Para facilitar a compreensão dos vários conceitos, conteúdos e modelos utilizados foi disponibilizada uma lista de referências bibliográficas e webgráficas, com destaque para o Manual para Jovens Empreendedores – Comportamentos e Competências dos 13 aos 18 anos (Leitão, Nabeiro & Gomes, 2014). As sessões de dinamização de atividade comercial que se seguiram decorreram no espaço onde já são realizadas as atividades “Banca na Praça do Município de Bragança” (Bragança Município, 2017).



Figura 3. Registo fotográfico de várias sessões

Posteriormente, cada grupo procedeu à avaliação da experiência procedendo ao preenchimento de dois modelos de inquéritos: o primeiro pretendia registar a sua opinião individual sobre a atividade comercial levada a cabo e o segundo pretendia registar a contabilidade da atividade aferindo o lucro e outros aspetos considerados relevantes. Acresce o facto de a observação da experiência ter sido registada através de uma grelha composta por parâmetros sobre a preparação, execução e controlo da experiência.

Genericamente, constatamos que esta prática superou as expectativas tanto em termos de aprendizagem, como em termos financeiros.

4. Principais Resultados da atividade “Empreendedor por um dia: Micronegócio na Praça da Sé”

A atividade de dinamização comercial realizada teve como propósito principal a avaliação dos micronegócios gerados pelos diferentes grupos de participantes das sessões explanadas na secção 3 e 4, que incidiram essencialmente na comercialização de produtos típicos das regiões de proveniência destes.

Com vista a avaliar a experiência, resumimos os dados decorrentes da análise de três instrumentos principais: inquérito individual sobre a atividade comercial, resumo da contabilidade da atividade aferindo o lucro e observação por parte dos investigadores.

No que diz respeito ao inquérito individual preenchido após a atividade comercial e que se baseou no modelo usado pelo gabinete de empreendedorismo do IPB, destacamos que, numa escala de 1 (um: mau) a 5 (cinco: excelente), os 12 formandos avaliaram muito positivamente esta experiência.

Quanto ao “Comprometimento e determinação”, todos os participantes avaliaram os diversos parâmetros desta categoria com 5 ou 4, corroborando a observação dos investigadores no que respeita à proatividade, tenacidade, dedicação e imersão total nas atividades desenvolvidas. Os parâmetros de “Obsessão pelas oportunidades” tiveram uma avaliação mais heterogénea pelos participantes. Apenas quatro participantes consideraram ter conhecimento do mercado e dos clientes, estarem preocupados com o mercado e estarem focados na criação de valor, avaliando esses parâmetros com 5. Os restantes consideraram o seu envolvimento com 4 e 3, equitativamente.

Quanto aos parâmetros referentes à “Tolerância ao risco e incerteza”, a maioria auto-avaliou-se com 5 e 4. Apenas 2 reconheceram que não calcularam devidamente o risco, medindo este parâmetro com 3 e 2. Este facto pode ser justificado pelo facto de terem sido aqueles que se assumiram como analistas e que estudaram o modelo de negócio mais minuciosamente, de acordo com a sua escolha no âmbito modelo dos três *Disney*.

Os parâmetros de “Criatividade e auto-confiança” também foram avaliados maioritariamente com 5 e 4. Apenas dois elementos assumiram sentir medo de falhar, avaliando este parâmetro com 3. A justificação parece-nos apontar para o motivo apresentado no parâmetro anterior. No âmbito dos parâmetros de “Motivação e Superação”, os participantes demonstraram estar orientados para metas e resultados, apesar de três deles admitirem que nem sempre tiveram consciência do nível de sucesso mínimo a atingir. Este facto pode ser justificado com o facto de serem os mesmos que se assumiram como os sonhadores da equipa.

Finalmente, quanto à “Liderança”, todos avaliaram com 4 a sua intervenção, exceto dois que se avaliaram com 5. Estes valores decorrem do facto de cada grupo ter um líder devidamente aceite e reconhecido, mas também pelo facto de todos eles terem trabalhado as suas competências de gestão e liderança e se sentirem confortáveis para liderar o grupo quando o gestor e líder não estavam presentes.

Desta avaliação, destacam-se ainda os comentários enumerados pelos participantes e as suas reflexões, de onde sobressaíram as seguintes palavras-chave: *projeto agregador, interação na criação de um micronegócio, boa experiência, trabalho em equipa, ganhei muita experiência*, entre outras.

No que diz respeito ao resumo da contabilidade da atividade, após o registo do custo unitário de cada produto, preço do produto, margem de lucro, a tabela 1 resume os cálculos finais.

Tabela. 1 – Resumo da Contabilidade da atividade “Empreendedor por um dia: Micronegócio na Praça da Sé”, por grupo.

Grupos	Custo total	Receita total	Lucro
I – 5 elementos	74,28€	105,71€	31,43€
II – 7 elementos	37,46€	95,75€	58,29€

Não podemos deixar de referir que, apesar dos micronegócios que emergiram serem de comércio de produtos típicos, os grupos tentaram inovar a apresentação e entrega dos mesmos aos clientes através de técnicas de apoio à criatividade e ao marketing.

5. Conclusões finais e trabalho futuro

Em termos globais, este projeto procurou criar um ambiente de ação propício ao desenvolvimento de competências de aprendizagem empreendedoras e de inclusão social com o apoio de ferramentas educativas e de contacto com contextos reais.

Pode-se assim afirmar que os objetivos foram amplamente alcançados e que esta experiência, face aos questionários e reflexões críticas apresentadas pelos formandos, poderá impulsionar significativamente a integração empreendedora destes participantes, reforçando a sua atitude e permitindo que acreditem nas suas competências rumo ao sucesso, quer na comunidade brigantina portuguesa ou até mesmo na africana.

Os formandos reforçaram também que o recurso às tecnologias de informação e comunicação, nomeadamente o grupo criado na rede social *Facebook* para fomentar a discussão, a *drive Google* para partilha de apresentações e outros documentos, tecnologias para construção de mapas mentais e o *Business Model Fiddle* foram indispensáveis para discutir e projetar o modelo de negócio.

Acresce o facto de que esta ilha foi de extrema importância para o objetivo primeiro deste projeto - a integração intercultural. Estamos convictos de que os formandos adquiriram as competências essenciais no que diz respeito à educação para o empreendedorismo e que as ferramentas de aprendizagem adquiridas por cada participante poderão, a médio/longo prazo, ser alavancadas nos seus países de origem. Esperamos manter contacto com estes formandos através das ferramentas informáticas utilizadas neste projeto com vista a aferir se os seus sonhos se tornam de facto uma realidade.

Em suma, estamos conscientes de que os grupos de formandos podem ser bastante heterogéneos, mas não podemos deixar de salientar que a avaliação deste primeiro ciclo formativo nos deixou com uma enorme motivação para iniciar o do próximo ano.

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Valores humanos emergentes em obras de literatura clássica de potencial receção infantil

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Resumo

O presente estudo insere-se num projeto de investigação conjunto que envolve docentes de duas instituições de ensino superior, uma Portuguesa e outra Brasileira, a decorrer entre fevereiro e junho de 2017. Neste contexto, pretende-se, primeiramente, perceber que valores humanos emergem de um conjunto de obras de literatura clássica de potencial receção infantil previamente selecionadas. Assim, fez-se uma escolha apurada de um conjunto de obras de literatura para a infância de cariz clássico, mais especificamente, dos contos de Hans Christian Andersen, a saber: “As flores da Idinha”; “O abeto” e “O rouxinol”. No contexto de uma metodologia qualitativa, procedeu-se a uma análise minuciosa destas obras ao nível literário, estilístico, bem como ao nível dos valores humanos emergentes nos mesmos. Os contos foram posteriormente trabalhados através de duas estratégias narrativas - a representação e a leitura oral - por parte dos alunos do 2.º ano da Licenciatura em Educação Básica, com um público constituído por crianças dos 3.º e 4.º anos de escolaridade de um agrupamento de escolas do norte de Portugal. Após este trabalho, decorreu a exploração de cada conto através do estabelecimento de um diálogo alargado moderado pelos alunos da referida licenciatura e uma das investigadoras. Neste diálogo realizou-se o registo áudio, devidamente autorizado, das respostas dos alunos às questões levantadas, que foram previamente delineadas com o objetivo de auscultar as perceções dos alunos acerca dos contos, nomeadamente, no que concerne aos valores subjacentes. Trazem-se agora à discussão os resultados preliminares deste estudo.

Palavras-chave: literatura para a infância, contos, valores.

Introdução

Nas últimas décadas, a sociedade tem passado por inúmeras transformações ao nível económico, social, cultural e educativo. Vivemos num mundo que tantas vezes carece de mais respeito pelo outro, de diálogo, de afeto, de valores, tão imprescindíveis ao salutar convívio entre as pessoas. Ouvimos falar, de forma recorrente, numa profunda crise de valores.

Acresce que cada vez mais surgem preocupações relacionadas com o facto de atualmente, as crianças, tantas vezes, não interagirem entre si, pelo menos presencialmente, limitando-se ao uso de tecnologias de informação e comunicação e à interação virtual através de redes sociais. A família tem passado inúmeras reestruturações e a escola, enquanto instituição, sofre, inevitavelmente, com esta realidade. O trabalho mantém os pais cada vez mais ocupados e pouco tempo resta para estes se dedicarem aos seus filhos, acabando muitos deles por transferir para a escola a responsabilidade de os educar ou, pelo menos a esperança de que esta o faça.

Desta forma, a escola vê-se obrigada a abraçar o desafio de ensinar crianças e jovens, e de os formar dando-lhes, além de bases de conhecimento propriamente dito, bases de convívio em sociedade, chegando a transmitir noções básicas de respeito e convivência que já deveriam ter sido aprendidas em casa, com a família. Entretanto, deparamo-nos com outro problema: a escassez de projetos na maioria das escolas portuguesas do 1.º Ciclo do Ensino Básico (CEB) que procurem trabalhar questões como os valores, a ética em sala de aula. A falta de trabalho a estes níveis repercute-se mais cedo ou mais tarde em toda a sociedade.

Parece-nos evidente a necessidade de a escola, a par da família, se assumir como contexto promotor da construção de valores humanos. E para abraçar e concretizar este desafio consideramos que a literatura de potencial receção infantil pode ser um dos veículos privilegiados.

Assim, no contexto deste estudo, alicerçamos o nosso trabalho na escolha de um *corpus textual* clássico, mais especificamente de contos de Hans Christian Andersen (1805-1875).

Escolhemos Andersen porque a sua escrita de potencial receção infantil reflete o Romantismo do séc. XIX, em que se insere, revelando uma capacidade de observação penetrante e uma fantasia tão desprendida e tão extensiva, que se pode dizer que se apoderou dele. Os seus contos revelam um estilo vivo e inconventional cuja inspiração advém dos contos populares dinamarqueses - “Danske Folkeeventyr” - daí o seu estilo simples, comunicativo e sem ornamentação excessiva. Neles se mesclam dois universos: o poético ou fantástico e o realista, típico dinamarquês. A linguagem é despojada, embora não seja infantilizada, e responde ao seu modo de compreensão. O recurso expressivo base da sua construção textual é a animização: os animais, as plantas, as coisas inanimadas têm uma individualidade viva. O conhecido e o desconhecido são compreendidos do mesmo modo.

Para percebermos que valores emergem nos contos de Andersen importa, antes de mais,

destacar que valores são representações cognitivas dos objetivos ou motivações importantes para as pessoas, distinguindo-se, primeiramente, pelo objetivo motivacional que expressam (Schwartz, Sagiv & Boehnke, 2000). De acordo com Granjo e Peixoto (2013) é profunda a influência que eles exercem nas nossas vidas não só ao nível individual como também social, sendo inclusivamente elemento primordial na explicação do comportamento humano.

Schwartz et al. (2012) apresentam uma classificação dos valores humanos formada por 19 valores acompanhados da respetiva definição conceptual, elaborada tendo por base a motivação subjacente: auto-direção-pensamento (liberdade para cultivar as próprias ideias e habilidades); auto-direção-ação (liberdade para determinar as próprias ações); estimulação (excitação, novidade e mudança); hedonismo (prazer e gratificação para si próprio); realização (sucesso de acordo com os padrões sociais); poder-dominância (poder através do exercício de controlo sobre as pessoas); poder-recursos (poder através do controlo de recursos materiais e sociais); rosto (segurança e poder através da manutenção da imagem pública e evitando humilhação); segurança-pessoal (segurança no ambiente imediato); segurança-sociedade (segurança e estabilidade na sociedade em geral); tradição (manutenção e preservação das tradições culturais, familiares ou religiosas); conformidade-regras (cumprimento de regras, leis e obrigações formais); conformidade-interpessoal (restrição de ações que possam perturbar ou prejudicar outras pessoas); humildade (reconhecimento da sua insignificância no esquema maior das coisas); benevolência-dependência (ser um membro confiável e digno de confiança no grupo); benevolência-cuidado (devoção ao bem-estar dos membros do grupo); universalismo-preocupação (compromisso com a igualdade, justiça e proteção para todas as pessoas); universalismo-natureza (preservação do ambiente natural); universalismo-tolerância (aceitação e compreensão daqueles que são diferentes de si mesmo).

1. Metodologia

No contexto de uma metodologia qualitativa realizámos um estudo de carácter exploratório com os seguintes objetivos: 1) Perceber que valores humanos emergem em obras de literatura clássica de potencial receção infantil; 2) Compreender de que forma as crianças no 1.º Ciclo do Ensino Básico (1.º CEB) percebem estes valores; 3) Refletir sobre o papel do professor do 1º CEB, em contexto de sala de aula, na construção de valores.

Para a concretização destes objetivos selecionámos especificamente três contos de Anderson: “As Flores da Idinha”, “O Abeto” e “O Rouxinol”. Assim, começámos por fazer uma análise minuciosa dos três contos selecionados, ao nível literário e estilístico, assim como relativamente aos valores humanos neles emergentes.

A concretização prática no contexto do segundo objetivo foi realizada pelos alunos do 2.º ano da Licenciatura em Educação Básica da Escola Superior de Educação do Instituto Politécnico de Bragança, nos meses de maio e de junho de 2017, numa escola do 1º CEB da cidade de Bragança - nordeste de Portugal - tendo como público-alvo crianças dos 3.º e 4.º anos de

escolaridade (9-10 anos). Esta componente prática foi realizada ao abrigo de um protocolo previamente estabelecido com o Agrupamento de Escolas ao qual pertence a escola onde a mesma foi realizada, com autorização dos encarregados de educação das crianças envolvidas e sob a supervisão da docente da unidade curricular de Literatura Infantojuvenil e da professora titular da turma do 1.º Ciclo.

Foram formados três grupos de estudantes (mediadores de leitura) da referida licenciatura, cabendo a cada grupo apresentar e explorar um conto a uma turma em particular, partindo de uma determinada estratégia narrativa, tal como nos sugere Cerrillo (2011):

En la *promoción de la lectura*, como en la *animación a la lectura*, sobre todo cuando los destinatários de las mismas son niños o adolescentes, es muy importante la figura del *mediador* (...) El mediador es el puente o enlace entre los libros y esos primeros lectores que propicia y facilita el diálogo entre ambos (Cerrillo, 2011, p. 277)

Independentemente da estratégia narrativa selecionada, todas as atividades se dividiram em três momentos: pré-leitura, leitura e pós-leitura. Na fase da pré-leitura, o objetivo visado foi, em larga medida, o de materializar um determinado horizonte de expectativas, estimular a leitura, suscitar a motivação e promover respostas pessoais. Relembramos Giasson (1993) que, ao apresentar as componentes relativas às estruturas do leitor, remete para os conhecimentos sobre o mundo, bem como os conhecimentos sobre a língua. Esta fase da pré-leitura envolveu processos de antecipação que permitiram fazer previsões, construir imagens mentais e concomitantemente raciocinar na ligação com os conhecimentos do presente e do passado. Em simultâneo, podemos afirmar que todos os processos foram exercitados no decorrer deste tipo de atividade, pois ao desenvolver-se o vocabulário, igualmente se perspectivam, quer os processos de integração, quer os de elaboração, os metacognitivos e até os microprocessos (Irwin, 1986).

Durante a fase da leitura, e atendendo a que o objetivo apontado era, em larga medida, o de estimular respostas pessoais, os contos foram trabalhados com base em várias estratégias narrativas: manipulação de fantoches, sombras chinesas, construção de álbum narrativo gigante e leitura oral expressiva. Todas estas atividades possibilitaram às crianças, com o apoio dos mediadores da leitura, um mais amplo e pormenorizado conhecimento do texto lido.

Na fase da pós-leitura, as atividades realizadas, visando estimular respostas pessoais e conduzir as crianças à inferência de valores presentes nos contos, foram as seguintes: brainstorming, diálogo orientado, seleção de citações estimulantes ou poderosas - “Powerful Passages”, (na expressão de Yopp & Yopp, 2001, p. 106), jogos de palavras - “Book Charts” (Yopp & Yopp, 2001, p.108) ou ilustração de passagens textuais mais significativas. Estas atividades ajudaram as crianças a resumir, com o recurso a elementos-chave, o essencial das narrativas, fosse por meio de citações estimulantes ou poderosas (frases ou parágrafos

entendidos como significativos pelo aluno e que merecem ser lembradas ou partilhadas com os restantes colegas), fosse por meio da ilustração do texto ouvido/visto ou de parte dele - “Sketch to Stretch” (Yopp & Yopp, op. cit.:109).

2. Resultados

2.1. Da análise literária e estilística dos contos à reflexão sobre os valores emergentes

Falar dos contos “O Abeto”, “O Rouxinol” e “As Flores da Idinha” é, sem dúvida, abordar um conjunto de questões – ideias, afetos, ansiedades – que lhes são transversais por termos, efetivamente, um conjunto de textos que espelham a mesma época literária, na qual a abundância de elementos efabulados, pertencentes ao mundo fantástico (fadas, gigantes, anões, bruxas, elfos, duendes, dragões, castelos encantados, poções, tesouros, fontes da juventude, países quiméricos e inebriantes), preenchia o imaginário de qualquer criança, depois de um dia de trabalho junto do pai ou da mãe. Sem dúvida, uma forma de alimentar o espírito daqueles que faziam da tradição oral um modo de formação/aprendizagem.

Assim sendo, o conto “O Abeto” apresenta-se sob a forma de metáfora – a vida de um abeto, naturalmente insatisfeito com o seu percurso, ora enquanto habitante da floresta, ora enquanto árvore de natal. O Abeto, por acreditar que os dias vindouros poderiam ser sempre melhores e trazer experiências mais enriquecedoras, descurou os momentos vividos no presente e assumiu uma posição de ansiedade perante um futuro distante e sem qualquer garantia de que pudesse ser melhor, futuro este, ilusoriamente imaginado, repleto de beleza, de ostentação, de brilho e de *glamour*, que afinal se revelaram muito efémeros.

O conto apresenta, pois, uma lição de vida (“Passado! Passado! Se me tivesse alegrado quando podia!”¹) sob a qual a própria personagem, o Abeto, reflete – devemos viver um dia de cada vez, como se fosse o derradeiro e sem manifestarmos qualquer ilusão em relação ao que nos poderá reservar o futuro.

Importa, neste contexto, salientar também a forma como o autor coloca em evidência a importância de se ouvirem os mais velhos, mais especificamente quando os raios de sol aconselham o abeto a alegrar-se com o seu fresco crescer e com a sua vida de jovem árvore. Se, em “O Abeto”, a personagem principal é uma árvore, em “O Rouxinol” não deixamos de ter um elemento ligado à natureza no papel mais relevante – uma ave - assim como espaços manifestamente ligados à natureza – o bosque, o jardim (também elementos transversais ao conto “As Flores da Idinha”). E tal como o abeto, também as flores e o rouxinol “murcham” fora do seu habitat natural. Aliás, o rouxinol perde a vontade de cantar atado às doze fitas que lhe controlavam os movimentos nos passeios fora da gaiola; o abeto fica seco no sótão,

¹ Andersen, H.C.(2004). *Contos de Hans Christian Andersen*. Lisboa: Público, p. 122.

após a festa de natal e as flores cortadas não recuperaram, apesar dos tratamentos feitos pela criança.

Se, por um lado, a natureza se deseja livre para sobreviver (em qualquer um destes contos), poderá, por outro lado, conduzir as personagens ao arrependimento ou à reflexão – ideia que se aplicará à doença do imperador e ao abeto. Embora o imperador tenha recuperado devido ao canto da ave e ao seu perdão, o abeto não logrou alcançar o mesmo patamar de bem estar por já estar cortado. Isto significa que nos contos de Andresen, por nós selecionados, a natureza assume um caráter panteísta, sendo dotada de pensamentos, afetos, emoções, capaz de sofrer e, ao mesmo tempo de remeter o ser humano para a reflexão.

Desta forma, parece evidente que dos três contos emerge de forma clara, principalmente, um valor humano, o universalismo-natureza no sentido, definido por Schwartz et al. (2012), da preservação da natureza. Ficam claros em “O Abeto” a dor e o sofrimento da mãe natureza, neste caso, personificada no abeto, quando é sacrificado em nome de efémeros momentos de prazer e ilusórios momentos de alegria.

Por fim, vieram os criados e cortaram a árvore em pequenos pedaços. Ficou ali em monte. Ardia lindamente sob a grande vasilha para fazer cerveja que lhe tinham posto em cima, e suspirava profundamente. (...) Pensava na noite de Natal... Os rapazes brincavam no pátio e o mais pequeno tinha no peito a estrela dourada que a árvore exibira na sua noite mais feliz. Agora esta já era passado... (Andersen, 2004, pp. 122-123)

São, assim, postas a nu algumas conseqüências devastadoras do abate de árvores, nomeadamente, na época natalícia, com o único propósito de servirem de ornamento natalício, acabando posteriormente por arder numa fogueira.

Em “O Rouxinol” este valor torna-se ainda mais evidente quando a beleza e o poder na mãe natureza, personificada no rouxinol, se sobrepõem ao fausto, ao luxo, ao artificialismo, e ao poder que, afinal, nem tudo consegue, nem tudo permite, nem tudo nos dá. Por mais poder que o imperador tivesse, foi a riqueza da natureza, neste caso o rouxinol, que o salvou. E note-se que, no meio do seu poder e do seu luxo, o imperador nunca se tinha apercebido de tal beleza, de tal riqueza que era este rouxinol, que cantava todas as noites ali tão perto. E neste conto a natureza surge também como forma de transmissão de uma mensagem de esperança:

Era o rouxinolzinho vivo que pousara num ramo lá fora. Tinha sabido da agonia do seu imperador e viera para lhe cantar consolação e esperança. E à medida que cantava esvaneciam mais e mais as figuras, o sangue corria mais e mais rápido nos fracos membros do imperador... (Andersen, 2004, p. 284).

Em “As Flores da Idinha” o mesmo valor é-nos transmitido, um pouco à semelhança de “O Abeto”, por via das conseqüências irreversíveis do mal que se faz à mãe natureza. Uma vez

cortadas, por maior boa vontade que tenhamos, por mais que litemos, a sua beleza fica para sempre irremediavelmente perdida e muitos dos seus benefícios ficarão para sempre negados. Sendo bem tratada, a natureza alegra-se e alegra-nos com a sua beleza. Importa acrescentar que neste conto, não obstante a irreversibilidade da morte, fica a ideia de esperança (à semelhança do que acontece em “O Rouxinol”) e de renovação, bem como a ideia de que a partir de uma vida, outra vida pode surgir. Em “As Flores da Idinha”, as flores morrem, mas as suas sementes irão, em breve, gerar uma nova vida.

Para além da presença constante da natureza nos três contos, verifica-se o recurso aos diálogos entre as personagens humanas, bem como entre as personagens e elementos da natureza personificados, bem como a presença de crianças, concretamente em “O Abeto” e em “As Flores da Idinha”. Neste último, a criança aceita e dá continuidade à fantasia, cuidando das flores como se fossem de carne e osso.

Transversal a este conjunto de contos é também o facto de as personagens não possuírem qualquer designação e serem personagens planas, criadas com o objetivo de proporcionar um ensinamento, através de uma situação, muitas vezes, igualmente por si desencadeada. Consideramos que é também pertinente, neste ponto, referirmo-nos ao registo marcadamente oral que cada um dos contos revela. Expressões como “Olha, sabes os que têm?²”, “Nós sabemos! Nós sabemos!³” ou ainda “Música, música!⁴”, são apenas alguns dos muitos exemplos que nos remetem para o carácter oral e dialógico dos contos – aspeto este que, sem dúvida, nos envolve na tradição oral do séc. XIX, em que o conto assumia uma base educativa e cívica junto das crianças.

Em questões de tempo e espaço, os contos aqui em análise, vão ao encontro dos padrões habituais, ou seja, uma indefinição como se as expressões - “Já lá vão muitos anos⁵”; “Dentro do bosque erguia-se um bonito abeto⁶” – que não apontam para um tempo cronológico preciso ou um espaço geográfico definido - fossem suficientes para reter a atenção do ouvinte e o situar porque, na verdade, importante é a mensagem que veiculam.

² Andersen, H.C.(2004). *Contos de Hans Christian Andersen*. Lisboa: Público, p. 225.

³ Andersen, H.C.(2004). *Contos de Hans Christian Andersen*. Lisboa: Público, p. 115.

⁴ Andersen, H.C.(2004). *Contos de Hans Christian Andersen*. Lisboa: Público, p. 284.

⁵ Andersen, H.C.(2004). *Contos de Hans Christian Andersen*. Lisboa: Público, p. 275

⁶ Andersen, H.C.(2004). *Contos de Hans Christian Andersen*. Lisboa: Público, p. 113

2.2. Breves considerações sobre a componente prática: a voz das crianças

No contexto da componente prática de exploração dos contos, e sendo esta componente apenas de carácter exploratório, trazem-se à discussão os aspetos que nos parecem mais pertinentes. As nossas considerações baseiam-se nas gravações áudio que foram feitas no final de cada uma das sessões do projeto implementado na Escola Básica de 1.º Ciclo.

Assim, em relação ao conto “O Rouxinol”, efetivamente, nenhuma criança percecionou na sua plenitude, e de forma direta, o valor que assinalámos anteriormente - universalismo-natureza. No entanto, conduzidos pelos mediadores, é unânime o reconhecimento e a valorização do rouxinol verdadeiro escolhido por todas as crianças como a personagem que gostariam de interpretar se tivessem oportunidade. Esta escolha é justificada por uma criança pelo facto de se tratar de um ser vivo, justificação esta que é aceite pelas restantes crianças. É ainda salientado o facto de o rouxinol verdadeiro voltar para junto do imperador e o salvar da morte.

No conto “As Flores da Idinha”, as crianças aproximaram-se bastante da percepção do valor por nós identificado anteriormente - universalismo-natureza. Através do diálogo orientado pelos mediadores de leitura, todas as crianças reconheceram a importância da conservação do ambiente natural e a relevância de preservar as espécies, nomeadamente, as flores, no seu ambiente, pois cortá-las provoca a sua “morte” precoce. Salientamos também a faceta mágica do conto - apresentando o baile das flores como a justificação para o facto de elas murcharem, o que agradou às crianças, indo ao encontro da sua imaginação e criatividade.

Por último, no conto “O Abeto”, todas as crianças, sempre com a orientação dos mediadores de leitura, chegaram a uma das conclusões pretendidas: o abeto era um ser “mal-agradecido” que nunca estava satisfeito com nada e a sua ânsia de desejar sempre o futuro não o deixava desfrutar e viver com prazer o presente, tendo desperdiçado toda a sua vida. À imagem do que aconteceu com o primeiro conto, nenhuma criança percecionou na sua totalidade o valor que identificámos - universalismo-natureza.

3. Considerações finais

Após a exposição anteriormente enunciada, acreditamos que se torna pertinente assinalar que os três contos lidos e analisados são, manifestamente, atemporais no que respeita à transmissão de valores e nas questões ambientais em geral - fauna e flora - na descrição das quais predomina o animismo ou personificação. Percebe-se, pois, que, possivelmente, o grande objetivo do narrador terá sido conseguir uma aproximação entre as experiências relatadas pelas personagens/narrador e o público destinatário, de forma a criar um ambiente que remetesse para a reflexão, numa época em que a palavra oral desempenhava um papel crucial na formação humana e cívica da Criança.

Dos dados obtidos através das gravações, é perceptível o carácter atemporal das mensagens veiculadas pelos contos, bem como a riqueza axiológica e a reflexão a que estes contos

convidam, apesar de escritos/compilados no séc. XIX, daí ter-mo-los escolhido para partilhar com as crianças do séc. XXI.

Em termos do público destinatário do projeto - crianças dos 3.º e 4.º anos - verificámos que elas não perceberam na sua globalidade o valor universalismo-natureza. Contudo, importa referir que esta situação era expectável, pois, nesta fase etária, a Criança necessita ser conduzida no seu processo de reflexão. Residiu precisamente aqui o ponto de partida para definirmos o nosso terceiro objetivo.

Desta forma consideramos que, neste contexto, e a partir daqui, o professor tem um importante papel de orientação na construção de valores, nomeadamente a partir daqueles que emergem em obras de literatura de potencial receção infantil. Para tal, o professor não necessitará de os identificar tal e qual constam na classificação que apresentamos, mas levará cada criança a perceber os valores emergentes nos mesmos e colocando questões que levem à reflexão. Por sua vez, também podem orientar o diálogo, no sentido da colocação de questões e da compreensão do(s) valor(es) propriamente dito(s), no conto em questão, e à sua extrapolação para outras situações do quotidiano infantil. A articulação entre este processo de construção, com a aprendizagem de conteúdos relacionados com outras áreas do conhecimento (neste caso, para os contos que aqui trabalhamos, destacaríamos as Ciências da Natureza) parece-nos não só possível como desejável.

Os mediadores de leitura, no contexto deste estudo foram, como referido, os alunos do 2.º ano de uma Licenciatura em Educação Básica (curso que dá acesso aos mestrados de profissionalização para a docência em Educação Pré-Escolar e Educação Pré-escolar e 1.º Ciclo do Ensino Básico). São, portanto, ainda, estudantes em formação. Desta forma, também eles foram conduzidos, antes da implementação das atividades com as crianças, a um processo de reflexão acerca da forma como poderiam explorar os contos e contribuir para que cada criança percebesse os valores emergentes nos mesmos.

Assim, para além de termos trazido à discussão a questão dos valores emergentes em obras de literatura de potencial receção infantil, e de termos, ainda numa fase exploratória, ouvido aquela que é a forma como as crianças os percebem, consideramos ter contribuído também para a formação destes futuros docentes, no sentido em que os levámos a perceber de que forma pode o professor assumir um papel primordial na construção de valores por parte das crianças.

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A incidência dos jogos pedagógicos no desenvolvimento de atividades comunicativas em Inglês entre crianças do 1º Ciclo do Ensino Básico

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Resumo

O estudo de caso que agora se apresenta teve como finalidade determinar a utilização dos jogos pedagógicos no ensino das atividades comunicativas (produção e interação orais) numa escola do 1º ciclo do ensino básico pública portuguesa com alunos de seis e nove anos de idade. A investigação integrou uma tese de doutoramento apresentada em 2017. O estudo de caso foi preparado com dois grupos a frequentar o 1º ano e dois grupos a frequentar o 4º ano de escolaridade (ou seja, dois grupos de controlo e dois grupos experimentais), cujas aulas foram planificadas tendo em conta conteúdos da disciplina de Estudo do Meio e da Atividade de Inglês. A disciplina de Estudo do Meio, ao longo do estudo, serviu, especialmente, para estabelecer conteúdos e para perceber que percentagens de produção e de interação orais poderiam esses conteúdos obter quando apresentados e trabalhados em Inglês, língua estrangeira (LE). Para estabelecer esta “articulação”, entre Estudo do Meio e a LE, utilizaram-se algumas ferramentas proporcionadas pelo enfoque Cross-curricular (CC) e pela metodologia Task-Based Language Learning and Teaching (TBLL/T), assim como um questionário dirigido a professores, um estudo de caso com todas as aulas gravadas (que incluem jogos pedagógicos e materiais “convencionais”) e um protocolo de observação. Concluiu-se, entre outros aspetos, que nem todos os jogos são igualmente úteis no desenvolvimento da produção e da interação orais e verificaram-se valores percentuais de produção e de interação diferentes, de acordo com os grupos: controlo/experimental, quer entre os alunos do 1º ano, quer entre os alunos do 4º ano.

Palavras-chave: atividades comunicativas, jogos, crianças.

Introdução

No presente trabalho refletimos, sobre a importância, cada vez mais crescente, do ensino das línguas estrangeiras nos primeiros anos de escolaridade da criança.

Centrámo-nos, principalmente, na questão das sonoridades e na importância das línguas como veículo e motor para nos conhecermos e conhecermos o outro. Escolhemos, portanto, o campo científico do Ensino das Línguas Estrangeiras (Inglês) e abordámos a possibilidade de desenvolver atividades comunicativas para potenciar a produção e interação orais nesta língua, - através de jogos pedagógicos traçados para o 1.º Ciclo do Ensino Básico Público Português (1.º CEBPP) no 1.º e 4.º anos de escolaridade -, enquanto Atividade de Enriquecimento Curricular (AEC) no centro escolar de uma cidade do interior transmontano português.

As razões que revestem a base deste estudo prendem-se com a necessidade de se perceber a influência dos jogos pedagógicos no desenvolvimento da produção oral e interação oral com alunos dos 6 e dos 9 anos de idade -, num contexto de ensino em que a Língua Estrangeira (LE) não dispõe de um carácter de disciplina obrigatória (com exceção do 3º ano de escolaridade desde o ano letivo 2015/2016¹) e num contexto de ensino em que os jogos não são encarados como materiais coadjuvantes em nenhuma das etapas do ensino e da aprendizagem, mas como materiais que têm como função proporcionar momentos lúdicos, de descontração e diversão.

Assim sendo, e através da investigação que levámos a cabo, tentámos perceber que características devem ter os jogos pedagógicos para poderem ser considerados eficazes no desenvolvimento da produção e da interação orais e, por outro lado, quais os jogos que menos favorecem a expansão dessas capacidades. Os jogos pedagógicos por nós elaborados seriam úteis para promover a socialização, a motivação e a participação dos alunos nas atividades, contudo, de acordo com os resultados, os alunos apenas jogavam por puro prazer e competição. Através do inquérito dirigido a um grupo de professores do 1.ºCEB, concluímos que os docentes também acreditam que a preparação dos jogos exige muito tempo; não existem recursos para suportar essa preparação e os programas de ensino e aprendizagem são muito extensos. Isto levou-nos a aferir que os alunos do 1.º CEBPP não estariam habituados a utilizar os jogos pedagógicos com propósitos didáticos.

Entre outros aspetos, procurámos também entender quais os materiais “convencionais” que melhor contribuem para o desenvolvimento da produção oral e da interação oral e em que circunstâncias se verificou uma maior percentagem de concretização de objetivos face às aulas com jogos pedagógicos.

¹ Deve dizer-se que no momento do estudo, a língua estrangeira também não possuía, para o 4º ano de escolaridade, estatuto de disciplina e, portanto, não surgia intergrada no currículo dos alunos. Esse estatuto aconteceu apenas no presente ano letivo (2016/2017).

Assentámos o nosso trabalho na metodologia *Task-Based Language Learning and Teaching* (TBLL/T) porque considerámos a língua como um veículo para um propósito, uma ferramenta que incita à ação. A forma como traçámos e explorámos os jogos pedagógicos sugeridos aos alunos com os quais trabalhámos, aproximou-se do conceito de “task” e, das ideias defendidas pela metodologia TBLL/T. Ora, de acordo com essa metodologia, a noção de “task” advoga princípios como, a) “an emphasis on learning to communicate through interaction in the target language”; b) “an enhancement of the learner’s own personal experiences as important contributing elements to classroom learning”; c) “the linking of classroom language learning with language use outside the classroom”, (Nunan, 2004: 1) - princípios, esses, que adotámos ao longo do estudo de caso.

Pensámos, pois, num conceito utilitário da língua e em situações de aprendizagem autênticas que refletissem os pressupostos de TBLL/T e englobassem as chamadas “tasks” como veículos de produção de significado. Para este estudo foram também consideradas outras teorias de aprendizagem, nomeadamente, o *Communicative Language Teaching Approach* e algumas ideias provenientes da metodologia *Content and Language Integrated Learning*, assim como o “input hypothesis” de Krashen, uma vez que considerámos importante estabelecer situações comunicativas contextualizadas na sala de aula que proporcionam uma prática pedagógica natural.

1. Metodologia

No conjunto de questões problema que estabelecemos, pretendíamos encontrar resposta para: a) a possibilidade de os jogos pedagógicos contribuírem ou não para o desenvolvimento das competências comunicativas; b) o seu contributo para o desenvolvimento da interação oral e/ou da produção oral; c) o favorecimento dos jogos pedagógicos para o desenvolvimento da interação oral entre aluno/professor ou entre os alunos; d) a eficácia dos materiais “convencionais” em comparação com os jogos no desenvolvimento das atividades comunicativas orais e interacionais; e) a relevância dos jogos no âmbito da metodologia *Task-Based Language Learning / Teaching*; f) as características que os jogos pedagógicos devem possuir para serem mais eficazes no desenvolvimento da produção oral e da interação oral.

Um dos métodos adotados para recolher dados foi o estudo de caso. Este procedimento teve início em janeiro de 2014 e terminou em maio do mesmo ano. Estiveram envolvidos 57 alunos, 23 dos quais com idades compreendidas entre os 5-6 anos (1.º ano de escolaridade – grupo A (grupo de controlo) e grupo C (grupo experimental)) e 34 com idades compreendidas entre os 9-10 anos (4.º ano de escolaridade – grupo D (grupo de controlo) e grupo C (grupo experimental)).

Para ambos os grupos (controlo e experimental do 1.º e 4.º anos de escolaridade) foram ministradas aulas com os mesmos objetivos, conteúdos, competências e *skills*, contudo, os materiais deferiam. Se para os grupos de controlo foram preparados materiais “convencionais” – com um cariz principalmente escrito, sem uma dimensão comunicacional

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e centrados no professor – para os grupos experimentais foram preparados jogos e as respetivas regras. No início de cada unidade didática, no entanto, os conteúdos eram introduzidos para ambos os grupos, por exemplo, através de gravuras e diálogos e estes materiais demonstraram ser úteis para motivar os alunos para um novo contexto e também para lhes transmitir as estruturas de que precisariam numa situação de jogo nas aulas seguintes da unidade didática.

Com os alunos dos grupos do 1.º ano foram trabalhadas duas unidades didáticas – com um total de três aulas em cada unidade e uma aula de avaliação no final de cada unidade. Com os grupos do 4.º ano foram trabalhadas quatro unidades. A primeira e segunda unidades incluíram duas aulas cada uma e as respetivas aulas de avaliação e as unidades três e quatro incluíram três aulas cada uma, bem como uma aula de avaliação no final de cada unidade. Na preparação de todas as unidades foram tidas em consideração o *Programa Anual de Estudo do Meio* (1999), assim como as *Orientações Programáticas para a Língua Estrangeira* (2006) no que ao nível elementar respeita.

Os planos das aulas preparados permitiram uma interseção entre a disciplina de Estudo do Meio e a Língua Estrangeira. Esses planos revelaram-se ainda úteis para registar as competências e as Atividades Comunicativas que pretendíamos introduzir e desenvolver ao longo das aulas. Os conteúdos da disciplina de Estudo do Meio utilizados foram aqueles que, no nosso ponto de vista, mantinham semelhanças com os conteúdos da Língua Estrangeira, ou seja, os conteúdos que poderiam ser agrupados e trabalhados em conjunto.

A metodologia incluiu também um questionário a 42 professores do 1.º Ciclo do Ensino Básico o qual teve como principais objetivos perceber até que ponto os jogos pedagógicos eram úteis no processo de ensino e aprendizagem, nomeadamente, no ensino das disciplinas do currículo. Com o questionário pretendíamos averiguar a opinião geral dos professores em relação aos jogos: se eram muito utilizados ou apenas pontualmente em alguns momentos de ensino e aprendizagem; as razões que levavam os professores a utilizá-los ou a optar pela sua não utilização; se os jogos tinham alguma influência nas atitudes e comportamento dos alunos e de que forma eram encarados pelos alunos.

Preparámos um protocolo de observação organizado de acordo com os planos das aulas e que nos permitiu melhor observar a performance individual de cada aluno durante as aulas com jogos e com materiais “convencionais”; se os alunos conseguiam fazer uso da LE ou interagir na LE; se apenas o faziam utilizando a sua Língua Materna e a percentagem de objetivos atingida no final de cada aula (ou seja, a percentagem de objetivos estabelecida para cada aula e atingida por cada aluno individualmente e também pelo grupo como um todo).

1.1. Organização dos dados

A Tabela 1, que se apresenta a seguir, inclui três questões retiradas do protocolo de observação. A questão 8.1 reflete a percentagem de produção oral que cada aluno atingiu; a questão 9.1 reflete a percentagem de interação oral e a questão 9.4 reflete a percentagem de Língua Materna utilizada. Para as questões 8.1 e 9.1 estabelecemos 4 intervalos diferentes de acordo com o número de vezes que o aluno usou a LE numa pontuação de 3 a 0. Três pontos foram atribuídos aos alunos que conseguiram utilizar a LE um maior número de vezes. Contudo, para a questão 9.4 estabelecemos 5 intervalos, numa pontuação de 4 a 0. A pontuação mais elevada foi atribuída aos alunos que nunca utilizaram a Língua Materna. Os resultados reunidos permitiram tirar conclusões em relação: a) à interação oral entre todos os participantes; b) à produção oral; c) à Língua Materna utilizada e a sua influência nos resultados; d) aos materiais utilizados; e) o tipo de atividades que melhor beneficiaram a interação oral entre aluno/professor e entre os alunos e d) às características que os jogos devem reunir de forma a contribuir para o desenvolvimento da produção oral e da interação oral.

Tabela 1. Intervalos estudados e respetiva pontuação

Questions	Answer Options	Points
8.1 According to number of times the S was expected to use English in the lesson, (and according to number of SS present in the lesson), what percentage do all the previous results represent?	a) If the S uses FL one to five times b) If the S uses FL six to ten times c) If the S uses more than ten times d) No FL use	a) 1 point b) 2 points c) 3 points d) 0 points
9.1 What percentage, (according to number of times the S was expected to use English in the lesson, number of times the S used English for SI and number of SS present in the lesson), do all the previous results represent?	a) If the S speaks one to five times b) If the S speaks six to ten times c) If the S speaks more than ten times d) No FL use	a) 1 point b) 2 points c) 3 points d) 0 points
9.4 What percentage, (number of SS present in the lesson), do all the previous results represent in terms of Portuguese language use?	a) If the S never reverts to Portuguese b) If the S reverts to Portuguese one to five times c) If the S reverts to Portuguese six to ten times d) If the S reverts to Portuguese more than ten times e) If the S always reverts to Portuguese	a) 4 points b) 3 points c) 2 points d) 1 point e) 0 points

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2. Discussão dos resultados

Os grupos dos 1.º e 4.º anos mostraram diferentes níveis de produção oral devido à sua idade e conhecimentos ao nível da LE, como se poderá ler nas Figuras 1 e 2. Em termos de interação oral, as figuras mostram-nos que os alunos do 1.º ano se tornaram mais dependentes dos conhecimentos adquiridos nas aulas de LE para poderem participar por iniciativa própria e tornaram-se mais dependentes da orientação do professor.

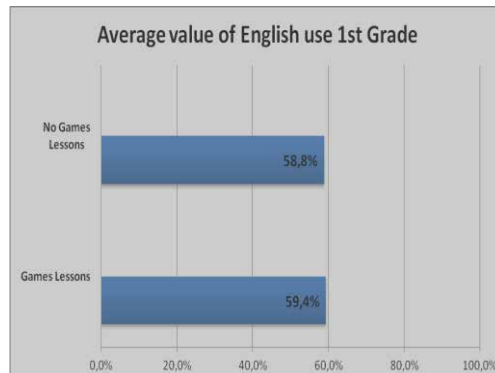


Figura 1. Utilização média da LE nos grupos do 1.º ano

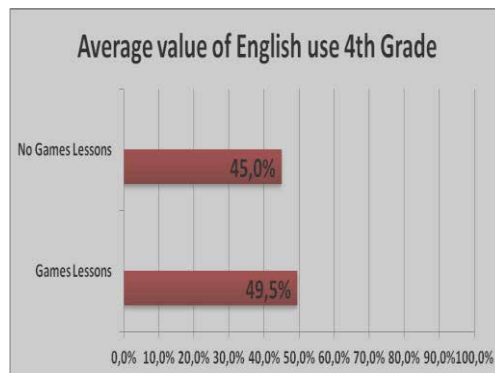


Figura 2. Utilização média da LE nos grupos do 4.º ano

Em termos de produção oral para os alunos do 1.º ano, a diferença, entre aulas com jogos e materiais “convencionais”, é de apenas 0,6%. Para os alunos do 4.º ano, essa diferença é de 4,5%. Em termos de interação oral, entre alunos e entre aluno/professor, as Figuras 3 e 4 mostram-nos que os resultados são mais elevados nas aulas com materiais “convencionais”. Para os alunos do 4.º ano verifica-se um aumento de 10% em termos de interação oral entre os alunos nas aulas com jogos devido à sua performance em LE. A percentagem de interação oral entre aluno/professor desce 3% nas aulas com jogos. Para ambos os grupos (1.º e 4.º

anos) a percentagem de produção oral é mais elevada nas aulas com jogos, contudo, a percentagem de interação oral é variável.

Por outro lado, verifica-se que a interação oral obteve valores mais elevados entre os alunos, ou seja, nos grupos do 1.º ano as aulas com materiais “convencionais” apresentaram resultados mais elevados em termos de interação oral entre aluno/professor (3%) e nos grupos do 4.º ano verificou-se um aumento em termos de interação oral nas aulas com jogos entre os alunos e um aumento de 3% entre aluno/professor nas aulas com jogos.

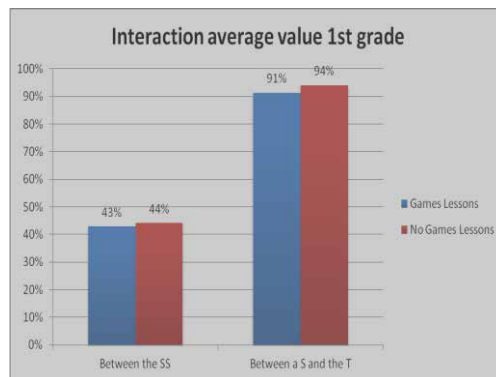


Figura 3. Valor médio de interação nos grupos do 1.º ano

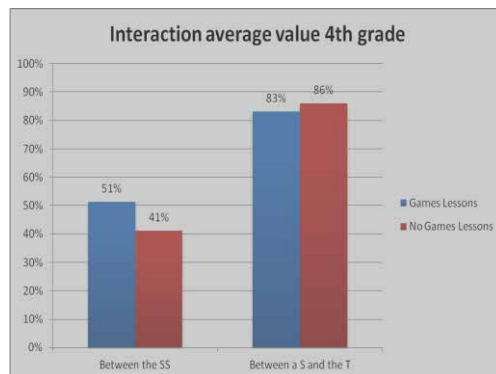


Figura 4. Valor médio de interação nos grupos do 4.º ano

Os resultados mostram, ainda, um balanço entre aulas com jogos e materiais “convencionais” porque num conjunto de 22 aulas, 13 aulas com jogos obtiveram resultados mais elevados do que aulas com materiais “convencionais” e 9 aulas com materiais “convencionais” obtiveram resultados mais elevados do que aulas com jogos. Embora os materiais “convencionais” aliassem audição, leitura e escrita, atenção e concentração, não podem ser destacados em relação aos jogos e às atividades comunicativas.

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Além disso, numa perspetiva TBLL/T, os jogos poderão despertar no aluno a noção de aprendizagem através de descoberta e permitir-lhe trazer para aula as experiências comunicativas da sua vida real, assim como outras que possam revelar-se úteis para a sua aprendizagem. Segundo esta metodologia, o significado é mais relevante do que a forma e as destrezas aprendidas para lá da sala de aula (cantar, dançar, dramatizar, etc.) poderão ser importantes na hora de jogar, uma vez que, quando a improvisação é requerida, os alunos poderão deitar mão dessas destrezas e completar uma tarefa sem perderem a noção de jogo. E num contexto de ensino da LE, os jogos poderão surgir como uma ferramenta fundamental para adquirir competências comunicativas. Esta é a razão pela qual optámos pela metodologia TBLL/T – para termos a oportunidade de juntarmos o melhor dos jogos e o melhor das “tasks” se perder de vista a noção de divertimento dos alunos, excitação e entretenimento e conduzi-los à ideia de que poderiam colocar em prática as estruturas e destrezas adquiridas fora do contexto da LE e conseguirem concluir o jogo.

Nesta análise deve ainda dizer-se que estes jogos eram completamente desconhecidos para os alunos e/ou inspirados em jogos mundialmente conhecidos como o Monopólio. Após todo os resultados analisados, percebemos que os jogos que obtiveram percentagens mais elevadas foram aqueles que conjugaram: a) a utilização de diferentes destrezas adquiridas fora do contexto da sala de aula; b) atenção, concentração, disciplina e uma correta compreensão das regras orais e simulação de situações reais; c) audição e memorização visual; d) o jogo e os seus desafios no seio de uma equipa com criatividade.

3. Conclusões

Os jogos poderão revelar-se ferramentas muito úteis no desenvolvimento das atividades comunicativas orais em Inglês, Língua Estrangeira, num contexto de ensino elementar se preparados e organizados pelo professor de acordo com a metodologia TBLL/T, mas sem o controlo ou a supervisão do professor, ou seja, os jogos deverão proporcionar aos alunos liberdade para aplicarem diferentes destrezas e estes deverão sentir que se estão a divertir e a cumprir um objetivo ao mesmo tempo.

Além disso, destacamos que os jogos preparados se aproximaram muito do conceito de “task” cujos principais objetivos se prendem com a promoção do uso da LE através da Produção e da Interação orais. Assim, de acordo com esta ideia, há um ênfase claro na comunicação e na filosofia “learn by doing”. Isto significa, por outro lado, que os alunos se sentem motivados para utilizar a língua em situações reais e deitam mão de diferentes destrezas, previamente adquiridas para lá do contexto da LE, para concretizar a “task”.

Os jogos por nós preparados não obtiveram resultados explícitos a seu favor devido ao contexto Português, no qual as crianças não estão acostumadas a utilizar os jogos em propósitos didáticos específicos. Devemos, ainda, ter em conta que, utilizar jogos, num enquadramento comunicativo, é diferente de ensinar vocabulário ou gramática e que, os jogos preparados à luz da metodologia TBLL/T poderão despertar nos alunos a noção de

aprendizagem através da descoberta e permitir-lhes trazer para aula de LE competências comunicativas adquiridas na sua vida real, assim como outras - úteis para a sua aprendizagem.

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A (re)construção do perfil profissional do administrador contemporâneo

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Abstract

The present study intends to test the application of renewed learning practices through the use of interdisciplinary methods that can contemplate behavioral, emotional and specific aspects (intrapersonal and interpersonal intelligences) in the process of professional development among undergraduate students in Administration (n=478) from the University of the Acaraú Valley (Brazil). Based on the assumption that the introduction of renewed learning practices enables the introduction/reinforcement of knowledge, skills, abilities and attitudes that, in line with the expectations of the organizations and the aspirations of society, can translate into a more humanized contemporary management, a research paradigm has been defined that assumes two paths that integrate mixed methods in the collection and analysis of data: (1) a quantitative nature in order to assess the impact of the use of active learning practices; (2) a qualitative nature in order to understand the opinions of the course format, its development, use and learning. As such, the data were collected through the application of the Multiple Intelligences Inventory for Adults (MIIA), an instrument created by Armstrong and adapted from the Howard Gardner Multiple Intelligence Test. Regarding the treatment and analysis of the collected data, statistical procedures of a descriptive and inferential nature were favored through the statistical software SPSS. The results obtained reinforce the need to (re) think systematization and didactic procedures that are able to dynamize the learning in the context of the classroom and the development of the different dimensions / competences necessary and fundamental to the construction of the identity / profile of the professional of the administration / contemporary management.

Keywords: *Multiple Intelligences, interdisciplinary methods, administration.*

Resumo

O estudo que se apresenta pretende testar a aplicação de práticas renovadas de aprendizagem através da utilização de métodos interdisciplinares que possam contemplar aspectos comportamentais, emocionais e específicos (inteligências intrapessoal e interpessoal) no processo de desenvolvimento profissional junto de alunos do curso de graduação em Administração (n=478) da Universidade do Vale de Acaraú do estado Ceará-Brasil. Partindo do pressuposto que a inserção de práticas renovadas de aprendizagem possibilitam a introdução/reforço de conhecimentos, competências, habilidades e atitudes que, em sintonia com as expectativas das organizações e anseios da sociedade, se podem traduzir num desempenho e pensamento mais humanizado do profissional de gestão contemporâneo, foi definido um paradigma de investigação que assume dois percursos que integram métodos mistos na recolha e análise dos dados: (1) de natureza quantitativa com o objectivo de aferir o impacto da utilização de práticas de aprendizagem activas; (2) de natureza qualitativa de forma a perceber as opiniões do formato do curso, o seu desenvolvimento, aproveitamento e aprendizagem. Como tal, os dados foram recolhidos por meio da aplicação do Inventário de Inteligências Múltiplas para Adultos (IMM), instrumento criado por Thomas Armstrong e adaptado do Teste de Inteligências Múltiplas de Howard Gardner. No que concerne ao tratamento e análise dos dados recolhidos foram privilegiados procedimentos estatísticos de natureza descritiva e inferencial através da utilização do software estatístico SPSS (Statistical Package for the Social Sciences). Os resultados obtidos reforçam a necessidade de se (re)pensar a sistematização e procedimentos didácticos que sejam capazes de dinamizar a aprendizagem em contexto de sala de aula e o desenvolvimento das diferentes dimensões/competências necessárias e fundamentais à construção da identidade/perfil do profissional da administração/gestão contemporâneo.

Palabras-chave: *Inteligências Múltiplas, métodos interdisciplinares, administração.*

Introdução

Como as *universidades*, que são centros de excelência, estão *preparando os jovens* para lidar com os *aspectos comportamentais, emocionais e específicos* que a sua *profissão de Administrador* e um *seletivo mercado de trabalho* exigem?

A proposta desse estudo é testar a aplicação de práticas renovadas de aprendizagem através da utilização de métodos interdisciplinares que possam contemplar aspectos comportamentais, emocionais e específicos no processo de desenvolvimento profissional de alunos do curso de graduação em Administração da Universidade Estadual Vale do Acaraú

(UVA), localizada no estado do Ceará, Brasil. O curso de Administração é um curso de Bacharelado com 23 anos de existência, regulamentado e reconhecido através do Sistema Nacional de Educação, tendo já formado quase mil alunos e assumindo uma significativa importância para a região visto sua missão de formação e gestão para a região/local e para o empreendedorismo. Atualmente, sua integralização curricular está disposta em unidades curriculares da seguinte forma: de formação profissional 59%, de formação básica e instrumental 25%, de estudos quantitativos e suas tecnologias 8% e de formação complementar 8%, distribuídos em nove semestres. Dessas unidades, embora seja um curso interdisciplinar, as abordagens didáticas mais ativas ainda não estão muito presentes.

De metodologia que utiliza métodos mistos de análise de dados, essa investigação, apresenta-se descritiva e quase experimental. Os resultados apontaram a necessidade de se repensar/dinamizar a aprendizagem em sala de aula e as formas de atingir e desenvolver as competências, habilidades e atitudes necessárias ao administrador/gestor contemporâneo.

1. Enquadramento

A educação superior busca mudar o foco na formação do profissional, assim como as novas diretrizes buscam possibilitar um momento diferente de formação, numa tentativa de estabelecer significados entre a área em que se quer ser profissional, com suas competências teóricas e como lidar com as situações advindas da vivência no exercício da profissão escolhida, com suas complexidades, especificidades, similaridades e singularidades, o que passa a envolver outras competências além dos conteúdos teóricos, será preciso desenvolver habilidades de saber fazer, de aplicação de valores, ética e ainda saber lidar com as emoções advindas de todo comportamento humano (Moretto, 2001). O compromisso com uma formação acadêmica de qualidade, ética e cidadã deve fazer o estudante desenvolver-se (competência formal) sendo conhecedor da existência dos vários saberes na sociedade proporcionados pela pesquisa e pela extensão e, principalmente que ele será um alavancador de resultados visíveis através da criação e gestão de organizações que, conseqüentemente gerarão empregos e melhores condições de vida à população. Um curso de “administração deve ter dinamicidade e ser ajustado ao ambiente, pois o administrador, além de trabalhar com as mudanças ambientais e de identificar novas tendências, deve atuar como agente de transformação” (Rosário, 2010, p. 4).

A formação dos administradores, deve ser, em primeiro lugar, a preparação de indivíduos com capacidade de reflexão e análise, combinando, na universidade, o saber, o pensar e a busca da verdade com visões práticas da realidade, em especial das organizações (Angeloni & Zanella, 2006), depois a formação de profissionais de administração com conteúdo teórico e multidisciplinar, capacidade para utilizar as informações para tomada de decisão, habilidades nas aplicações de técnicas gerenciais (Lima et al., 1985, *apud* Angeloni & Zanella, 2006). Cabe também a universidade, no exercício de sua competência, construir e desenvolver meios que ajustem suas unidades a um novo momento social, devendo seus

cursos envolver unidades que contemplem características intelectuais indispensáveis a uma nova ordem. Em suma “a universidade vive assim, um constante desafio, ser fruto da sociedade e ao mesmo tempo transformá-la” (Readings, 1983, p. 3). Daí propormos novas formas de aprendizagem em sintonia com os contextos de conhecimentos, competências, habilidades e atitudes nas expectativas de realização, felicidade, compromisso, atendimento de expectativas das organizações e os anseios da sociedade, por forma a contar com indivíduos mais sensíveis considerando uma sociedade mais humana, mais compartilhada e mais justa.

No curso de Administração, incorporam-se comunicação interpessoal, ética profissional, estudos sobre mudanças, filosofia, psicologia, estatística, sociologia, entre outras. O desenvolvimento de competências, desde a década de 90, passa a ser um modelo de articulação entre conhecimento e inteligência pessoal, ganhando espaço nas instituições educacionais por exigência da última modificação da Lei das Diretrizes e Bases da Educação Nacional e se torna o norteador dos processos de ensino e aprendizagem. A lei focaliza a dimensão da competência quando diz que “não se limita ao conhecer, vai mais além, porque envolve o agir numa determinada situação” (Andrade & Amboni, 2004, p. 115). Sendo as competências são, desse modo, as capacidades ou os saberes em uso, que envolvem conhecimentos, habilidades e valores/atitudes. E nesse seguimento, o mercado de trabalho no primeiro mundo já existe uma tendência que privilegia outros aspectos além das capacidades instrumentais, técnicas e mecanicistas, que aos poucos se dissemina mundo afora. A incidência e expansão das organizações sociais e de serviços favoreceram esse impacto passando a se exigir dos gestores, energia para o trabalho, hábitos saudáveis, maturidade emocional, empatia e principalmente, saber lidar com as pessoas. A definição do perfil do formando deve ser baseado no desenvolvimento de competências (conhecimentos, habilidades e valores/atitudes) e essas devem ser traduzidas e explicitamente conceituadas. Cada conteúdo curricular de cada curso deve ensinar determinadas competências, assim como mobilizar, integrar e articular saberes múltiplos (Fleury & Fleury, 2004; Takahashi & Fischer, 2009).

As atribuições da profissão de Administrador passa pela identificação e manifestação de competências, ou seja, da compreensão do conceito de competência, em duas instâncias de análise: do indivíduo e da organização. Para os administradores atuais, o principal conhecimento para o exercício de suas atividades é administrar pessoas e equipes, considerando essa a maior função da administração estratégica, que lhe é fornecido, ou deveria ter sido pelo conhecimento teórico aprendido na formação técnica e teórica, ou seja, na universidade. Às competências, agrega-se-lhe a competitividade, destacando-se a identificação de problemas, a formulação e implantação de soluções, a capacidade de enfrentar desafios, a solução de conflitos, o processo decisório, as funções de planejar, organizar, dirigir e controlar, e ainda elaborar e interpretar cenários (Demo, 1991). No que concerne às habilidades (Modelo da Árvore das Competências), o administrador tem que

saber relacionar-se (relacionamento interpessoal), fazer a leitura da visão do todo, liderar, adaptar-se e promover adaptação de outros a transformações conjunturais, contextuais, organizacionais, dentre outras, ser criativo, inovador e hábil no uso de técnicas e tecnologias. O que vem do ato são as atitudes, e envolvem valores, ética, atitudes, compromisso, aprendizado contínuo como vontade de sempre aprender mais, responsabilidade consigo e com o outro e com a sociedade como um todo.

Os aspectos comportamentais de um indivíduo e que podem se trabalhados no processo de aprendizagem são o enfoque desta pesquisa. Questões como inteligência, motivação, auto imagem, auto estima, quociente emocional, dentre outras se manifestarão na prática da investigação e deverá ser registrada. Inteligência e aprendizagem estão intrinsecamente ligadas, daí a necessidade de se apresentar umas referências clássicas, conforme segue. Neste sentido surge a Teoria Triárquica da Inteligência. Sternberg (2005) refere três inteligências distintas: 1. Com inteligência experiencial ou criativa: capacidade de ir além, planejar, criar, permitindo resolver problemas novos; 2. Com inteligência componencial ou analítica: capacidade para analisar, comparar e avaliar ideias e resolver problemas; 3. Com inteligência contextual ou prática: capacidade de fazer a práxis, transformar e fazer grandes realizações. Goleman (1995) refere que inteligência emocional é a capacidade de identificar os nossos próprios sentimentos e os dos outros, de nos motivarmos e de gerir bem as emoções dentro de nós e nos nossos relacionamentos. As emoções são estados internos de entendimento do mundo (componente cognitiva) que, mediante algum estímulo súbito pode alterar o equilíbrio de todo o organismo (componente fisiológico) gerando uma resposta e comunicando-a com os outros (componente social). O Teste de QE mede a inteligência emocional possui uma escala de cinco níveis (desde *nunca* até *sempre*) e mapeia a inteligência emocional em cinco áreas de habilidades: 1. auto conhecimento emocional: reconhecimento de sentimentos; 2. controle emocional: habilidade de lidar com seus próprios sentimentos; 3. auto motivação: saber conduzir suas emoções objetivadas; 4. reconhecimento de emoções em outras pessoas: empatia com o outro; 5. habilidade em relacionamentos interpessoais: facilidade na vida pessoal e profissional.

Gardner afirma que todos os seres humanos possuem inteligências, pois são elas “que nos tornam humanos, falando em termos cognitivos, rompendo com a ideia de que a inteligência é única e se apresenta igual a todos os indivíduos” (Gardner, 1999a, p. 19), elas são independentes umas das outras e são autônomas, assim, um mesmo indivíduo pode ter um tipo de inteligência muito desenvolvido e outro ou outros tipos de inteligência pouco desenvolvido. A inteligência é “a capacidade que permite um indivíduo de resolver problemas ou elaborar produtos que sejam valorizados em um ou mais ambientes culturais ou comunitários” (Gardner, 1995, p. 14). Existe uma visão pluralista da mente, reconhecendo que as pessoas tem forças cognitivas diferenciadas e estilos cognitivos contrastantes, sugerindo o conceito de uma escola centrada no indivíduo, o que seria uma visão multifacetada da inteligência. As inteligências identificadas por Gardner são: Linguística:

capacidade de compreensão, de processamento de pensamentos e de expressão através da linguagem oral e/ou escrita; Lógico-matemática: capacidade em lidar com lógica e com números matemáticos e com capacidade científico-matemática; Espacial: capacidade de formar um modelo mental de um mundo espacial e ser capaz de manobrar e operar utilizando esse modelo; Musical: capacidade de fazer e perceber notas musicais e leitura de sons, cantar e tocar algum instrumento; Corporal-Cinestésica: capacidade de usar o próprio corpo para expressar uma emoção, jogar um jogo ou criar um novo produto; Intrapessoal: capacidade de (re)conhecer os aspectos internos de si mesmo, formando um modelo que possa conduzi-lo a orientar o seu próprio comportamento e operar efetivamente a sua vida; Interpessoal: capacidade de perceber as diferenças entre as pessoas e compreendê-las, perceber suas intenções e desejos, o que as motiva, como trabalham e possibilitar trabalhos em grupos cooperados; Naturalista: capacidade para reconhecer flora e fauna, fazendo distinções relativas ao mundo natural (reconhecendo e classificando plantas, animais, minerais, incluindo rochas e gramíneas e toda a variedade de fauna, flora, meio-ambiente e seus componentes) e para usar essa habilidade produtivamente na agricultura ou na biologia; Espiritual ou Moral: capacidade que depende imensamente dos valores culturais onde o indivíduo está inserido; são as capacidades que se mobilizam pelos valores de uma cultura e não pelos comportamentos manifestados ou valorizados.

Da mesma forma que há autores que concordam com a flexibilidade da inteligência como um elemento importante no ensino, pois as pessoas podem avaliar suas forças, suas fraquezas e descobrir formas de se reinventarem, seja corrigindo ou remediando, para prosseguirem no que podem fazer melhor e viverem melhor, assim percebemos a aprendizagem, o que mais importa é a sua validade em determinadas situações, explicamos melhor, é o resultado que poderemos obter ao utilizarmos essa ou aquela técnica. Cada curso, de acordo com suas especificidades, define junto com seus atores a adequação do método, a forma de aprendizagem, como melhor aproveitar a experiência dos alunos na busca dos resultados esperados. Para se envolver ativamente no processo de aprendizagem, o aluno deve interagir a todo instante, seja lendo, escrevendo, perguntando, discutindo, resolvendo problemas, desenvolvendo projetos. A aprendizagem continuará sendo uma grande contribuição do homem para a sociedade tendo o próprio indivíduo no centro. Deve portanto perfil do administrador contemporâneo compreender a preocupação com valores morais, humanos, sociais, éticos, dentre outros, mas esses valores, naquele contexto devem ser resgatados e quiçá, alterados e melhorados e se for o caso, pois aquele indivíduo, naquele momento, já tem esses valores institucionalizados por sua história de vida.

2. Metodologia

O universo da pesquisa são os estudantes do curso de Administração da UVA com matrículas ativas no sistema (n=478), dados do segundo semestre de 2015 (matrículas semestrais) pois são realizados dois vestibulares no ano, distribuídos nos turnos diurno e noturno. O recorte

da população foi feito em segmentos ou estratos, sendo cada segmento um semestre, no total de 9 (nove) ou seja 4 anos e meio de curso. Optamos por esta via pois possuímos o conhecimento/experiência sobre o objeto e contexto em estudo e pelo acesso facilitado a população, permitindo recolherem-se dados que possam subsidiar uma futura proposta de implantação e por possibilitar a experiência com o grupo experimental (GE) e a comparação com o grupo de controle (GC) que compõe a investigação. Presumimos que o número de pessoas com desenvoltura comportamental ao final do curso não seria superior a 30%, pois não foram estimulados a isso, consideramos um nível de confiança de 95% (dois desvios-padrão) e toleramos um erro de até 5%, o que nos deu uma amostra total de 198 elementos, partindo de uma população identificada por fonte secundária, considerada finita.

A investigação pode ser classificada como um levantamento, visto que apresenta uma descrição quantitativa de opiniões de uma população e a partir dos resultados da amostra, poderemos generalizar ou fazer afirmações sobre a população (Creswell, 2010). Foram feitas duas coletas: a primeira em forma de levantamento padrão com os dados coletados em um determinado momento (corte transversal) com toda a população através dos seus estratos; e a segunda, com o GE foi feita a coleta para conhecer o impacto de um tratamento ou intervenção com dados coletados ou registrados no decorrer do tempo (corte longitudinal). Os dados primários foram coletados por meio da aplicação do Inventário de Inteligências Múltiplas para Adultos (IMMA), instrumento criado por Armstrong (2001), adaptado do Teste de IM de Gardner, que explora as oito IM. Esse constructo foi composto por 81 questões ordenadas por blocos correspondentes às inteligências pesquisadas, mas sem identificação da pergunta ao bloco na qual pertencia aquela inteligência. Sua aplicação foi *in loco*, em contexto de sala de aula onde ocorrem as aulas de cada semestre (estrato) nos turnos equivalentes, num intervalo de uma semana.

Quanto aos GC e GE, ambos têm a mesma quantidade amostral e são estudantes do primeiro semestre. Estes estudantes foram selecionados de forma aleatória para o GC e por tipicidade ou intencional para o GE (indivíduos diferentes do GC), os quais participaram (*in loco*) no experimento transformado em curso certificado pela UVA, com rigorosa frequência e acompanhamento de relatos. Creswell (2010, p. 189) afirmou que “quando os indivíduos não são designados aleatoriamente, o procedimento é chamando de quase-experimento”. Com carga horária de 40 horas presenciais distribuídas em dez dias seguidos, com registro de frequência e exigência integral de presença no período. Diariamente, eram coletadas opiniões sobre o formato do curso, seu desenvolvimento, aproveitamento, aprendizagem, além de relatos espontâneos individuais, no início e no final dos trabalhos. Foi definido material de acompanhamento, didático, instrumental e roteiro de aprendizagem como planos de aula, lembramos que tratava-se de um curso onde se trabalhou com métodos ativos de aprendizagem. Como se tratava de um registro experimental, havia a definição de procedimentos específicos sistematizados para o resgate necessário das informações e para, havendo a possibilidade, ser replicado por pessoal habilitado. No final do curso, o GE

respondeu o IMMA, o mesmo instrumento já aplicado ao GC, àquele sem a intervenção. Foi trabalhado, inicialmente com estatística descritiva, quando se traçou o perfil da amostra, médias, frequências e distribuição das inteligências por semestre. Depois o teste de normalidade das variáveis dependentes que se trabalhou e suas correlações e significâncias, e por fim, a comparação dos GC e GE, e se analisou a representatividade da intervenção das práticas ativas no processo de aprendizagem no GE.

3. Resultados e Discussões

Na análise dos dados comparamos os resultados das oito inteligências: Literária, Matemática, Espacial, Interpessoal, Motora, Musical, Intrapessoal, de todas as turmas reunidas, depois, de cada turma/semestre, do 1.º ao 9.º e posteriormente os dois grupos de destaque já mencionados, parte do 1.º semestre como GC e outra parte do 1.º semestre como GE. Sobre o perfil do curso, a amostra indica que do total 50,5% são do sexo feminino e 49,5% do sexo masculino, um curso bem dividido em termos de gênero. O curso de administração é composto por sujeitos com idade média entre 19 e 22 anos (54,5%). Estes estudantes são egressos do ensino médio, com concludentes também jovens, o que influencia sensivelmente no grau de maturidade com que entram no mercado de trabalho. Verifica-se uma distribuição equilibrada, semestre a semestre, da quantidade de alunos, exceto no último semestre, visto ser o semestre em que os alunos apresentam o trabalho de conclusão de curso, sendo frequente estes estarem matriculados somente nessa unidade curricular. Sobre a distribuição das médias das IM dos estudantes de Administração, existe uma variação de entre as sete inteligências (ver Gráfico 1).

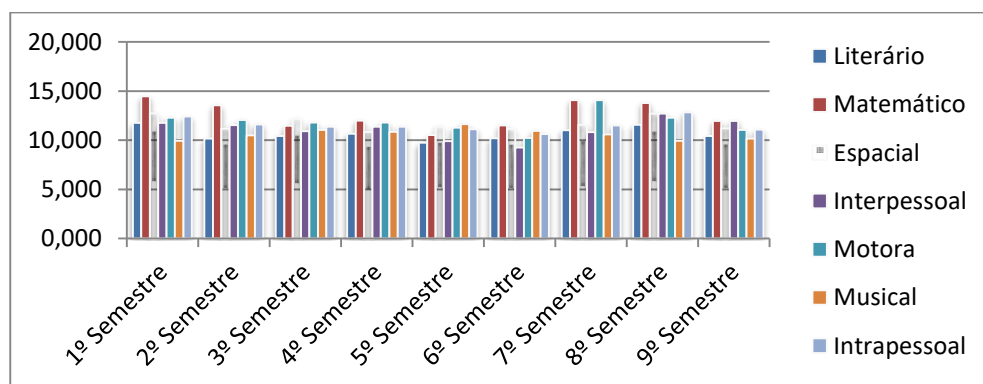


Gráfico 1. Média das inteligências por semestre

Mesmo com um grupo relativamente homogêneo, dentro de cada semestre, o resultado das inteligências oscila muito, e as pontuações do último semestre são bem menores que as do primeiro, exceção feita à inteligência interpessoal (maior). Há um decréscimo de semestre a

semestre a partir do primeiro que merece ser apresentado ao Colegiado do Curso, somente sendo resgatado no quarto ano (sétimo semestre) do curso.

Constatamos que não existe um expressivo desenvolvimento nos alunos quando comparamos o primeiro com o último semestre. Há semelhança entre as médias de desenvolvimento das inteligências, o que não permite inferir que os alunos concludentes sejam menos inteligentes que os ingressantes (ou vice-versa). As variáveis correlacionadas não obedeceram à normalidade, conforme os testes de Kolmogorov-Smirnov e Shapiro-Wilk, previamente aplicados, e assumiram medidas a serem correlacionadas caracterizadas como ordinais (Semestre) e Escalares (Média das Inteligências) o que atenderam aos requisitos do teste. A partir de testes não paramétricos mostrou-se que, no intervalo dos nove semestres, ocorreu uma correlação, ou seja, uma variação conjunta entre as variáveis, mas para essa demonstração, essa correlação foi de tão baixa magnitude (não tendo como identificar em qual semestre e nem como se procederam as variações) que a aplicação deste método ativo de aprendizagem poderia ter o mesmo efeito de uma outra qualquer intervenção. Em suma, para a Inteligência Interpessoal ela foi positiva e para a Intrapessoal ela foi negativa como se observou nas linhas de tendência estudadas. Saber em que semestre essa variação se verifica de forma mais significativa não afeta nem gera impacto no resultado final da investigação. Em relação às inteligências inter e intrapessoal, entre o primeiro e o nono semestre, existe um dado relevante, pois estão melhor no semestre inicial que no semestre final, o que, a priori, nos leva a refletir sobre o papel do curso em relação a esse desempenho, despoletando reflexões sobre novos caminhos para o ensino a serem desenvolvidos (propostos por Gardner). Após essa comparação entre semestres foi feita a comparação do GE com o GC com objetivo de verificar a eficiência da intervenção. No GE, os estudantes foram selecionados por tipicidade ou intencional (30% do quantitativo e qualquer aluno regularmente matriculado naquele semestre poderia participar). Comparando esse grupo com o primeiro semestre verificamos que os índices das inteligências interpessoal e intrapessoal dos alunos não diferiram, bem como as demais inteligências. O mesmo ocorreu quando comparamos o GE com o último semestre do curso (índices das inteligências Interpessoal e Intrapessoal), ambas com p-valor maior que o nível de significância o que confirma que não há diferenças significativas entre os grupos. Recorremos a hipóteses posteriormente verificadas (ou não) por forma a termos informação relevante sobre os tópicos da avaliação em estudo. E, desta feita, podemos verificar que mesmo trabalhando práticas diferenciadas para cada uma das inteligências, destacando-se as interpessoal e intrapessoal, não houve desenvolvimento tão diferenciado (começo e final do curso) que pudesse ser representativo e mensurado no Inventário das IM.

4. Considerações finais

Em geral, o aluno busca na universidade a continuidade da sua formação e, como podemos verificar, por vezes é difícil alterar ou influenciar alguns aspetos, tendências ou formas de assimilar e compreender determinados conhecimentos e matérias. Concluímos que a UVA deve, no seu Projeto Pedagógico de Curso, manter as unidades curriculares que contemplam temáticas de cunho comportamental, as unidades curriculares *Psicologia Aplicada a Administração* (3º semestre) e *Cultura e Mudança Organizacional* (optativa) e se possível incluir distribuindo em outros conteúdos essas temáticas de forma transversal e de forma ativa, lúdica e comportamental. À universidade cabe a formação superior e específica para o mercado de trabalho e o estímulo de outras competências, mas como se justifica tantos problemas psicossociais e um tão elevado índice de infelicidade no trabalho? Urge (re)construir do perfil profissional do administrador contemporâneo. O aluno pode ser estimulado, inclusive em qualquer unidade curricular de forma transversal com as ciências comportamentais possibilitando agregar conhecimentos à sua forma de gerenciar. Quando se estimula já se deve ter uma resposta esperada, o que não ocorreu. As universidades, na busca de melhores respostas dos seus alunos terão que assumir uma formação didática intensa e complementar ao docente, uma mudança em seus processos metodológicos e de avaliação, investimento em tempo, esforço e recursos financeiros, o que, possivelmente e provado estatisticamente, agregaria na formação e desenvolvimento de melhores profissionais e com as inteligências requeridas pelo mercado de trabalho dentro do portfólio das competências mais desenvolvidas. Podemos concluir do estudo que, dentre outras, ou o estímulo poderia ser redimensionado/indicado, ou o tempo de avaliação dos resultados não foi suficiente ou contrariamos a teoria do estímulo/resposta. Teixeira (1981, p. 31) afirmou que “faltam ainda estudos de campo e testes para que cheguemos a conclusões mais definitivas sobre as funções do administrador”, pois a abordagem clássica é incompleta e as abordagens que existem indicam mais sobre o conteúdo da função do administrador que ele em si, seus papéis representam dimensões de realidades, mas, na prática, no dia-a-dia, ele realiza muito mais do que se possa supor.

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Oficinas de Viver – Desenvolvimento do Potencial Criativo um estudo artístico no Ensino Superior

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Abstract

The research of creativity in the educational context has been mostly carried out with teachers and students in elementary/secondary teaching, and there is a lack of research in higher education. This observation, together with the need for a deeper understanding of the most exciting characteristics of the human being, represents the purpose of this empirical work, developed by students of the Vale do Acaraú State University (Sobral, Ceará, Brazil) Of Living - Development of Creative Potential. A qualitative, collaborative, participatory and multidirectional methodological strategy was defined, involving a total number of participants (n = 30) divided into two groups: the first group (G1) is formed by students = 12) of the Institutional Program of Scientific Initiation (PIIC) / UVA; The second group (G2) consists of university students (n = 18), belonging to any course or year. Data collection instruments include participant observation, questionnaire, field diary and group exercise. For the lex-ographic/multivariate analysis and treatment was used IRAMUTEQ (Interface of Multidimensional Analyzes of Textes et de Questionnaires), and the words were grouped graphically according to their frequency in the text used. From the analysis and cross-checking of the data, the following indicators were produced: (1) dominance of the terms creation, innovation, solutions of problems and transformation as fundamental elements of the concept of creativity; (2) failure to understand creativity as a human potential that can be developed and influenced by the environment. The exchange and discussion of creative experiences/experiences assumes, on the one hand, a fundamental role in the construction of a broad vision of the concept of creativity among the university population, and on the other, it is a vehicle of innovation in the field of research, teaching and extension the community.

Keywords: *Creativity, higher education, workshops.*

Resumo

A investigação sobre a criatividade no contexto educacional tem sido realizada na sua maioria com professores e alunos do ensino fundamental/médio, observando-se uma carência de pesquisas no âmbito do ensino superior. Tal observação, aliada à necessidade de uma compreensão mais profunda das mais instigantes características do ser humano, representa a finalidade deste trabalho empírico, desenvolvido por estudantes da Universidade Estadual Vale do Acaraú (Sobral, Ceará, Brasil) no laboratório artístico Oficinas de Viver – Desenvolvimento do Potencial Criativo. Face aos objetivos deste trabalho foi definida uma estratégia metodológica qualitativa, colaborativa, participativa e multidirecional, que envolveu um total de participantes (n=30) divididos em dois grupos: o primeiro grupo (G1) é formado por estudantes (n=12) do Programa Institucional de Iniciação Científica (PIIC)/UVA; o segundo grupo (G2) é constituído por estudantes da universidade (n=18), pertencentes a qualquer curso ou ano. Os instrumentos de recolha de dados incluem a observação participante, questionário, diário de campo e um exercício de grupo. Para o tratamento e análise lexográfica/multivarada foi utilizado o IRAMUTEQ (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires), sendo agrupado os vocábulos de forma gráfica em função de sua frequência no texto utilizado. Da análise e cruzamentos dos dados resultaram os seguintes indicadores: (1) dominância dos termos criação, inovação, soluções de problemas e transformação, como elementos fundamentais do conceito de criatividade; (2) não compreensão da criatividade como potencial humano que pode ser desenvolvido e é influenciado pelo ambiente. A troca e discussão de experiências/vivências criativas assume, por um lado, papel fundamental na construção de uma visão ampla do conceito de criatividade entre a população universitária, e por outro, é veículo de inovação no campo da pesquisa, ensino e extensão à comunidade.

Palavras-chave: *Criatividade, ensino superior, oficinas.*

Introdução

A *criatividade* tem sido investigada através de diferentes abordagens e perspectivas. A sociedade atual, que valoriza a rapidez no fluxo de informações e a inovação como fatores essenciais ao desenvolvimento, tem dado, nos últimos anos, uma ênfase especial a esta temática. Apesar da sua presença e utilização regular no vocabulário quotidiano, a *criatividade* compreende múltiplas e complexas dimensões que tornam este conceito de difícil definição.

Nos anos 50, o psicólogo Joy Paul Guilford associava o conceito de *criatividade* à *criação de algo novo*, às habilidades que são características (fluência, flexibilidade, originalidade e pensamento divergente) dos indivíduos criadores (Pelaes, 2010). Um outro expoente nas pesquisas sobre *criatividade* é o psicólogo e educador Paul Torrance (1965). Para este autor, a *criatividade* é uma capacidade humana que permite a percepção de um problema e a geração de novas ideias. O autor salienta que o pensamento criativo “é um processo de perceber lacunas ou elementos faltantes perturbadores; formar ideias ou hipóteses a respeito deles; testar essas hipóteses; e comunicar os resultados, possivelmente modificando e retestando as hipóteses” (Torrance, 1976, p. 34). Os conceitos de *criatividade* e *espontaneidade* são um dos pilares da teoria de Jacob Levy Moreno. Na sua proposta, a espontaneidade é a capacidade de dar resposta adequada a situações novas, criando uma resposta inédita e que transforme as situações preestabelecidas, caracterizando-se por uma superação de respostas insatisfatórias para adequadas (Moreno, 1959). A noção de *criatividade* advém desse conceito, uma vez que a possibilidade de modificar uma dada situação envolve a capacidade humana de criar. Na visão deste autor, o homem nasce com os recursos da espontaneidade, criatividade e sensibilidade trazendo consigo fatores favoráveis ao seu desenvolvimento. Contudo, as condições que favorecem a vida e a criação, podem ser perturbadas por ambientes ou sistemas sociais constrangedores. Nesse caso, resta a possibilidade de recuperação dos fatores vitais, através da renovação das relações afetivas e da ação transformadora sobre o meio (Gonçalves, Wolff, & Almeida, 1988). Colaborando com a ideia que os sistemas sociais exercem um papel relevante na expressão criativa, Mihaly Csikszentmihalyi destaca que a *criatividade* é resultado da interação entre os pensamentos do indivíduo e o contexto sociocultural (Fleith, 2001). Nesse sentido, Rogers (2009) enfatiza que o processo criativo incorpora uma relação primorosa entre a singularidade do indivíduo e as circunstâncias externas de sua vida. Outra pesquisadora que ressalta a importância do contexto no desenvolvimento e expressão da *criatividade* é a artista plástica brasileira Fayga Ostrower. Segundo a autora, a criatividade é um potencial inerente ao homem, e a realização deste potencial uma de suas necessidades. Ou seja, o ato criador abrange “a capacidade de compreender; e esta, por sua vez, a de relacionar, ordenar, configurar, significar” (Ostrower, 2009, p. 9). A mesma salienta que a natureza criativa do homem se elabora no contexto cultural. Todo indivíduo se desenvolve em uma realidade social, em cujas necessidades e valorações culturais se moldam os próprios valores de vida. Descrevendo algumas reconceitualizações de *criatividade*, Gardner (2007) aponta que as primeiras visões deste conceito enfatizavam o papel do divino ou da causalidade, ressaltando que até recentemente, este era visto por psicólogos como um traço peculiar de determinados indivíduos. Em uma síntese da evolução dos conceitos de *criatividade* Wechsler (1998) comenta que a partir dos anos 90 uma linha conceptual mais abrangente foi proposta, sendo a *criatividade* entendida como o resultado da interação entre processos cognitivos, características de personalidade, variáveis ambientais e elementos inconscientes. Assim, a visão de que a *criatividade* é um

dom, reservado a pessoas especiais e artistas está sendo substituída pela outra percepção mais ampla e complexa: a criatividade é inerente ao homem, está ligada a um fazer, formar, elaborar, constituir algo novo; está condicionada ao contexto histórico/cultural e pode ser desenvolvida. Amaral (2006) comenta, em conformidade com outros autores, que a expressão da *criatividade*, constituída ao longo da história das pessoas por suas características subjetivas e contexto em que vive, recebe grande influência das instituições educativas. A compreensão, portanto, dessas características pode contribuir para conceção de estratégias educativas que propiciem uma aprendizagem mais criativa no ensino superior. Referindo-se particularmente ao contexto educacional, a *criatividade* encontra-se no âmago dos processos que conduzem à atitude inovadora e crítica face ao conhecimento que constituem objetivos fundamentais do ensino superior (Bahia, 2008; Catani, Dourado & Oliveira, 2002). As Instituições de Ensino Superior (IES), portanto, deveriam configurar-se em ambientes de incentivo à *criatividade*. Contudo, nossa prática docente tem apontado para uma percepção diferente, partilhada com colegas de variadas áreas, de que os estudantes demonstram uma certa apatia quando desafiados a problematizar e criar. A universidade seria, portanto, um ambiente propício à criatividade? Esse questionamento nos apresenta uma reflexão inicial. Autores como Alencar (2002) apontam algumas razões para a importância atribuída ao desenvolvimento da *criatividade* na educação: (i) o reconhecimento da criatividade como elemento do bem-estar e saúde mental do indivíduo; (ii) a crença que a limitação da criatividade diminui a realização plena do ser e a expressão de talentos; e (iii) os processos de rápidas mudanças em curso na sociedade atual exigem respostas criativas às diversas situações que se colocam. Outro reconhecido pesquisador, Gardner (2007) destaca que, na sociedade global e conectada, a *criatividade* é buscada, cultivada e valorizada. Em contraponto, vários autores ressaltam que as instituições de ensino não estão habilitadas para desenvolver o pensamento criativo. Apesar do reconhecimento da importância da *criatividade* para o desenvolvimento pessoal e social, a prática educativa quotidiana pouco ou nada a incentiva. O que prepondera ainda muitas vezes é uma educação que privilegia a memorização e reprodução de conhecimentos (Wechesler & Nakano, 2011).

Este texto aborda especialmente duas questões: Os estudantes universitários são criativos? Como os estudantes avaliam sua própria criatividade? Partindo destas questões, é objetivo deste artigo descrever e discutir conceitos de *criatividade* elaborados/construídos por estudantes da Universidade Estadual Vale do Acaraú (UVA), localizada em Sobral, Ceará, Brasil. O entendimento e percepção sobre este conceito foi investigada durante a *Oficina de Viver – Desenvolvimento do Potencial Criativo*. O desafio foi desenvolver um espaço que se assumia como laboratório de exploração e experimentação de práticas artísticas e que ao mesmo tempo fosse apropriada ao contexto regional.

1. Método

1.1. Amostra

Os sujeitos envolvidos constituíram uma amostra não probabilística de 30 indivíduos, que frequentavam diferentes cursos na UVA durante o período de recolha de dados. Esta amostra foi dividida em dois grupos distintos. O primeiro grupo (G1) foi formado a partir da lista de inscritos do *Programa Institucional de Iniciação Científica* (PIIC)/UVA, contemplados pelo *Programa Institucional de Bolsas de Iniciação Científica* (PIBIC), do *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq) no ano de 2015. Foram disponibilizadas 20 vagas e 12 estudantes aderiram à ação proposta pela pesquisa. O segundo grupo (G2) foi formado por estudantes da universidade pertencentes a qualquer curso ou período (ano). Este grupo constituiu-se por adesão espontânea dos estudantes, adotando como critério de exclusão pertencer ao G1. Foram disponibilizadas 20 vagas e 18 estudantes aderiram à ação proposta pela pesquisa.

1.2. Instrumentos

Para a apreensão do conceito de criatividade dos estudantes utilizou-se um formulário com questões abertas. As respostas ao formulário foram processadas pelo programa informático IRAMUTEQ (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires), que faz análise estatística de corpus textuais com análise lexográfica e análises multivariadas (Marchand & Ratinaud, 2012). Entende-se como corpus o conjunto de Unidades de Contexto Inicial (UCI) que se pretende analisar. Para cada grupo estudado (G1 e G2), foi utilizada a forma de análise “nuvem de palavras” que agrupa os vocábulos de forma gráfica em função de sua frequência no texto utilizado. Para a síntese das respostas dos dois grupos foi utilizada a Classificação Hierárquica Descendente (CDH), após a leitura do corpus e a emersão das categorias que foram analisadas e comparadas.

1.3. Procedimento

A ação realizada denominada Oficinas de viver - Desenvolvimento do Potencial Criativo, aconteceu nos meses de julho e outubro de 2015, com carga horária horaria de 40 horas em cada aplicação. Esta carga horária foi didaticamente distribuída em três módulos, nos quais foram exploradas expressões artísticas diferentes. As oficinas podem ser definidas como um espaço de ação e reflexão, no qual se pretende integrar teoria e prática; conhecimento e trabalho; educação e vida (Omiste, López & Ramírez, 2000). A oficina prevê momentos de troca de saberes a partir de uma horizontalidade na construção do saber inacabado.

2. Resultados

Uma síntese dos conceitos de criatividade elaborados pelos estudantes do grupo G1 e G2 pode ser visualizada nas Figuras 1 e 2. Na nuvem de palavras gerada para a Oficina G1 pode-se observar a posição central ocupada pela palavra criatividade, com destaque para as palavras como problema, criar, novo, ideia, capacidade, indicando que estas aparecem com maior frequência no corpus textual.



Figura 1 Nuvem de palavras com respostas à pergunta “O que é criatividade”, Oficina G1, Sobral, Ceará, Brasil, 2015.

Na nuvem de palavras gerada para a Oficina G2 pode-se observar a posição central ocupada pela palavra criatividade, com destaque para as palavras ideia, criar, novo e transformar, indicando que estas aparecem com maior frequência no corpus textual.



Figura 2 Nuvem de palavras com respostas a pergunta “O que é criatividade”, Oficina G2, Sobral, Ceará, Brasil, 2015.

Na síntese dos conceitos de criatividade elaborados pelos 30 participantes das Oficinas G1 e G2, o Método de Classificação Hierárquica Descendente (CDH) apresentou como resultado um dendrograma dividido em classes, que agrupam vocábulos semelhantes dentro da mesma classe e diferente de outra classe (ver Figura 3).

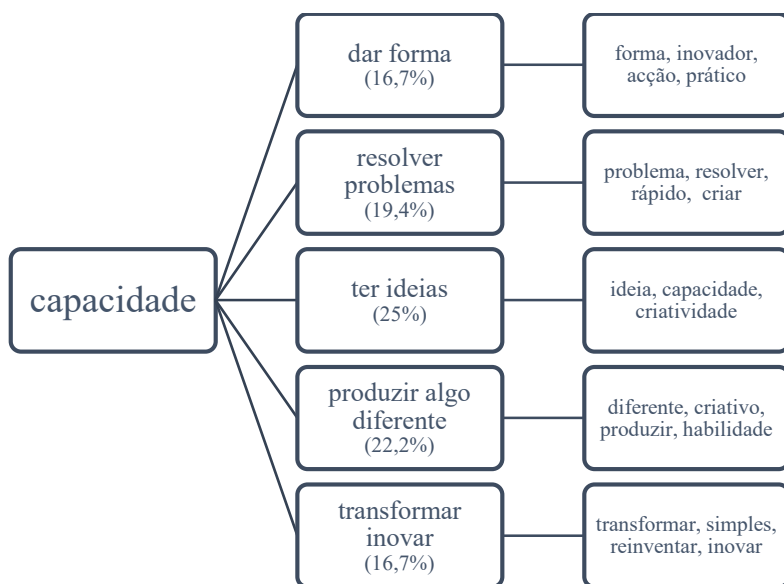


Figura 3. Conceito de Criatividade segundo participantes das Oficinas de Viver - Desenvolvimento do Potencial Criativo.

O conceito de *criatividade* dos estudantes se subdividiu em 5 classes ou categorias: (1) capacidade de dar forma; (2) capacidade de resolver problemas; (3) capacidade de transformar, inovar; (4) capacidade de ter ideias; (5) capacidade de produzir algo diferente. A partir dessas categorias obteve-se o seguinte enunciado: “*Criatividade é a capacidade de dar forma, de resolver problemas, de transformar e inovar, ter ideias e produzir algo diferenciado*”. Ressalta-se, ainda, que o conceito de *criatividade* elaborado pelos estudantes da UVA, retrata uma visão geral do coletivo dos participantes, e que individualmente há uma variação na amplitude da percepção sobre este conceito.

Em suma, observou-se que os dois grupos participantes destacaram no conceito de criatividade a criação/produção de ideias. Os estudantes da Oficina G1 mostraram-se mais interessados na resolução de problemas, enquanto que os da Oficina G2 na possibilidade de transformar /inovar. Observou-se também que os estudantes da Oficina G1 delimitaram com maior precisão o objeto/conceito a ser descrito. Os estudantes da Oficina G2, por outro lado, introduziram elementos das suas vivências, dando um carácter mais pessoal ao conceito de criatividade.

3. Discussão

De uma forma geral, o entendimento e percepção dos estudantes mostra que o conjunto dos conceitos elaborados apresentam elementos destacados por diferentes autores que associavam a criatividade à *criação de algo novo*, explorando habilidades que são características de indivíduos criadores (Pelaes, 2010). É ainda visível a colocação deste conceito como uma capacidade humana que permite a percepção de um problema (Torrance, 1976).

Um dos aspetos que foi pouco evidenciado, diz respeito à compreensão da *criatividade* como potencial humano que pode ser desenvolvido e é influenciado pelo contexto sociocultural a que pertence. Numa visão holística, a artista plástica brasileira Fayga Ostrower (2009) afirma que o criar pode ser visto num sentido global, como um agir integrado em um viver humano. Segundo a autora, a *criatividade* é um potencial inerente ao homem, e a realização deste potencial uma de as suas necessidades, isto é, o “homem cria, não apenas porque quer, ou porque que gosta, e sim porque precisa” (Ostrower, 2009, p. 10). Na mesma linha, Rogers (2009) refere que a *criatividade* responde a uma tendência natural dos potenciais humanos. A obliteração, em forma de resistência ao movimento criador natural, reflete a inércia dos corpos. Ou seja, o silêncio fúnebre da vida humana, a morte do indivíduo.

Outro aspeto importante mencionado refere-se ao facto de a *criatividade* possuir características de um fenómeno multidimensional, que se relaciona com muitos fenómenos individuais e coletivos, e decorre de múltiplas interligações de saberes. Neste particular, Wechsler (1998) conceitua a *criatividade* em uma abordagem ampla, onde são necessários diversos tipos de interações para que seja completada de forma harmónica para o indivíduo e para a sociedade. Neste sentido, devem ser consideradas todas as possíveis combinações entre habilidades cognitivas, características de personalidade e elementos ambientais. Considerando aspetos pessoais, profissionais e mesmo transcendentais do desenvolvimento humano, a combinação harmónica destas variáveis permitiria alcançar a autorrealização. Alencar (2007) sintetiza a visão multidimensional, interativa e complexa da *criatividade* quando afirma que vários dos atributos pessoais (atitudes, valores, interesses, motivações e traços de personalidade), que “predispõem o indivíduo a pensar de uma forma independente, flexível e imaginativa, são desenvolvidos e modelados ao longo da vida, sofrendo influência de distintos ambientes em que o indivíduo foi socializado” (p. 159).

Estar no âmago dos processos que conduzem à atitude inovadora e crítica face ao conhecimento é uma característica da *criatividade* e que deve constituir um dos objetivos fundamentais do ensino superior.

4. Conclusões

Em relação à percepção dos estudantes universitários sobre a *criatividade* concluiu-se que os estudantes demonstraram conhecer elementos fundamentais deste conceito, associando-o à criação, inovação, resolução de problemas e transformação. Outros aspetos, como a visão da *criatividade* como potencial humano que pode ser desenvolvido e sofre influência do contexto em que se vive não foram abordados pelos estudantes. Será importante promover a inclusão da discussão, troca de experiências e vivências criativas no quotidiano académico no sentido ampliar a visão da *criatividade* entre os universitários e contribuir para a inovação no campo da pesquisa, ensino e extensão.

Não foi observada diferença significativa nas respostas dos dois grupos participantes (G1 e G2), apenas a manifestação de um interesse mais acentuado na “resolução de problemas” para o grupo G1 e na “possibilidade de transformação e inovação” para o grupo G2. Dessa forma, pode-se afirmar que o facto de participar de projetos de pesquisa na universidade, não interferiu de modo contundente na visão de *criatividade* dos estudantes dessa amostra. Ressalta-se a relevância de que espaços privilegiados como o *Programa de Iniciação Científica* atuem mais firmemente no fomento deste conceito, tanto como construto teórico, basilar para pesquisa e inovação, quanto como vivência pedagógica para preparar futuros profissionais comprometidos com a excelência. Em um aspeto mais amplo essa discussão envolveria a própria formação do professor, as habilidades necessárias ao desenvolvimento da pesquisa científica e, ainda, os métodos propostos pelas agências de fomento em relação à produtividade académica.

Os estudantes são com certeza o maior patrimônio da universidade. Desenvolver seu potencial criativo é uma questão necessária, urgente, e mesmo vital para se construir uma instituição de ensino superior crítica e aberta, capaz não apenas de reproduzir ideias, mas de fazer ciência e cultivar a sabedoria.

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Fundamentos de um Redesign Educacional: um estudo sobre instituições brasileiras

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Abstract

This work purpose to study the transformations that are taking place in Brazil regarding the break with the "traditional" practices of teaching and learning, starting to investigate a different conception of formal school education, which was denominated in the study as school educational redesign. Thus, the present research identified and analyzed ten non-governmental institutions and their contributions to the academic community and society in the defense of educational transformations. Using the thematic content analysis technique, the result presents fundamentals regarding educational purposes and practices, use of digital technologies, concept and use of learning spaces and management strategies to account for such transformations.

Keywords: *Educacion, design, school, learning.*

Resumo

Este trabalho trata das transformações discutidas no Brasil no tocante à ruptura com as práticas “tradicionais” de ensinar e aprender, passando a ser investigada uma concepção diferente de educação escolar formal, o que foi denominado no estudo como redesign educacional escolar. Para tal a pesquisa identificou e analisou dez instituições não-governamentais e suas contribuições para a comunidade acadêmica e sociedade no tocante à defesa dessas transformações educacionais. Com uso da técnica de análise de conteúdo temático, o resultado apresenta fundamentos para um redesign educacional defendido pelas instituições analisadas, envolvendo propósitos e práticas educacionais, uso de tecnologias digitais, conceito e uso de espaços de aprendizagem e estratégias de gestão.

Palavras-chaves: *Educação, design, escola, aprendizagem.*

Introdução

A escola, como espaço de formação de cidadãos e profissionais, precisa estar atenta às transformações e demandas da sociedade, das quais destacamos o intenso acesso às tecnologias digitais, que acaba por alterar o pensamento e o comportamento das pessoas. Com efeito, consideramos que as experiências e transformações proporcionadas por tais tecnologias precisam ser compreendidas pelos educadores como um fenômeno relevante para o planejamento das interações proporcionadas pela escola nos seus processos de ensino.

Desta forma, pontuamos como problema motivador desta investigação a presença de um descompasso entre o design educacional escolar e o perfil, necessidades e anseios das crianças e jovens da atual sociedade, o que leva a escola a ser percebida como um local ultrapassado e enfadonho. Esta questão é reforçada por Silva (2012, p. 84) ao afirmar que “Esse novo perfil de aprendiz, que está nas escolas, nas universidades e nas organizações, nos inspira a repensar a educação, os currículos, as metodologias, práticas e processos de mediação pedagógica e avaliação”.

Ao explorarmos tal questão, percebemos que algumas instituições não-governamentais no Brasil também se mostram inquietas com as práticas tradicionais de educação escolar, e, dentro de suas áreas de atuação, incentivam e realizam ações em prol do que chamamos de redesign educacional escolar.

A partir desse contexto, este estudo teve como objetivo conhecer essas instituições que atuam discutindo e orientando sobre a necessidade de redesenhar as práticas educacionais nas escolas. Três perguntas de partida conduziram o estudo: 1. Quais instituições no Brasil atuam como mobilizadoras de um redesign educacional escolar? 2. O que elas defendem como boas práticas educacionais? 3. Quais ações desenvolvem e o que entregam para a comunidade acadêmica e sociedade? Em tese, consideramos que ao compreender esse contexto é possível identificar potenciais fundamentos didático-pedagógicos que possam ser considerados pela escola como pilares para uma revisão de seu *modus operandi*, passando a oferecer uma experiência mais ajustada às características da sociedade contemporânea.

1. Fundamentos teóricos para um redesign educacional

1.1 Design educacional

No presente estudo partimos do princípio de que toda escola possui um design educacional, seu conjunto de práticas que a caracteriza como uma instituição formadora de pessoas. O design educacional da escola reflete sua forma e função, se mostra pela percepção mais imediata de suas práticas, mas, além disso, carrega consigo uma filosofia educacional, um posicionamento político-pedagógico de fazer educação. De forma mais concreta, consideramos que o design educacional escolar se configura por meio da organização dos alunos, do uso dos espaços, das atividades/projetos de aprendizagem realizadas, do papel do

professor em sala de aula, dos processos de avaliação e do que é considerado como importante de ser estudado, dentre outros elementos.

Como design educacional clássico, seguimos o cenário descrito por Behrens (2013), onde os alunos são separados por idade em salas de aula, sentam-se enfileirados e, em silêncio, para ouvir o professor que atua como transmissor de conteúdos que devem ser memorizados pelos alunos para repetição posterior. Neste design, os estudos ocorrem de forma individualizada e competitiva e a linguagem oral e escrita são priorizadas. Em contraponto, em um design educacional inovador, o professor assume um papel menos falante e mais mediador, conduzindo aulas que ofereçam ao aluno atividades mais dinâmicas e interativas, os mantendo atentos, colaborativos e comunicativos. Além disso, num design educacional inovador, os limites físicos da escola são derrubados, integrando-se à comunidade.

Assim, ao utilizarmos os termos redesign ou redesenho escolar, estamos a falar de uma “reinvenção”, “recriação”, o projeto de outra configuração para a educação realizada pela escola; uma educação que reinvente os espaços, as experiências, as avaliações, as interações aluno/professor e o próprio pensamento sobre a função da escola e dos saberes ali desenvolvidos.

1.2 Tendências em mediações da aprendizagem

A necessidade de realizar um redesign educacional escolar relaciona-se com fato de que as tecnologias digitais de informação e comunicação (TDIC) são apontadas como transformadoras dos modos de ler e aprender da criança e jovem. Barros (2014) destaca características importantes que precisam ser observadas: alterou-se a noção de tempo e espaço, deixando de ser fixos; a linguagem passa a se dar sob códigos específicos com predominância do simbolismo multimídia; há facilidade de acesso aos conteúdos e, consequentemente, o aumento da interatividade na relação sujeito-objeto. Além disso, o acesso às tecnologias multimídia dão-se de forma hipertextual (configurando-se, portanto, como uma hipermídia), onde o usuário é autônomo para construir seus próprios caminhos de acesso ao conteúdo, selecionando aquilo que, para si, tem importância.

As tecnologias de comunicação móvel têm contribuído significativamente para essa forma de interação, estando presente com frequência no cotidiano de jovens e adultos, seja para atividades de trabalho, entretenimento ou relações sociais. Saccol, Schlemmer e Barbosa (2011) destacam que o conceito de mobilidade, acrescido à aprendizagem, é na verdade o que há de mais importante a ser apreendido. Mobilidade física dos aprendizes; mobilidade tecnológica; mobilidade conceitual; mobilidade sociointeracional e mobilidade temporal são apontadas pelos autores como cruciais para o entendimento da prática de uma educação móvel. Considerando que existe esse contexto de frequente mobilidade, fica para a escola o desafio de se tornar também uma experiência menos fixada em um tempo e espaço.

E um dos fenômenos que se percebe relacionado ao uso de tecnologias móveis são os jogos digitais. A relação entre aprender e brincar, jogar, sempre fora investigada quando se trata de

educação escolar infantil. Outrossim, cumpre-nos destacar que nos últimos anos, tais estudos passaram a ser realizados no contexto da educação de jovens e adultos, sendo o termo “diversão” como o mais utilizado ao se falar de aprendizagem com uso de atividades lúdicas e de entretenimento.

Prensky (2012), em importante obra sobre os jogos no contexto da aprendizagem, chama atenção para o fato de que “diversão”, “brincadeira”, tudo é conceito abstrato, podendo ser usado de diferentes formas. Afirma que a diversão no processo de aprendizagem tem como principal papel ‘relaxar e motivar’, onde o primeiro faz com que o aprendiz assimile os conteúdos mais facilmente; e o segundo o faz se empenhar na experiência, sem arrependimento. O autor afirma ainda que aprendemos quando nos divertimos, mas que aprendemos pela dor também, quando, por exemplo, nos encostamos em um objeto quente e aprendemos que esta situação deve ser sempre evitada.

Coll e Monereo (2010) tratando também dos desafios de comunicação educativa na sociedade atual, destacam o fenômeno da *web 2.0*, compreendida como aquela rede em que o usuário não se limita somente ao acesso e *download* de informações da *web* (a *web 1.0*), ele passa a incorporar e coordenar as informações, relacionando dados, inserindo conteúdos e tornando os ambientes mais significativos para si. Nesse espaço de consumo e produção, o usuário se torna protagonista, ao mesmo tempo que ajuda a disponibilizar conteúdos cada mais diversificados e particularizados às necessidades de si e de outros.

Percebe-se portanto, uma intensificação das relações interativas, onde Coll, Bustos e Engel (2010) destacam as comunidades de aprendizagem como outra tendência de conexão nessa sociedade mediatizada. Conforme os autores, as comunidades podem ser organizadas na sala de aula (aprendizagem colaborativa com alunos e professores), com instituições (interação da escola com agentes externos) e com a comunidade (interação escola e contexto social). Tais colaborações rompem com o paradigma de que a escola é um ambiente desconectado de seu contexto e de que o processo de aprendizagem se dá de forma isolada.

Assim, educadores têm relacionado a sociedade da informação com a necessidade de uma aprendizagem mais ativa, desafiadora e problematizadora, realizada em cooperação e colaboração, o que passou a ser chamado de “Metodologias Ativas de Aprendizagem”. Estas metodologias se referem ao planejamento e realização de atividades que proporcionem aos alunos o confronto com situações complexas do mundo real, havendo a necessidade de que analisem, pesquisem e reflitam, tornando-se ativos no processo. Geralmente se dão por meio de desenvolvimento de projetos, estudos de caso, resolução de problemas e desafios.

A aprendizagem ativa centra-se na aprendizagem dos alunos: os próprios alunos assumem a responsabilidade por seu processo de aprendizagem e, gradualmente, por aumentar a sua própria aprendizagem (Arbelaitz, Martin & Muguerza, 2015). Além disso, fornece aos alunos habilidades profissionais genéricas ou competências transversais, como a capacidade de resolver problemas, habilidades de equipe, habilidades de gerenciamento de informações,

adaptabilidade à mudança, o conhecimento crítico, habilidades de comunicação, autoaprendizagem e habilidades de autoavaliação.

2. Metodologia

Posicionada num paradigma interpretativo, a investigação caracteriza-se como exploratória e descritiva e de abordagem qualitativa. Como campo de pesquisa, fez uso de fontes disponíveis na internet, considerando a navegação hipertextual como uma tecnologia de acesso ao conhecimento. Partimos do *site* da Iniciativa de Comunicação e Mobilização Social “Porvir” (<http://porvir.org/>), uma vez que como agência de notícias conta com jornalistas que mapeiam as mais diversas ações relacionadas às inovações nas práticas educacionais no Brasil e no mundo.

Como resultado parcial, apontamos 10 instituições que consideramos na observação de campo como as mais representativas dentro deste propósito, a saber: Instituto Ayrton Senna (2015), Instituto Crescer (2015), Instituto Educa Digital (2015), Instituto Inspirare (2015), Instituto Natura (2016), Instituto Oi Futuro (2015), Instituto Península (2015), Fundação Lemann (2015), Fundação Telefônica Vivo (2015) e a Iniciativa Porvir (2015).

O estudo se deu por meio da técnica de análise de conteúdo, que segundo Bardin (2006, p. 33), caracteriza-se como “[...] um conjunto de técnicas de análise das comunicações, que utiliza procedimentos sistemáticos e objetivos de descrição do conteúdo das mensagens”.

Primeiramente os conteúdos das instituições foram descritos e a seguir analisados por meio de codificação aberta, processo que tem como objetivo identificar os temas de interesse por meio da análise de conteúdo temática. Esse processo foi organizado com uso de uma Grelha de Análise, compreendida como uma planilha ou quadro que organiza e sistematiza os conteúdos selecionados e a análise realizada (vide quadro 3.1).

Tabela 1 - Grelha de análise dos dados

GRELHA DE ANÁLISE		
UNIDADE ANALISADA	Nome da instituição.	
APRESENTAÇÃO	Texto em que se apresenta a natureza da instituição, seus criadores e mantenedores, localização no Brasil, missão e função, dentre outras informações possíveis.	
RASTREABILIDADE	Site oficial e data do último acesso.	
CONTEÚDO ANALISADO	SÍNTESE DESCRITIVA	CODIFICAÇÃO ABERTA
Projeto/Atividade	Texto descritivo do projeto/atividade ou outra natureza do conteúdo analisado. Deve indicar a quem se dedica, o que defende ou pretende, dentre outras informações possíveis.	Campo para listagem dos códigos identificados na Síntese Descritiva. Deve ser numerado e não há limite de quantidade.
<p>EXEMPLO de descrição e codificação</p> <p>Seminário Transformar (evento apoiado pela Fundação Lemman)</p>	Evento realizado em parceria com o Instituto Inspirare por meio do Porvir, e com o Instituto Península com o objetivo de compartilhar e discutir sobre inovação no ensino (1), buscando atender as necessidades educacionais do século 21 (2). Trata especificamente da “transformação” e “evolução” da educação (3), afirmando que a educação está em busca de novos caminhos. Aponta que a tecnologia delinea novas possibilidades para a garantia da equidade (4), engajamento (5) e personalização (6) nos processos de ensino e de aprendizagem.	<ol style="list-style-type: none"> 1. Discussão sobre inovação no ensino; 2. Necessidades educacionais no século 21; 3. Transformação e evolução da educação; 4. Equidade; 5. Engajamento; 6. Personalização do ensino e da aprendizagem
Projeto/ Atividade	Idem	Idem
Projeto/ Atividade	Idem	Idem
Totalização dos Conteúdos Analisados	Texto resumo sobre as ações gerais da instituições	Totalização dos códigos gerados

O trabalho de codificação das 10 instituições gerou 415 códigos abertos, sendo necessária a realização de redução por meio de análise comparativa constante, uma vez que vários códigos surgiram de forma idêntica, repetidas vezes, e outros, embora não fossem escritos de forma idêntica, em sua essência apresentavam o mesmo significado (similares). Vale ressaltar que,

nesta fase da análise (redução), não consideramos distinção entre as Instituições geradoras dos códigos, pois já caminhávamos para um resultado mais geral, independente das especificidades de cada unidade analisada.

Realizada a redução por repetição e similaridade obtivemos 120 códigos que, ao olhar do analista, ainda precisariam de algum tratamento intermediário que possibilitasse uma análise e conclusão a partir de uma quantidade menor de códigos. Desta forma, realizamos novamente uma análise comparativa constante e agrupamos os 120 códigos em cinco assuntos: 1. Propósitos Pedagógicos (27 códigos); 2. Práticas Educacionais (29 códigos); 3. Tecnologias Digitais (39 códigos); 4. Espaços de Aprendizagem (11 códigos); 5. Estratégias de Gestão (14 códigos).

A partir de então, cada grupo de códigos foi analisado separadamente por meio de um Diagrama de Afinidades, técnica onde os códigos são agrupados por similaridade de assuntos, possibilitando categorizá-los. A categorização é o resultado alcançado pelo diagrama de afinidades - a cada agrupamento foi dado um nome que fosse representativo de todos os códigos, nascendo a “categoria”. O quadro 3.2 apresenta um exemplo de categorização do grupo temático “Espaços de Aprendizagem”.

Tabela 2 – Categorização de Espaços de Aprendizagem (exemplo)

CÓDIGOS ABERTOS ENCONTRADOS NAS ANÁLISES DE CONTEÚDO	1.	Espaço físico para trabalho interdisciplinar
	2.	Ambiente físico estimulante para o protagonismo do jovem
	3.	Sala de aula colaborativa, flexível e dinâmica
	4.	Salas de aula com design diferente
	5.	Mobiliário que possibilite mobilidade
	6.	Organização do espaço de sala de aula para promover a integração entre os alunos
REDESIGN DO ESPAÇO ESCOLAR (nome escolhido para a categoria)		

As categorias foram consideradas como os fundamentos teórico-práticos para um redesign educacional escolar, a partir das ações das instituições analisadas.

3. Resultados e Discussão

Realizado o Diagrama de Afinidades em cada grupo de assuntos, chegamos às categorias dos códigos abertos do grupo “Propósitos Educacionais”, em um total de 5. Já no grupo “Práticas Educacionais”, identificamos 6 categorias. No tocante às “Tecnologias Digitais”, alcançamos 3 categorias, e no grupo “Espaços de Aprendizagem” identificamos 2 categorias representativas dos 11 códigos abertos. O grupo “Estratégias de Gestão” surgiu a partir da identificação de ações realizadas em paralelo às atividades de ensino, mas que supomos impactar direta ou indiretamente nas práticas educacionais, e gerou 3 categorias.

A figura 1 apresenta as 19 categorias resultadas da análise, que podemos considerar como 17, dada a repetição de duas categorias. O texto síntese após a figura descreve e conecta todas as informações do resultado do estudo, com ênfase para respostas às 3 perguntas de partida apresentadas na Introdução.

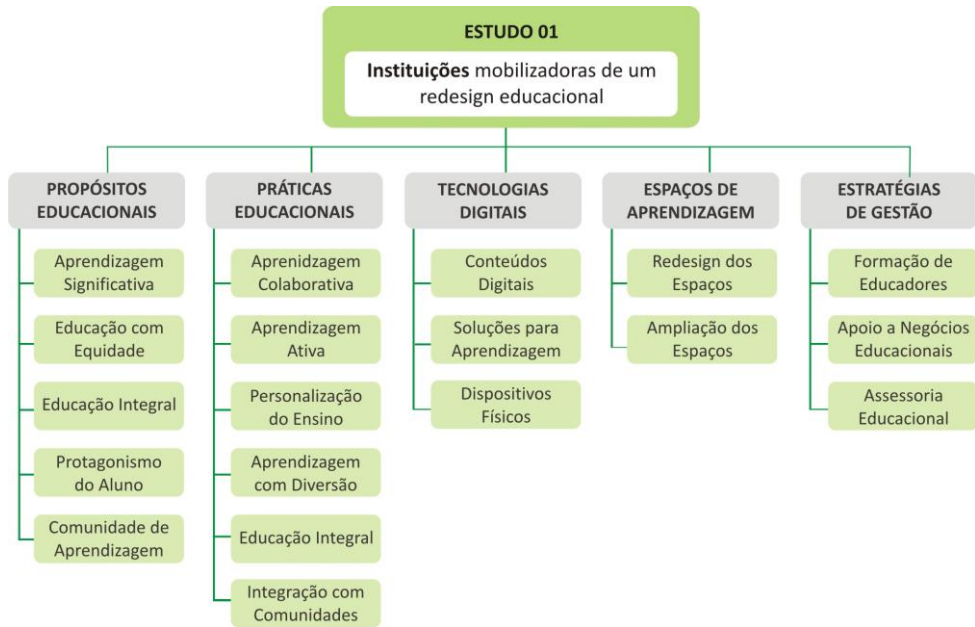


Figura 1. Diagrama de Categorias

Segundo a investigação e análise das ações e movimentos realizados pelos institutos analisados, concluímos que eles defendem uma educação que tenha como propósito pedagógico uma aprendizagem significativa, uma educação com equidade, integral, onde o aluno seja protagonista e que funcione como uma comunidade de aprendizagem. Como prática, os institutos indicam uma educação por meio da realização de atividades colaborativas, em que o aluno seja sujeito ativo no processo, que possa contar com um ensino personalizado, divertido, integral e integrado com a comunidade.

Em relação ao uso educacional das tecnologias digitais concluímos que os institutos incentivam o uso de conteúdos digitais gratuitos e abertos e o uso de tecnologias como ambientes, plataformas, *sites* e jogos (por exemplo) como “soluções” que venham contribuir com a melhoria da aprendizagem. Os institutos comentam com menor ênfase sobre a convergência digital dos dispositivos físicos, o uso de *mobiles* na sala de aula e como tendência, o uso das tecnologias vestíveis a favor das experiências de aprendizagem.

Identificamos também que estes institutos defendem que os espaços de aprendizagem sejam redesenhados, integrando novos mobiliários, novas disposições e uma comunicação visual atraente ao aluno e que não se limite à sala de aula e à escola, podendo os ambientes e ações educacionais ocorrerem fora da escola e em espaços informais de aprendizagem. Por último, concluímos ainda que os institutos defendem a formação de professores, a geração de negócios educacionais e a realização de assessorias especializadas para que o design

educacional das escolas possa caminhar para propostas que atendam, de forma mais adequada, às demandas do século XXI, o que apontamos como estratégias de gestão.

Os institutos analisados atuam por meio de diferentes ações, a saber: realização de eventos; de estudos e pesquisas com produção de conteúdo; qualificação profissional; desenvolvimento comunitário; formação de professores e gestores; empreendedorismo social educacional; contribuição na elaboração de políticas públicas; apoio ou desenvolvimento de tecnologias educacionais e apoio a espaços culturais, escolas e projetos sociais que tenham como mote as transformações sociais por meio da educação.

O estudo completo apresenta de forma detalhada todo o processo de categorização, bem como a descrição teórica de cada categoria encontrada como resultado (aprendizagem significativa, ativa, colaborativa, equidade e etc.), definindo por meio de uma segunda revisão de literatura.

4. Conclusão

No tocante às instituições analisadas parece-nos evidente a defesa de uso das tecnologias digitais nos processos educativos, conexão lógica no momento em que algumas das instituições se vinculam, de alguma forma, com a produção e difusão de tecnologias digitais de comunicação. Nesse sentido, devemos considerar seus discursos com cautela, reservando-nos ao exercício de contrapor os argumentos que defendem, mesmo que a princípio concordemos com eles.

De todo modo, os institutos cumprem importante papel no cenário de pesquisa e discussão daquilo que pode ser chamado de novas práticas educacionais – por um lado, situam-se em uma discussão de vanguarda, fazendo-se presente em relevantes postos comunicativos, como os eventos nacionais e internacionais e mesmo junto ao poder público. Por outro lado, fazem uso de sua missão e inserção social para impulsionar as comunidades menos favorecidas no tocante ao acesso e uso das TIC, contribuindo para diminuir situações de exclusão digital.

Sendo assim, mesmo que algumas ações dos institutos tenham fundo de interesse financeiro, como por exemplo a realização de assessorias educacionais e aceleração de *startups*, consideramos que se trata de negócios sociais, o que não invalida a contribuição de tais mobilizações para um redesign educacional. Nesse sentido, cabe às escolas e comunidades conhecer profundamente e avaliar quais tecnologias educativas seriam adequadas para seu contexto, cientes de que não existem soluções prontas para os desafios enfrentados no particular de cada comunidade e cotidiano escolar. Da mesma forma, é importante que quando uma comunidade for partícipe de projetos apoiados por estas instituições, ela possa perceber e pensar não somente no presente, mas no que espera como resultado perene dessas ações ou projetos; no que fica para a comunidade como um desenvolvimento próprio e futuro, independente da presença ou recurso recebido pela instituição não-governamental.

Sobre as 17 categorias apresentadas pelo resultado da pesquisa consideramos validar a relação existente entre os fundamentos defendidos para um redesign educacional escolar e as experiências proporcionadas pelas TDIC. Justificamos essa afirmação ao percebermos, por

exemplo, que a principal característica desse redesign educacional é uma configuração multimídia, uma escola em que o trajeto e a comunicação se dá por meio de multisignos, com possibilidade de mobilidade, de colaboração, de diversão e de outras estratégias para atrair a atenção do educando e assim contribuir na sua formação integral.

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O efeito das redes sociais e a Competência 7 do ENEM: estudo realizado com os alunos do Instituto Federal de Brasília, Centro Oeste do Brasil

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Resumo

A finalidade deste trabalho consiste em explorar o uso de novas mídias como estratégia de ensino, facebook e whatsapp, por exemplo. Objetiva-se, portanto, compreender até que ponto o material proveniente das redes sociais pode auxiliar no ensino de conteúdos dos diversos componentes do ensino básico, na perspectiva da competência 7 das linguagens, códigos e suas tecnologias da matriz do ENEM – Exame Nacional do Ensino Médio, modalidade avaliativa cujo objetivo é universalizar e padronizar os meios de avaliação do ensino médio nacional como forma de ingresso às universidades brasileiras e algumas portuguesas. Essa nova proposta não resolve algumas demandas sociais decorrentes do ensino desigual. Diante desse cenário, faz-se necessário um entendimento da matriz do ENEM: seus eixos cognitivos, competências e habilidades como instrumento de práticas sociais que permitam aos candidatos, com menos chances de ingresso, obterem melhor desempenho. Foi ofertado, pelas autoras deste trabalho, curso de interpretação de texto para a comunidade da Cidade Estrutural, no IFB – instituição pública da rede federal de educação profissional, científica e tecnológica, localizada no Distrito Federal, Brasil. O intuito do curso foi desenvolver os objetivos do projeto que inspirou este artigo. Para tanto, a metodologia utilizada foi de natureza qualitativa e etnográfica a partir de anotações baseadas no comportamento dos participantes do curso e da compilação dos resultados obtidos nas respostas dos questionários aplicados aos alunos envolvidos. Verificou-se, durante as oficinas do curso, que os pressupostos iniciais, além de se confirmarem, transcenderam a nossa expectativa: os alunos de fato percebiam a malícia das ironias, mas ainda prevalecia a falta de leitura de mundo que dificultava o posicionamento mais crítico e reformador desses alunos da população carente da Estrutural. Além disso, percebeu-se a limitação em articular conexões com eventos da

atualidade em se tratando de público mais jovem e várias incidências de extrapolação, entre outras observações.

Palavras-chave: *educação, redes sociais, leitura, Enem, habilidades/competências.*

Introdução

Idealizado no final do século passado, em 1998, o Enem – Exame Nacional do Ensino Médio – representa uma modalidade avaliativa cujo objetivo é universalizar e padronizar os meios de avaliação do ensino médio nacional como forma de ingresso às universidades brasileiras e algumas portuguesas. A princípio, essa prova surgiu como ferramenta governamental com o fim de se criar uma estimativa da qualidade do ensino médio brasileiro. Com o passar desses dezenove anos de existência, o referido exame incorporou um modelo mais experiente e inovador na medida em que permite ao candidato, que pretende cursar uma universidade, a possibilidade de concorrer a vagas no ensino superior, mesmo fora de seu local de domicílio. Além disso, o Enem é aproveitado como critério de seleção para os estudantes concorrerem a uma bolsa no Programa Universidade para Todos (ProUni). Com efeito, considera-se um avanço na conquista da isonomia nas condições de realização da prova. Por outro lado, essa nova proposta de acesso aos cursos superiores não resolve algumas demandas sociais decorrentes do ensino não tão isonômico quanto à forma de aplicação do Enem.

Diante desse cenário, fez-se necessário um entendimento da matriz do Enem: seus eixos cognitivos, suas competências e suas habilidades como instrumento de práticas sociais que façam os candidatos, com menos chances de ingresso, compreenderem melhor os conteúdos, dentro de um ambiente menos sistematizado e mais social e ideologicamente contextualizado.

Nesse contexto, ponderou-se o uso de ferramentas audiovisuais como um dos meios para se atender ao mote da competência 7 do Enem, referente ao tópico de linguagens e códigos e objeto de análise deste trabalho. Conforme documento de divulgação do Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP), essa competência é definida da seguinte forma: “Confrontar opiniões e pontos de vista sobre as diferentes linguagens e suas manifestações específicas”. Dessa maneira, fica evidente a alusão dessas aptidões ao que há hoje em redes sociais. Imagens, sons, mensagens verbais são projetados a um universo ilimitado de pessoas e fazem parte do cotidiano de seus usuários. Dessa forma, os conteúdos veiculados nesses modernos formatos de comunicação se apresentam como significativos e, nesse sentido, apontam para diversas perspectivas ideológicas, capazes de moldar a forma de pensar, de formar opinião de um grupo, e de provocar a reflexão.

Com efeito, a proposta deste trabalho foi verificar as potencialidades decorrentes das mensagens verbais ou não verbais das redes sociais, sobretudo as duas mais utilizadas no Brasil, *facebook* e *whatsapp*. A hipótese que sustentou este artigo, portanto, reside no fato

de ideologias serem moldadas, e identidades construídas por meio do conteúdo veiculado nas redes sociais, e isso pode interferir nas relações interpessoais, principalmente de jovens em busca de conhecimentos.

Enfatizou-se o modelo de leitura postulado por Marcuschi (2008) sobre os horizontes de compreensão textual, com o intuito de estimular a consciência da ação das camadas de entendimento no processo de interpretação textual.

1. Instituto Federal De Brasília – *Campus* Estrutural

O *Campus* Estrutural, juntamente de mais nove campi, constitui o Instituto Federal de Brasília, que, de acordo com a Lei nº 11.892/2008 que cria os Institutos Federais, foi criado com a finalidade de ofertar educação profissional e tecnológica, em todos os seus níveis e modalidades, formando e qualificando cidadãos com vistas na atuação profissional nos diversos setores da economia.

Visando à implantação do *Campus* Estrutural, durante o segundo semestre de 2010, foram realizadas audiências públicas para que a comunidade pudesse participar da decisão de quais seriam os cursos ofertados. Foram definidos os eixos tecnológicos de Gestão e Negócios; Informática e Comunicação; e Controle e Processos Industriais.

Com o intuito de estimular e apoiar processos educativos que conduzam à geração de trabalho e renda e à emancipação do cidadão do ponto de vista do desenvolvimento socioeconômico local e regional, as primeiras formações oferecidas pelo *campus* Estrutural foram cursos de formação inicial e continuada (FIC) - cursos de curta duração, que focam nos aspectos práticos da profissão com intenção de ensinar uma ocupação para quem necessita se inserir no mercado de trabalho e aperfeiçoar os conhecimentos de profissionais que já trabalham.

Com a mudança para a sua sede definitiva, em janeiro de 2015, o *Campus* iniciou uma nova fase com a inclusão de ofertas na modalidade de curso técnico subsequente com o curso de Manutenção Automotiva e na modalidade superior com a licenciatura em Matemática.

2. Redes Sociais

Com a popularização do computador, e após rápidas mudanças, surge a internet. Para (HEGEL III e ARMSTRONG, 1999), a internet era essencialmente uma comunidade de pesquisa interativa que ultrapassava o campus da universidade para compartilhar dados, colaborar em pesquisas e trocar mensagens. Essas foram às primeiras comunidades.

Por meio da integração de aspectos culturais e tecnológicos, criam-se as comunidades virtuais — canais de relacionamentos digitais, onde os participantes se juntam para discutir assuntos de mesmo interesse. De acordo com (MATTOS, 2009), as chamadas redes sociais se caracterizam pela reunião de pessoas em torno de um mesmo fim. E elas não pararam de aparecer. Na lista das mais utilizadas no mundo, divulgada pelo site Lista10, temos o *Facebook* na liderança de acesso, o *YouTube* em segundo, seguido pelo *Qzone*, o *Sina Weibo* em quarto, e em quinto lugar o *WhatsApp*.

A evolução das redes sociais promove cada vez mais a interação entre as pessoas. O uso delas tem propiciado novas experiências no ambiente da aprendizagem e do ensino. O fato de permitir a exposição de opiniões e a troca instantânea de informações fez com que a comunicação por meio desses meios virtuais aumentasse, fazendo com que o uso do *Facebook* e do *WhatsApp* já ocupe um importante espaço na educação.

3. Metodologia

A metodologia utilizada foi de natureza qualitativa e etnográfica a partir de anotações baseadas no comportamento dos participantes do curso e da compilação dos resultados obtidos nas respostas dos questionários aplicados aos alunos envolvidos no curso ministrado pelas autoras, para alunos carentes de uma comunidade na Cidade Estrutural, periferia do Distrito Federal. Esse curso de interpretação de texto ocorreu nas dependências do IFB – Instituto federal de Brasília, e contou com a presença de um público com idades variadas e diferentes graus de escolaridade.

As questões organizam-se em quatro blocos específicos: i) Método de abordagem e possível mudança de discurso; ii) Percepção da intertextualidade e do dialogismo; iii) Pressupostos e subentendidos: marcas ideológicas; e iv) Análise das declarações feitas pelos alunos, sobre a importância da utilização das redes sociais no aprendizado. Essas perguntas direcionaram as observações em campo.

A mediação do professor é fundamental na ocasião da aula. Dessa forma, o método de análise dos dados baseou-se também no seguinte questionamento: há mudança de comportamento dos envolvidos após a apresentação da aula por meio dos recursos midiáticos?

Esta pesquisa, de natureza qualitativa, investigou as manifestações ideológicas das mensagens dos meios de comunicação das redes sociais, de caráter popular, como ferramenta de ensino/aprendizagem com base na competência 7 do ENEM.

Do ponto de vista metodológico, esta pesquisa segue o padrão qualitativo, uma vez que se propôs a investigar um universo menor, porém com mais intensidade. A fim de reconhecer a realidade na qual os pesquisados estão inseridos, houve uma sequência de ações: coleta de dados; descrição da pesquisa de campo; observação das aulas e notas de campo; entrevistas individuais; análise de discurso crítica e conclusão. Diante desse contexto, o enfoque metodológico será voltado para a pesquisa etnográfica, essa modalidade é propícia para a descoberta de experiências de outros sujeitos, de outras visões de mundo, de crenças, de ideologias, de atitudes, de éticas, de comportamentos e de ações. Dessa forma, o fenômeno humano pôde ser mais bem compreendido.

4. Desenvolvimento Da Pesquisa

Este trabalho se justificou pela necessidade de encontrarem-se respostas para as hipóteses possíveis no trabalho com a competência 71 do ENEM. Dada a relevância e a abrangência do processo seletivo em questão, conhecer os critérios de avaliação desse exame permite aos educadores repensar os planejamentos de ensino da língua portuguesa por intermédio dos modernos gêneros textuais e da análise crítica da “democratização” (FAIRCLOUGH, 2001): como instrumento de mudança social nas sociedades contemporâneas. Pretendeu-se, aqui, descobrir como ocorrem as relações “eu-tu”, e uma possível mudança de comportamento decorrente desse fenômeno social – a interação. Nesse sentido, considera-se, além do conceito de democratização o da “tecnologização”, segundo Fairclough (2001):

A tecnologização discursiva parece estar se estendendo de gêneros, como a entrevista, que têm um caráter público no sentido em que não estão associados a uma série de funções institucionais públicas, para o gênero central da esfera privada, a conversação.

O trabalho se desenvolveu, portanto, a partir da compreensão dos diferentes níveis discursivos de segmentos da sociedade, divididos em perfis: sexo, etnia, socioeconômico, instrucional.

1 A competência 7 do ENEM dentro das linguagens e códigos vem acompanhada de quatro habilidades, enumeradas como 21, 22, 23 e 24. A 21 é “Reconhecer, em textos de diferentes gêneros, recursos verbais e não verbais utilizados com a finalidade de criar e mudar comportamentos e hábitos”. A 22 é “Relacionar, em diferentes textos, opiniões, temas, assuntos e recursos linguísticos”. A 23 é “Inferir em um texto quais são os objetivos de seu produtor e quem é seu público-alvo, pela análise dos procedimentos argumentativos utilizados”. E a 24 é “Reconhecer no texto estratégias argumentativas empregadas para o convencimento do público, tais como a intimidação, sedução, comoção, chantagem, entre outras”.

4.1 Referencial teórico

A Análise do Discurso foi a linha adotada para esta pesquisa, portanto, apropriou-se da perspectiva do dialogismo e da polifonia de Bakhtin (1997); da mudança social segundo Fairclough (2001); e da ordem do discurso de Foucault (1996). Os enfoques de Fiorin (1994) à AD, aos trabalhos de Koch (1990), Travaglia (2002), Marchuschi (2008) na construção interação de sentidos em diferentes gêneros textuais e intertextuais que embasaram a proposta inicial e formulação das primeiras atividades com o grupo estudado.

Nesse sentido, o discurso dominante e o dominado revelaram os estigmas a que determinados conteúdos estão submetidos. O discurso opressor, que manipula o pensamento da massa, fomenta a divisão de classes, pois constrói a imagem daquilo que deve ter prestígio ou não, numa proposta elitizante. Observa-se esse procedimento no que afirma Bakhtin (2014, p. 47):

O ser refletido no signo, não apenas nele se reflete, mas também se refrata. O que é que determina esta refração do ser no signo ideológico? O confronto de interesses sociais nos limites de uma só e mesma comunidade semiótica, ou seja: *a luta de classes*.

Essa “luta de classes” a que Bakhtin se refere contribui ainda mais para que a linha tênue entre elite e massa seja evidenciada e reforçada. Em contrapartida, algumas instituições promovem um estudo crítico daquilo que é determinado como acultramento pela classe dominante. É o que se vê em alguns programas de avaliação e acesso à universidade (como o Programa de Avaliação Seriada -PAS, da UnB, por exemplo), em que são feitos recortes temáticos polêmicos. O status da comunidade da Cidade Estrutural é de extrema vulnerabilidade social.

A reflexão sobre os textos que foram selecionados para se trabalhar no curso tiveram enfoque na análise dos pressupostos e subentendidos. Os primeiros demonstraram as informações implícitas que são comprovadas por algum marcador discursivo explícito; os segundos dependem de uma experiência de vida, de uma representação visual (HERNANDEZ, 2007) que manifeste interpretações variadas e, para tanto, refutáveis. Conforme explica Argelim (2003, p. 16):

(...) fala-se apenas em diferença entre o que tem suporte significante (pressuposto) e o que não os apresenta e se infere por índices (subentendidos).

5. Conclusão

A finalidade central deste trabalho consistiu em alcançar o entendimento do uso de novas mídias como estratégia de ensino. Objetivou-se, então, compreender até que ponto o material proveniente das redes sociais, propagandas, campanhas, críticas, sátiras, entre outras puderam auxiliar no ensino de conteúdos dos diversos componentes do ensino básico regular, sobretudo o da língua portuguesa na perspectiva da competência 7 das linguagens, códigos e suas tecnologias da matriz do ENEM bem as habilidades envolvidas. Com efeito, percebeu-se marcas de manipulação, de preconceito, de alienação ou, por outro lado, de reflexão dos analisados por meio da análise das respostas discursivas deles bem como da postura de cada um durante as aulas do curso.

Verificou-se, durante as oficinas do curso, que os pressupostos iniciais, além de se confirmarem, transcenderam a nossa expectativa: os alunos de fato percebiam a malícia das ironias, mas ainda prevalecia a falta de leitura de mundo que dificultava o posicionamento mais crítico e reformador desses alunos da população carente da Estrutural. Além disso, percebeu-se a limitação em articular conexões com eventos da atualidade em se tratando de público mais jovem e várias incidências de extrapolação, entre outras observações.

Percebeu-se ainda, que 100% dos alunos que responderam ao questionário utilizam as redes sociais e, como mostra a imagem a seguir, a maioria concorda que a utilização das redes sociais desperta neles mais interesse, mais vontade de participar, de se envolver. Quando questionados por que as aulas ficam mais atraentes, eles afirmam que “Fica mais acessível a linguagem do aluno, e mais próxima de sua realidade.” e “Porque eu posso trocar ideias com pessoas com quem estou mais acostumada a conversar, fica mais fácil lidar com o assunto.”.

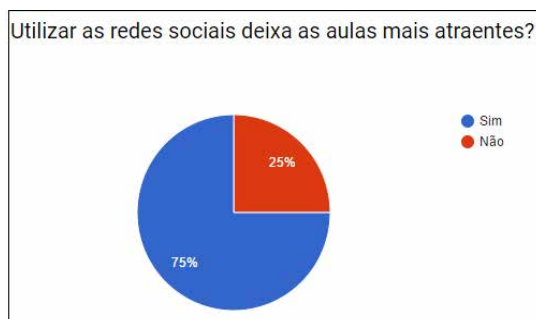


Figura 1. Utilização das redes sociais.

5.1 Percepção da intertextualidade e do dialogismo.

A leitura é compreendida em níveis: o da decodificação; o da apreensão e o da interpretação. O terceiro, mais desenvolvido, é aquele que permite ao leitor associar o texto em movimento às leituras anteriores. Dessa atividade surge a percepção de diferentes vozes ou de recortes de outros textos já conhecidos pelo leitor. Eis, então, o segundo ponto: os alunos têm alcance da dimensão dos textos estudados? É possível perceber que analogias, intertextos, dialogismos foram deflagrados ao longo das aulas?

Logo no início do curso, o texto “Aula de Intertextualidade” foi estudado. Nele, há uma sequência de menções intertextuais. Os alunos foram sondados quanto ao conhecimento prévio daquelas informações para que pudessem reconhecer a fonte da intertextualidade. Como podemos observar no gráfico a seguir, considerando um valor entre 0 e 5, dos estudantes que responderam pergunta, 13% deles consideraram ter instruções satisfatória para compreender todas as informações intertextuais presentes no texto. Uma considerável parte deles, 34,8%, se sente capaz de reconhecer grande parcela do conteúdo, mas não ele todo. A maioria, somando 52,2%, declara ter conhecimentos suficientes para compreender no máximo a metade do assunto exposto, 50%.



Figura 2. Nível de compreensão das informações intertextuais.

Durante as aulas de intertextualidade, alguns questionários foram aplicados e as respostas foram um pouco diferentes do esperado, surpreenderam. Pensava-se, a princípio, que as informações não verbais fossem de mais fácil compreensão, no entanto, de acordo com registro das respostas, como podemos perceber no gráfico a seguir, para 56,5% dos participantes, a análise do texto escrito convenceu mais que as imagens.

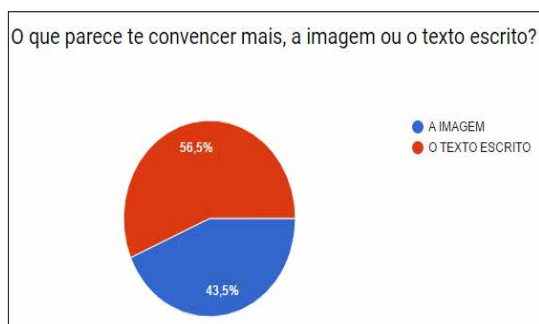


Figura 3. Comparação da compreensão entre imagem e texto.

5.2 Pressupostos e subentendidos: marcas ideológicas

Uma das funções sociais das novas tecnologias é permitir ao usuário desses novos gêneros digitais o contato com o texto literário típico da cultura de massa de acordo com os objetos de conhecimento associados às matrizes de referência do ENEM no site do Instituto Nacional De Estudos E Pesquisas Educacionais Anísio Teixeira - INEP. Diante desse cenário, julgar a intenção do autor, intuir quando o implícito é um pressuposto ou um subentendido pode auxiliar na identificação das marcas ideológicas. Segue, portanto, o terceiro questionamento que norteou os trabalhos em campo: As divergências entre pressupostos e subentendidos são consideradas no processo? Houve percepção adequada da intencionalidade discursiva dos textos estudados pelos alunos? Quais são as marcas ideológicas que parecem mais evidentes para os alunos nos textos?

De acordo com as respostas dos alunos, a maior dificuldade ocorreu na identificação dos pressupostos, os marcadores de pressupostos não ficavam evidentes para eles, por outro lado, a construção dos subentendidos foi mais fácil, apesar de a extrapolação representar o vício mais próximo. Entre os problemas de interpretação e compreensão dos textos analisados, verificou-se uma maior incidência de erros em extrapolação, no entanto a contradição e a redução foram registradas, mas com menos ocorrências.

Sobre a intencionalidade dos produtores das informações, esperava-se descobrir o que acontece na consciência desse público quando há ironias no enunciado. O que se encontrou foi uma relativa baixa percepção dessas informações. Os alunos demonstraram, na quantidade significativa de cerca de 70%, horizonte indevido (em razão dos falseamentos); horizonte problemático (por causa das extrapolações); horizonte mínimo (reprodução em paráfrases) até a falta de horizonte (cópia na leitura do texto original), na perspectiva de Marcuschi (2014). Os demais 30% realizaram as inferências possíveis.

Verificou-se, portanto, que a relevância dessa pesquisa identifica-se na reflexão que deve ser dada aos critérios de avaliação de importantes exames nacionais como proposta de trabalho nas escolas. E como esses métodos de avaliação, como o da competência 7, auxilia estrategicamente no ensino. A percepção de uso dos meios de avaliar os candidatos,

expressos nos editais de candidatura, associado ao contexto social (redes e mídias) deve ser tomada nas escolas como instrumento de estudo e reflexão para melhorar o desempenho desses alunos bem como prepará-los melhor para a vida.

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Possibilidades do uso das novas tecnologias: Uma proposta de reorganização didático-metodológica disciplinar

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Abstract

This paper aims at presenting the teaching-methods approach that supports the practice of reorganization of "hard" disciplines from the collection intitled “Laboratório Virtual e Modelo Multiplicador por grupo: perspectivas para o desenvolvimento de competencias formativas” (Sanzovo, 2016), through the Flipped classroom with the use of Educational Technologies, e-book organization (Bornatto.; Sanzovo, 2017; Machado; Sanzovo, 2017), and Collaborative Methodology (Fragelli, 2104) in the context of higher education, in the initial terms, in order to allow teachers and students to be co-subjects on the teaching-learning process.

Keywords: *Teaching-methods reorganizatio, flipped classroom, collaborative methodology, use of ICT.*

Resumo

Este texto tem por finalidade apresentar a abordagem didático-metodológica que embasa a prática de reorganização (redesenho) de disciplinas ditas “hard” da Coleção “Laboratório Virtual e Modelo Multiplicador por grupo: perspectivas para o desenvolvimento de competências formativas”, (Sanzovo y Escola, 2016), por meio da Flipped classroom (sala invertida) com o uso de Tecnologias Educativas, organização de e-book (Bornatto y Sanzovo, 2017; Machado y Sanzovo, 2017) e da Metodologia Colaborativa (Fragelli, 2104) no contexto do ensino superior, nos períodos iniciais, de modo a permitir a professores e estudantes serem co-sujeitos do processo ensino-aprendizagem.

Palavras-chave: *Reorganização didático-metodológica, flipped classroom. metodologia colaborativa, uso das TIC.*

Introdução

Em um trabalho realizado por Cabero (2000) ele sinaliza as seguintes características gerais para as tecnologias em tempos da sociedade da informação e da comunicação: (i) Imaterialidade; (ii) Penetração em todos os setores – cultural, econômico, educativo, industriais –; (iii) Interconexão; (iv) Interatividade; (v) Instantaneidade; (vi) Criação de novas linguagens expressivas; (vii) Ruptura da linearidade expressiva; (viii) Elevados parâmetros de qualidade de imagens e som; (ix) Potenciação de audiência segmentária e diferenciada; (x) Digitalização; (xi) Tendência para a automatização; (xii) Diversidade; (xiii) Inovação.

Embora as novas tecnologias tendam a se apresentar de forma independente, oferecem grandes possibilidades para combinar-se e ampliar suas possibilidades individuais – em interconexão, ou interconectividade – como ocorre quando se une a televisão via satélite e a cabo ou quando incluem em multimídia uma direção web e um computador conectado à internet. Essas conexões permitem chegar a uma construção de novas realidades expressivas e comunicativas, como ocorre na combinação de imagem, áudio e texto para a construção de plataformas multimídias..

Outra característica marcante das novas tecnologias são seus elevados parâmetros de imagem e áudios, entendidos exclusivamente na qualidade da informação (elementos cromáticos, número de cores definidas e representadas, tonalidade, representação harmônicos, etc.) como quanto à fidelidade com que podem transferir-se de um ponto a outro, e como também de evitar falhas de interrupção na transferência das mensagens e dos ruídos comunicativos. Essas qualidades têm sido, sem dúvida, alcançadas, de um lado, graças à digitalização dos sinais visuais, auditivos ou de dados; por outro lado, pela melhoria que se tem realizado em hardware de transferência.

Se até recentemente a influência das novas tecnologias da informação e comunicação se centrava fundamentalmente em setores militares, bancários e de transferência de comunicação de massa, em pouco tempo seus impactos alcançaram todos os setores da sociedade, desde o ensino à medicina, ao mundo das artes e da pesquisa. Como assinala Negroponte (1995), a informação já não se ocupa dos computadores, mas da vida mesmo.

O avanço tecnológico tem sido tal que em pouco tempo se conta com tecnologias que, com menor volume e custo que seus antecessores, realizam operações não somente mais confiáveis senão impensáveis com as antigas.

Contudo, esse grau de rapidez inovadora, quando se reflete no meio educativo, embora oferte a vantagem de poder contar com uma tecnologia razoável para a realização de atividades não imaginadas até pouco tempo, também introduz o problema de pouca capacidade que a instituição educativa tem para absorver as tecnologias de maneira que muitas delas, quando incorporadas na sociedade em geral, são rejeitadas como ocorreu com o vídeo interativo, por exemplo.

Escola (2008), por conseguinte, alerta que a “busca e o acesso à informação, a posse e o desenvolvimento de competências no domínio das tecnologias da informação e da comunicação, a alfabetização informacional e audiovisual, constituem desafios fundamentais das sociedades desenvolvidas, pós-industriais e pós-modernas”.

Se nesse contexto educativo as novas tecnologias estão colocando à disposição uma verdadeira eclosão de informação, tanto de forma quantitativa quanto de forma qualitativa, é verdade também que há uma quantidade de ruídos, o que leva, por conseguinte, a se discernir entre se ter mais informações ou se estar mais informado, ou por outro lado, o problema não é mais localizar a informação, mas selecionar ou avaliar criticamente a informação.

Realizados esses comentários, aborda-se a questão das possibilidades que as novas tecnologias oferecem à informação, como grandes recursos, e como consequência ao contexto educativo, como: (i) Ampliação da oferta informativa; (ii) Criação de ambientes mais flexíveis para a aprendizagem; (iii) Eliminação de barreiras espaço-temporalidade entre professor e estudantes; (iv) Incremento das modalidades comunicativas; (v) Potencialização das modalidades dos cenários e ambientes interativos; (vi) Favorecimento tanto da aprendizagem independente e da autoaprendizagem como colaborativa e em grupo; (vii) Ruptura dos clássicos ambientes formativos, limitados a instituições escolares, ou sala de aula; (viii) Oferta de novas possibilidades para a orientação e tutoria dos estudantes; (ix) Facilitação de uma formação permanente.

Por conseguinte, uma das possibilidades que oferecem as TIC (Tecnologias da Informação e da Comunicação) é a criação de ambientes de aprendizagem que coloca à disposição dos estudantes uma amplitude de informação com rapidez de atualização. Toma-se como exemplo o progressivo aumento de hospedagem de páginas na web ou o incremento de revistas virtuais.

Dessa forma, para fazer frente às dificuldades de aprendizagem dos estudantes nos primeiros períodos das Engenharia, nos chamados núcleo básicos, a proposta apresentada é resultado do trabalho de doutoramento, de acordo com o objetivo e metodologia propostos.

2. Objetivo

De acordo com o trabalho de pesquisa, um dos objetivos propõe:

- Criar/construir materiais didático-metodológicos que deem respaldo aos professores em serviço na sua (re)qualificação para a construção das competências de organizar e dirigir situações de aprendizagem, utilizando-se das TIC, que sejam resultantes da pesquisa desenvolvida e que possam ser aplicadas e replicadas em outros contextos.

3. Encaminhamento Metodológico

Num trabalho de pesquisa-ação, realizado na Universidade Tecnológica Federal do Paraná, Câmpus Pato Branco, constituiu-se um grupo, formado por professores que ministram a disciplina de Cálculo Diferencial e Integral, dos cursos de Engenharia Civil, Mecânica e Elétrica – com grandes bolsões, variando de 47 a 70% de não aprovação, conforme mostra o Gráfico 1, mais bolsistas de área de matemática e computação com a organização e coordenação da pesquisadora para conceber e por em prática um design didático-metodológico que permite ao professor e ao aluno mudarem a relação tradicional do processo ensino-aprendizagem.

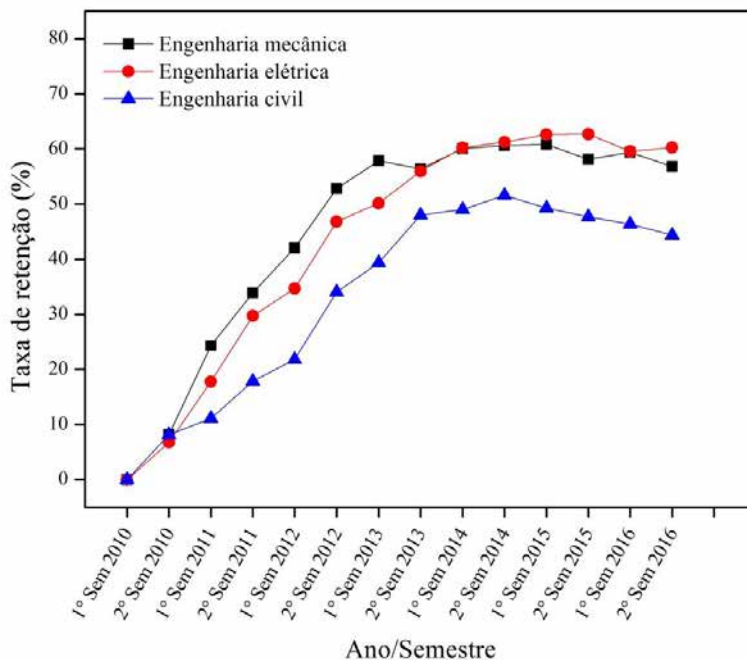


Gráfico 1 - Série histórica da retenção no primeiro período dos cursos de Engenharia (civil, elétrica e mecânica). Fonte: UTFPR-PB (2017)

Como se pode observar também, no geral, os índices de não aprovação nas disciplinas que envolvem Cálculo seguem a mesma tendência apontada em outras instituições.

No Brasil, dados dessa natureza são frequentes também na literatura, conforme apontam estudos de Wrobel, Zeferino e Carneiro (2013); Fernandes Filho (2001); Gomes & Lopes (2005); Lehmann & Lehmann (2006); Pereira et al (2010); Gomes (2012). Há estudos que colocam o foco do problema de ensino-aprendizagem no aluno, na formação inadequada, na falta de motivação ou mesmo em sua metodologia de estudo (Mendes & Giostri, 2008).

4. A proposta de Reorganização didático-metodológica

Dessa forma, a proposta de reorganização didático-metodológica aqui defendida se constitui de: (i) Laboratório Virtual – plataforma Moodle; (ii) Objetos de Aprendizagem (OA); (iii) Flipped Classroom (Sala invertida); (iv) Metodologias ativas colaborativas; (v) Ambiente Colaborativo, conforme ilustra a Figura 01.

Design da Proposta:

Laboratório Virtual (Moodle) + (Objetos de Aprendizagem – e-Book) + Flipped Classroom + Metodologia (s) Ativa (s) Colaborativa (s)

Figura 2 – Proposta de reorganização didático-metodológica (Designer). Fonte: Autoria própria

Há, pois, nesta perspectiva, mudança no modelo de comunicação em relação aos modelos unidirecionais de comunicação, onde há um emissor – normalmente o professor ou material didático, que envia ou manda a informação –, e um receptor, normalmente o estudante, que processa e em função de sua semelhança com a apresentada e recebe a qualificação acadêmica. Em contraposição a esses modelos unidirecionais, modelos mais dinâmicos propiciam que o receptor se converta em emissor de mensagens, tanto para receptores individuais como coletivos, ou seja, é importante levar em consideração, sobretudo, a utilização de ferramentas de comunicação telemática que funcionam em contextos multifuncionais.

4.1. Laboratório Virtual

O Laboratório Virtual propõe um modelo de intersecção e interação utilizando as tecnologias de informação e comunicação, para criar serviços que dão suporte ao ensino e à pesquisa, mas mais do que o aporte do recurso tecnológico é a possibilidade de desenvolver uma cultura da autonomia no estudante, posto que a cultura da aula narrativa continua muito forte e arraigada nos nossos sistemas formativos – é preciso, pois, aprender a aprender, desaprender e reaprender na atual sociedade da informação, quando os conteúdos mudam tão rapidamente também.

4.1.1. Os Objetos de Aprendizagem (AO)

Segundo Balbino (2007 p.01),

[...] Objetos de Aprendizagem são definidos como uma entidade, digital ou não digital, que pode ser usada e reutilizada ou referenciada durante um processo de suporte tecnológico ao ensino e aprendizagem. Exemplos de tecnologia de suporte ao processo de ensino e aprendizagem incluem aprendizagem interativa, sistemas

instrucionais assistidos por computadores inteligentes, sistemas de educação à distância, e ambientes de aprendizagem colaborativa.

Um bom Objeto de Aprendizagem deve estar dividido em três partes (Bettio e Martins, 2004, p.3): (i) Objetivos: tem como finalidade mostrar ao aprendiz o que ele poderá aprender com o estudo do Objeto. Pode, por exemplo, conter uma lista de conhecimentos prévios necessários para um bom aprendizado; (ii) Conteúdo instrucional: mostra todo o material didático que é preciso para que no final o aluno atinja os objetivos dispostos no item anterior; (iii) Prática e feedback: uma característica importante dos Objetos de Aprendizagem é que ao final dela coloca-se uma avaliação, para que o aluno veja se atingiu às expectativas, e se não, utilizá-lo novamente, quantas vezes for necessário.

Quando um Objeto de Aprendizagem é criado, o conteudista repassa todos os dados para a construção do metadados, assim qualquer pessoa pode procurar objetos em qualquer repositório.

Se na Educação a Distância, os Objetos de Aprendizagem podem ser propulsores das redes de aprendizagem, onde a partir da vivência e experiência com determinado Objeto o estudante pode socializar suas conclusões com os demais participantes da Comunidade de Aprendizagem, fazendo com que cada um possa trazer a sua contribuição visando à construção coletiva do conhecimento, mais ainda podem contribuir na educação regular/presencial quando o professor se coloca como agente pontifex¹, ao lado dos estudantes, ora como aprendiz, ora como mediador, não impondo sua opinião, mas construindo conjuntamente um conhecimento significativo para todos, onde possa haver, baseado em trocas, a vivência de situações autênticas de aprendizagem.

Assim, nesta proposta, os Objetos de Aprendizagem constituem-se de e-books (Bornatto, Sanzovo, 2017 e Machado, Sanzovo, 2017), depositados no Laboratório Virtual, plataforma Moodle, com o conteúdo determinado para cada disciplina de cálculo, nos núcleos básicos de cada curso dos cursos de Engenharia, como mostra a Figura 1.

¹ Título dado nos tempos antigos aos construtores de pontes, em virtude dos rituais religiosos que acompanhavam esta construção. (Weil, 2003)

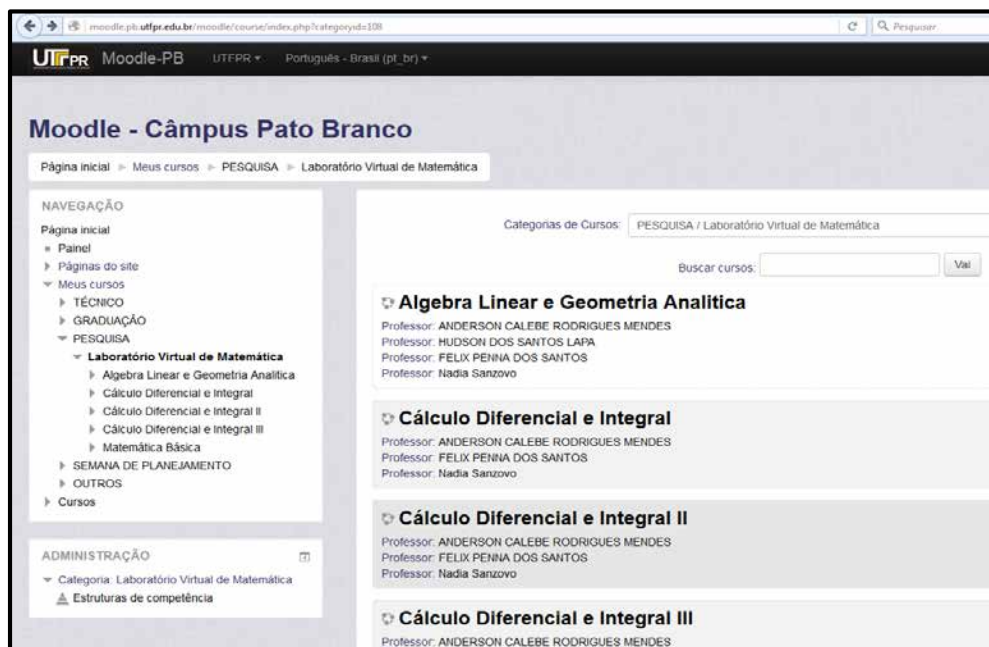


Figura 3 - Página inicial do Laboratório Virtual de Matemática. Fonte: Sanzovo (2016)

4.2. “The Flipped Classroom”- A Sala Invertida

O método consiste em: (i) fornecer os conteúdos com antecedência de forma que os estudantes possam se preparar antes de ir para a sala de aula; (ii) motivar os estudantes a serem protagonistas de sua própria aprendizagem; (iii) mobilizar aulas participativas, com discussões e aplicações práticas. Como vantagens, os defensores apontam uma adequação ao ritmo individual, já que as aulas em vídeo permitem andar, parar e andar para trás. Permitem também a comunicação com colegas e professores, aumentando a motivação; já os que se opõem apontam para uma grande dependência da tecnologia e um reforçar do tempo de ecrã. Assim, baseando-se nas reflexões que se têm produzido sobre a educação a distância – EAD – a questão da organização da sequência de atividades de ensino-aprendizagem vem ocupando a pauta de muitas dessas pesquisas e têm apontado que o ponto de partida tem sido sempre o ensino presencial. Schneider e outros (2013) apontam que, nessa modalidade, é essencial para a constante melhoria dos cursos oferecidos se pensar e buscar uma organização curricular específica e não apenas a transposição do modelo da escola tradicional, centrada na aula expositiva.

Dessa forma se pensa um currículo misto, ou utilização do expediente da modalidade EAD (Educação a Distância), no caso do “*Flipped Classroom*” no ensino regular e presencial, o que poderá conciliar as positivities de ambas as modalidades.

Muitas são as vantagens, segundo seus apoiadores, que estão presentes nessa modalidade metodológica, dentre as quais se destacam: (i) Os estudantes recebem feedback imediato porque os docentes dispõem de mais tempo para apoiar nos conceitos mais difíceis; (ii) O nível de frustração é menor, pois o estudante que antes deixava tarefas sem acabar devido à complexidade e/ou falta de pré-requisitos, nessa possibilidade conta com a ajuda do professor (e dos colegas) para realizar as tarefas; (iii) Os professores podem explicar com mais detalhes partes mais difíceis; (iv) Aqueles estudantes que não dispõem da ajuda/apoio familiar para seus estudos recebem de seus professores.

Enfim, o “Flipped Classroom” pode possibilitar ao estudante um papel muito mais ativo em seu processo de aprendizagem e uma maior responsabilidade em sua formação, ou seja, pode ser uma metodologia, conforme apregoa Canfranc (2015), para construir o cidadão do século XXI.

4.3. Metodologia ativa colaborativa

Em diferentes trabalhos (Cabero e Hernandez, 1995; Cabero e Marquez, 1997 e 1999), conforme aponta García-Valcárcel (2003), tem-se insistido nas possibilidades educativas que tem o uso dos *media* pelos alunos como: contextualização dos *media* e dos materiais de ensino, passar de meros reprodutores/receptores a produtores de *media* e à compreensão de seu processo, aprendizagem das linguagens e características técnicas das tecnologias..., sinalizando que sua verdadeira potencialidade educativa não se encontra no produto propriamente dito, mas em todas as atividades que são realizadas no processo.

De outro lado, não se deve esquecer a significação ou significância que a aprendizagem ativa colaborativa está adquirindo com as tecnologias nos últimos tempos. A aprendizagem colaborativa tem recebido diversas conceituações, como se pode observar em Owens (1989), citado por García-Valcárcel (2003) nos seguintes termos: “[...] el intercambio y cooperación social entre grupos de estudiantes para el propósito de facilitar la toma de decisiones y/o la solución de problemas. La colaboración entre aprendices les permite compartir hipótesis, enmendar sus pensamientos y trabajar mediante sus discrepancias cognitivas”.

Sob esta perspectiva, considera-se que a função da educação é mostrar aos estudantes como devem chegar a construir os conhecimentos em colaboração com o restante dos seus companheiros.

Para diversos autores clássicos e contemporâneos, elencados por García-Valcárcel (2003), como Teilhard de Chardin (1982), Vygotsky (1984), Levy (2007) e Castells (2002), dentre outros, a educação se beneficia dos relacionamentos interpessoais, da interação com a realidade, da afetividade e da troca de experiências. Isto pode ser obtido hoje em muito maior escala do que há apenas dez anos, graças a ambientes virtuais de informação, comunicação e compartilhamento de conteúdos como o *facebook*, *google*, *twitter*, *youtube*, *skipe*, *slide share* e muitos outros.

Torres (2004) propõe doze princípios considerados essenciais em sistemas de aprendizagem colaborativa: (i) Participação ativa do estudante no processo de aprendizagem; (ii) Mediação da aprendizagem feita por professores e tutores; (iii) Construção coletiva do conhecimento, que emerge da troca entre pares, das atividades práticas dos estudantes, de suas reflexões, de seus debates e questionamentos; (iv) Interatividade entre os diversos atores que atuam no processo; (v) Estímulo aos processos de expressão e comunicação; (vi) Flexibilização dos papéis no processo das comunicações e das relações a fim de permitir a construção coletiva do saber; (vii) Sistematização do planejamento, do desenvolvimento e da avaliação das atividades; (viii) Aceitação das diversidades e diferenças entre os estudantes; (ix) Desenvolvimento da autonomia do estudante no processo ensino-aprendizagem; (x) Valorização da liberdade com responsabilidade; (xi) Comprometimento com a autoria; (xii) Priorização do processo sobre o produto.

Esses princípios estabelecem um referencial que precisa hoje ser mais bem discutido, sob a visão dos autores, e entendido, uma vez que são múltiplas as estratégias possíveis para que cada uma dessas características seja alcançada.

A evolução tecnológica introduz continuamente novas alternativas no ambiente educacional que podem ser empregadas com tais finalidades. Observa-se que há, sim, tecnologias e ferramentas capazes de ser adequadamente integradas, de impulsionar a realização de tais princípios. O que ocorre, todavia, é que essa integração ocorre apenas em uma escala reduzida, empregando pouco do potencial disponível.

Stahl e outros (2004), citados por Pallazo e Ulbrich (2015), observam que a pesquisa em Sistemas de Aprendizagem Colaborativa (SAC) deve atender a diversos objetivos e apresenta múltiplas restrições

No entanto, embora todas essas ferramentas possam ser – e até tem sido – empregadas em educação colaborativa, não há por enquanto propostas concretas da integração, organização que permitem o seu uso pleno como pano de fundo em ambientes educacionais. Em geral, as redes sociais são empregadas meramente como ferramentas auxiliares de comunicação, em acoplamento fraco com as metas educacionais e cognitivas assumidas por determinado coletivo ou grupo.

4.3.1 Da Metodologia Colaborativa “Dos Trezentos”

A utilização de tecnologia de informação e comunicação possibilita desenvolver mecanismos que auxiliam no ensino e aprendizagem em ambientes universitários, como é o caso desta apresentação de uma alternativa metodológica, na modalidade de metodologia colaborativa, com apoio do Laboratório Virtual, propondo um modelo de intersecção e interação utilizando as tecnologias de informação e comunicação, para criar serviços que dão suporte ao ensino e à pesquisa.

Nesse sentido, espera-se construir e desenhar formas para possibilitar também a formação continuada de professores que ensinam Matemática – área de grande impacto na manutenção

sistêmica da reprovação e evasão nos cursos ditos hard –, por meio de um Modelo Multiplicador por Grupo, contribuindo na criação de uma nova distribuição de espaço, relação de tempo entre o trabalho do professor com o aluno e na construção da virtualização no sentido da ampliação do conhecimento e da informação.

Essa perspectiva se contrapõe ao modelo, chamado clássico, de ensino que continua a persistir sem questionamento por grande parte de professores, alunos e pela própria sociedade em geral em que o professor ensina, básica e fundamentalmente, dizendo aos estudantes o que se supõe que devem saber. É o que Don Finkel (2008) denomina “dar aula narrando”, contrapondo o modelo de “dar aula de boca fechada”, que estimula a busca de maneiras alternativas de ensinar.

Segundo Fragelli (2015), existem vários fatores que influenciam no baixo índice de concluintes nos cursos de Engenharia tais como a falta de conceitos prévios suficientes para uma aprendizagem significativa, a pouca relação entre o que é ensinado e o mercado de trabalho, e a insistência no modelo tradicional de ensino e aprendizagem que, por diversas vezes, se mostra ineficiente. Também um aspecto muito importante e pouco explorado está relacionado à forma de avaliação da aprendizagem utilizada, principalmente concernente ao nervosismo e à ansiedade que provoca em alguns estudantes.

A metodologia dos Trezentos (Fragelli, 2015) consiste, pois, em promover ao máximo a colaboração entre os estudantes, despertando o olhar para as dificuldades de aprendizagem do outro. Nesse sentido, para que essa colaboração seja estimulada, são formados grupos de estudo. Os estudantes realizam uma prova e, com base no resultado dessa avaliação, os grupos são formados pelo professor e contêm, obrigatoriamente, alguns estudantes que tiveram bom rendimento e alguns estudantes que tiveram rendimento considerado insatisfatório.

As atividades geralmente são as seguintes: (a) dois encontros presenciais com os integrantes do grupo com, pelo menos, duas horas de duração; (b) entrega de uma lista de exercícios desenvolvida pelo professor; e, (c) resolução de uma prova desenvolvida pelo líder do grupo. d) suporte do Laboratório Virtual, com o conteúdo organizado em e-book.

O líder do grupo é o estudante com a maior nota do grupo. Os estudantes com rendimento insatisfatório que completarem todas as atividades propostas poderão realizar uma nova prova e ficarão com a melhor das duas notas que, quase na totalidade dos casos, é aquela obtida na segunda avaliação. Os estudantes com bom rendimento não podem refazer a prova, contudo, melhoram a própria nota considerando duas dimensões: (a) o nível de ajuda oferecido aos estudantes do grupo; e, (b) a melhora no rendimento dos estudantes ajudados.

Para medir o nível de ajuda oferecido por um determinado estudante, é aplicado um questionário ao próprio estudante em que ele distribui os alunos ajudados do seu grupo de acordo com uma escala de Likert de cinco pontos variando de 1 (ajudei nada) a 5 (ajudei muito).

Uma outra escala de Likert é aplicada aos estudantes ajudados em que devem distribuir os estudantes do seu grupo que o ajudaram na melhora do seu rendimento. A escala também possui cinco pontos e varia de 1 (ajudou nada) a 5 (ajudou muito). O nível de ajuda final atribuído a um ajudante é medido com base na média entre essas duas escalas arredondando-se o resultado para cima (p.ex. 4,5 arredonda-se para 5).

As atividades que se propõem, geralmente, são as seguintes: (a) dois encontros presenciais com os integrantes do grupo com, pelo menos, duas horas de duração com suporte do Laboratório Virtual – e-book com o conteúdo organizado e disponibilizado por meio de aulas gravadas; (b) entrega de uma lista de exercícios desenvolvida pelo professor; e, (c) resolução de uma prova desenvolvida pelo líder do grupo - geralmente o estudante com a maior nota do grupo. Os estudantes com rendimento insatisfatório que completarem todas as atividades propostas realizam uma nova prova e ficam com a melhor das duas notas que, quase na totalidade dos casos, é aquela obtida na segunda avaliação. Os estudantes com bom rendimento não podem refazer a prova, contudo, melhoram a própria nota considerando duas dimensões: (a) o nível de ajuda oferecido aos estudantes do grupo; e, (b) a melhora no rendimento dos estudantes ajudados. Uma Tabela Excel exhibe a correlação entre essas duas dimensões e o acréscimo na nota dos ajudantes com a maior nota do grupo.

5. Considerações finais

Esta proposta de desenho didático-metodológico disciplinar, aliando Objeto de Aprendizagem (e-book), metodologia colaborativa e uso dos recursos tecnológicos - TIC, possibilita aos estudantes aprenderem melhor, seja pela característica humanista da proposta em que há uma colaboração para a aprendizagem, fazendo com que ele veja o outro e se coloque no lugar dele (Roger, 1973), ou pela percepção de aprender significativamente o conteúdo e, por outro lado, reestrutura o fazer pedagógico do professor.

Os professores que trabalham com o Laboratório Virtual e Objetos de Aprendizagem e aplicação da Metodologia Ativa Colaborativa precisam se firmar e ter domínio técnico dessa prática para poderem disseminá-la entre os seus pares, de modo que se estabeleça a cultura de desenvolver formas de aprender por meio da imersão tanto do professor como do estudante em experiências reais ou simuladas que exijam a solução de problemas condizentes com a prática social da área de estudo.

Sua aplicação coloca o professor em serviço diante de problemas que mobilizam o seu potencial intelectual para compreendê-los de modo que o conduza a obter informações, necessárias para a possível solução – o que contribuirá com o desenvolvimento da autonomia intelectual do estudante, papel fundamental da Universidade, bem como da reestruturação do papel do professor na sua prática docente.

Aliados a essa concepção das Metodologias Ativas Colaborativas, que envolve os estudantes como indivíduos ativos em seu processo educativo, são agregados os pressupostos principais

da Teoria da Aprendizagem Significativa – TAS (Ausubel et al, 1980) a fim de alcançar o ensino-aprendizagem eficiente e personalizado às características de cada aprendiz.

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