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PEER PAIRED RANKING: ASSESSING AND TRAINING 21ST CENTURY GRADUATES

1. Introduction

In the context of European Higher Education, universities are highly adopting innovative curricula focused on students acquisition of skills and competences needed for the further career development of the 21st century graduates [1][2]. Particularly, Universitat Politécnica de Valencia (UPV) (Spain), has launched an institutional Project on transversal skills UPV (i.e. skills acquired by the UPV graduates). This project is supported by the strategic plan UPV2020. Its main goal is to accredit, by using rubrics, 13 transversal skills of any graduate from the Universitat Politècnica de València [3].

Within this paper, we work on one of the 13 transversal skills, particularly, critical thinking. Our aim is not just to assess the level of acquisition of this skill, but also to improve students' performance. In so doing, an innovative computer-based tool is introduced based in 'paired peer ranking'. It is also shown that peer assessment strengthens students skills, encourages participation, promotes academic excellence, and hence increases students' performance, offers higher feed-

back, fosters attendance, and promotes greater accountability on the part of the students.

It is widely recognize that, among the most in demand graduate skills in the professional work, it can be found to be able to analyze information, to be critical of oneself and of others, to be able to solve problems and to communicate, as well as being able to sustainably improve along their professional career [4]. However, the traditional assessment methods do not reflect the acquisition of such skills [5], [6]. For this reason more innovative assessment methods are developed by faculty to permit the evolution of the assessment concept is aligned to the results expected from the students, both in terms of performance, and in terms of skills. In this context, one of the main goals of this change of approach in the European higher education landscape is to accompany students in their learning process as they see their progress when building their knowledge [1], [7]. This is what is called formative assessment. Formative assessment is known as any assessment that provides feedback to students throughout the course and helps them improve their learning, regardless of it being graded or not [8], [9]. Thus students reinforce their own learning as a result of the results of their assessments.

However, the reality we now face in classrooms is that assessment systems are not always formative assessments. Therefore, they do not always guarantee a higher level of learning by students. Although there are now more assessment acts than before the current educational reform, they do not always offer associated higher motivation, greater participation or a higher level of learning outcomes achieved by students [10].

Of all the different assessment systems, it has been shown that peer assessment increases students' motivation because they feel they actively participate in the process, and not only in learning, but also in assessing. Students also learn to be more critical, and they can also compare the results of the assessments they make with those made by peers or teachers. Thus it can be stated that peer assessment emphasizes skills, encourages participation, focuses on learning, promotes excellence, provides more feedback, encourages attendance, and teaches students responsibility and critical thinking [7], [11]-[13].

Of all existing peer assessment methods, here we focus on 'Peer paired Ranking' as an evaluation methodology for peer comparisons. It is a specific type of assessment that works in the order from the best to the worst work. This order is established by evaluators (students) who compare works in pairs according to certain preset factors or criteria [7], [13]. Hence through competitiveness among students, we intend to improve the results of student learning, participation, motivation and also critical thinking.

Assessing is quite a hard work and requires previous training in order to guarantee that it has been done effectively. For this reason, 'Peer paired Ranking' by

comparing the results in pairs, has been chosen instead of asking students to set a grade; this is with the aim of simplifying students' assessing work, and to facilitate objectivity and generalizable results.

Resulting from its application, the aggregated results of all the comparisons should allow the best to worst works to be defined and sorted, and the resulting order with the assessments made by each student to be compared. This system will speed up not only the peer review process, but also the subsequent management of the results to search for a more formative assessment.

This ranking can be most useful not only for the student's further qualification (both assessed and assessor), but also as a tool of student participation and motivation.

2. Peer paired ranking methodology and application

Students' assessment can be undertaken using different assessment methods depending on knowledge, competence and the subject to be assessed; as for instance: oral presentations; written reports; development of a project; team work; individual contributions in class; open question tests; student's portfolio; etc… During this work we study a methodology to assess short written reports. Particularly, we aim to use the assessment process as a tool for enhance the knowledge and competences of the students using formative assessment. In so doing we propose peer ranking as a formative assessment methodology. This methodology can be used also for other types of works done by the students, but we have chosen written reports as a pilot [14].

Peer paired ranking consists of, not just establishing a ranking of all the reports written by the students starting from the best one to the worst, but also doing it by comparison in a pair-wise mode by the authors, in this case, the students.

Establishing a ranking among students' results is not an easy task, especially when the number of outcomes to order is high or when the difference in terms of quality is not that high. Ranking from binary comparisons, also called peer-ranking, can be undertaken to simplify this decision making problem and to guarantee objectivity in the results. Indeed, instead of directly choosing one alternative from a set of options, or ranking all alternatives directly according to their desirability, it is often much simpler to start by comparing alternatives in a pair-wise fashion [15].

However, inadvertent biases and uncertainties constitute an indispensable part of many decision support processes. They are related to the specification of a decision problem, the environment in which the decision has to be made, and the character of the value system and preferences of a Decision Maker (DM). The complexity of this issue has led to the development of a framework for robust-

ness analysis, i.e. a theoretical basis and a diversity of dedicated multiple criteria decision support methods that take into account internal and external uncertainties observed in the actual decision situations [16].

There are different approaches to study this sort of problems minimizing the biases and optimizing results [17]. In our work, we build on the work done by Kadzinski et Al [16]. They focused on multiple criteria ranking problems with deterministic performance evaluations, and model the Decision Maker's preferences with additive multi-attribute value models defined through holistic pairwise preference statements (i.e. alternative a is (weakly) preferred over b). We aim to adapt their REPROC algorithm to obtain a pair-wise ranking of work done by our students during certain courses.

By using this algorithm we are reducing the amount of required paircomparisons in order to assure the best possible result for the obtained ranking. If we perform the peer-ranking in an arbitrary order, the number of comparisons needs to be really high (all the reports must be compare to the others). However, by using this algorithm, the saturation point is reached faster, therefore, not all the reports need to be compared against each other [16], [18]-[20].

Prior to the work done by the students, the professor grade the reports, and the marks are uploaded on the tool. So at the end of the process, two different results are obtained from this tool. On the one hand, it can be assess the ability of the students to compare the reports, in contrast to professor results; and therefore its critical thinking skills (they have been discerning between better and worse reports). And on the other hand by showing them different quality levels of reports, they are enhancing their knowledge, and therefore increasing their performance by the end of the course.

3. Conclusions and future research

Peer paired ranking is seen as a plausible objective and formative assessment methodology. Additionally, students enhance their learning outcomes by comparing better reports and worse reports. They identify the differences between them and the reasons for being worse or better.

This methodology can be spread among other types of student's work not just written reports. We are now working in determining a whole range of quality criteria for written works in courses with both engineering and management backgrounds. Our intention is to include this type of assessment in the syllabus of certain courses next year.

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