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Using Rubrics as Alternative Self-Assessment Technique of Project

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Abstract

In this paper, the effectiveness of employing rubric as a self-assessment technique of the project method is investigated, which covers a wide range of knowledge, skills and abilities in a variety of learning objects and activities. The assessment rubric is defined as a descriptive rating guide, which consists of specific pre-defined performance criteria. It is an alternative assessment technique, which produces a valid evaluation through a process of determining attainment based on pre-defined qualitative classifications of specific criteria. In this study, the assessment rubric was used as a self-assessment technique in the implementation of a project entitled "Utopia and Reality", conducted in ASPETE (School of Pedagogical and Technological Education) during the year 2017-2018. The students of two undergraduate departments of ASPETE participated in the study. The analysis of the data revealed statistically significantly differences in the students' self-assessment levels (as identified by the rubric) with respect to the students' gender and the department of study. Moreover, the tool allowed the students to evaluate the end product of their efforts, thus allowing for their realizing the usefulness of the rubric as a self-assessment tool.

Keywords: rubric, self-assessment, technique.

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1. Introduction

The use of qualitative assessment methods is an important issue in the field of education, especially nowadays that the citizens need to develop a variety of skills with aiming to fulfill the professional and social needs. Evaluation, as an integral part of the educational process, can contribute both to the development of these skills and to the overall improvement of the education.

The aim of this paper is to highlight the rubric as an alternative assessment tool that leads learners to self-assessment processes through reflection and feedback and the development of metacognitive skills. For this reason, a rubric was made in order to be used as a technique of evaluation of project. Project is each organized learning activity that takes place in the educational process, is developed as a free choice, with a predefined plan and aims at exploring, organizing and managing knowledge, materials, values and actions (Frey, 1986). According to Kilpatrick (1935) "The Project method is a planned action that takes place with the whole heart and takes place in a social environment". According to Frey (1986) "it is every organized learning activity that takes place in the educational process, it is developed in a free choice, with a predefined plan and aims at exploring, organizing and managing knowledge, materials, values and actions" (p.8).

A rubric is a qualitative assessment technique, which differs from conventional assessment methods, leading students to self-assessment and peer review assessment through reflection and feedback. The assessment rubric is defined as a descriptive rating guide, which consists of specific pre-defined performance criteria (Petropoulou, Kasimatis and Retalis, 2015: 101). It is an alternative assessment technique, which produces a valid evaluation through a process of determining attainment based on pre-defined qualitative classifications of specific criteria (Mitchel and Crawford, 1995).

It is also defined as a document which describes different levels of academic progress (e.g. from insufficient to perfect) (Andrade, 2000). Andrade (2003) argues that although the format of an instructional rubric can be varied, all rubrics have two features in common: (1) a list of criteria, or 'what counts' in a project or assignment; and (2) gradations of quality, with descriptions of strong, middling, and problematic student work".

More specifically, a rubric can be considered as a combination of:

- Criteria, the characteristics that a project must fulfill in order to be evaluated as correct, appropriate and complete, the conditions of a performance that must be met for it to be considered successful.
- Quality standards, the qualitative classification which describes (e.g. excellent, very good, good, etc.) the level of quality of the end product,
- Detailed description of students' achievement according to the relevant assessment criteria,
- Numeric scale, the possible points to be assigned (high to low) (Petropoulou, Kasimatis & Retalis,
- 2015, p. 101).

Thus, the vertical axis contains the criteria of achievement and the horizontal the quality levels of performance and the scale (Alter and McTighe, 2001; Andrade, 2001; Arter & Chappuis, 2009; Reddy, 2007).

Rubrics according to the learning aims and the nature of the feedback they offer, they are divided into two categories: a) holistic and b) analytical. In a holistic way, an overall grade is based on the overall quality of achievement, while individual grades for each dimension of performance are provided in detail (Wiggins & McTighe, 2005).

Holistic rubrics refer to the overall quality of student achievement (Nitko & Brookhart, 2007). It is an approach that uses holistic scoring providing the students with feedback in combination with the score of an analytical rubric or another evaluation process. In contrast, the analytical rubrics refer to the evaluation of specific dimensions, or elements of performance (Nitko &Brookhart, 2007). Holistic

rubrics require teachers to focus on onelevel or rating of performance that best exemplifies the overall quality of performance or product. They are often used to provide an overview of student work (Whittaker, Salend & Duhaney,2001), or when it is difficult to break out individual components of an assignment. In contrast, analytic rubrics focus on multiple aspects or components of performance and include several different quality indicators, allowing teachers to help students focus on all components of the product (Whittaker,et.al, 2001).

According to Lantz (2004), the analytically rated criteria provide useful feedback on the good and weak points of the product or process being assessed (more diagnostic), and in particular provide: a) a detailed basis for evaluation, b) Additional information since many evaluators evaluate the same performance, c) additional information on each quality level of each criterion (p.48).

Based on the purpose and the characteristics, they are divided into three categories: a) Task specific are unique to a specific task and provide a reliable form of assessment of performance on a specific task and b) developmental, which assess the development of skills (Solomon, 1998: 121).

The teachers by using the rubric can assess the achievement of the pupils and the students have the chance to be involved in their assessment through their participation in the project and in the evaluation process. This kind of evaluation helps the teacher perceive behaviour of work performance of students. Additionally, students are given a chance to assess themselves in terms of work performance related to the tasks assigned by the teacher (Turk & Sari, 2017).

According to Whittaker, et.al (2001), there are specific benefits of the use of rubrics for students and teachers, such as the following: a) Students see specific criteria needed for success in an assignment or assessment; b) they are able to develop their metacognitive or thinking skills by monitoring their own progress on assignments or tasks; c) they are encouraged to develop their self-assessment skills by becoming knowledgeable about the standards needed for success; and they are able to use the rubric as a final check before submitting an assignment.

Also, there are a lot of benefits of the teamwork and assessment which focus on the participation of the team members in group activities, such as project, on discussion, planning, informing, conflict problem solving and group relations. Students have the chance to evaluate themselves in terms of team work using rubrics as a self- assessment technique (Jirasak, 2017).

2. Methods

2.1. Purpose of the study

The purpose of our study is to investigate the effectiveness of employing rubric as a self-assessment technique of the project method, which covers a wide range of knowledge, skills and abilities in a variety of learning objects and activities. More specifically, our purpose is to investigate if there are differences in the students' self-assessment levels (as identified by the rubric) with respect to the students' gender and the department of study.

Research Questions:

What are the differences of the students' self-assessment levels (as identified by the rubric) regarding to the students' gender?

What are the similarities and the differences of the students' self-assessment levels (as identified by the rubric) between Civil Engineering Educators and Mechanical Engineering Educators?

2.2. Participants

The participants were 141 students of the two undergraduate Departments of ASPETE (Educational Mechanical Engineering, Civil Engineering), where 106 of them finally responded to the rubric. All the

above students successfully attended on the course Practical Teaching Placement during the academic year 2017-18.

2.3. Research Strategy

The quantitative method was chosen for this study because it was suitable for describing and investigating the characteristics of the population under investigation. It is an appropriate method when it is necessary to check specific research cases or questions and it is the most appropriate method for the investigation, the description and the explanation of the relationships between variables (Cohen, Manion & Morisson, 2008).

In this study, the assessment rubric was used as a self-assessment technique in the implementation of a project entitled "Utopia and Reality", conducted in ASPETE (School of Pedagogical and Technological Education) during the year 2017-2018. The rubric that was employed in the study included the following criteria (each with pre-determined quality levels; Kasimatis & Papanikolaou, 2012): Quality and Content completeness, Scientific validity, Structure and Organization, Form and Presentation. The rubric is described below:

Table 1 .Analytic Rubric

Insufficient **Quality and Content completeness** **Content Scientific**	**Average**	**Good**	**Very good**	**Perfect**
The assignment presents fragmentary parts of the project without giving a clear picture of the project. It also doesn't contain appropriate material and information as well as the students do not use the references of their sources.	The assignment includes a concise presentation of the project in a brief and obscure way. The text contains mistakes and inaccuracies, while the sources that are used are incomplete and they are written down at the end of the text.	The assignment mainly refers to the instruction of how the project can be made and less to functional instructions, or vice versa. The presentation of the project is concise, but comprehensible, with the sources mainly written down at the end of the text.	The assignment describes the purpose, the location, the structure and the operation of the project. The sources that are used are valid and they are written down where they should be.	The assignment includes (a) a detailed description of the purpose, structure and function of the project; (b) lists valid sources (scientific journals,, books, etc.) used in the text; As references at the end of the work, (c) comments on and assesses the development of the project regarding to

				the current developments in the field.
Content Financial				
The assignment does not include an economic study or includes fragmentary financial data regarding to other information.	The assignment includes financial data for some of the project implementation phases (design-construction-operation) without mentioning sources of finance and without commenting on costs to benefit.	The assignment provides financial data for the construction and its individual parts as well as the financial sources. There is no cost-benefit comment.	The assignment (a) provides financial information regarding to the construction and operation costs of the project, (b) reports financial sources, (c) evaluates costs to the benefit	The assignment includes: (a) complete financial data regarding to the cost of design, construction (analyzing the different phases and parts of construction), and the operation of the project (income / expenses) in human resources as well as the materials, (b) (c) comments on costs, proposes alternative approaches and evaluates costs and benefits.
Content Environmental				
The project impact on the environment is not presented or it is commented with mistakes and ambiguities giving personal opinions and considerations.	The project impact on the environment is commented with personal considerations and opinions without the linked literature sources. In several places, the text is obscure or unclear and	The impact on the environment is presented and commented in general on both the construction and the operation of the project. In some subtasks of the Assignment the text is	The assignment (a) presents the impact of the construction or operation of the project on the environment using linked literature	The assignment includes: (a) presentation of the impact of the construction and operation of the project on the

	includes generalizations that it is impossible to be checked for their correctness.	unclear and there aren't literature sources regarding to the impact on the environment.	sources (b) refers specific environmental studies regarding to the project impact on the environment.	environment with linked literature sources; (b) reporting of studies on the project environmental impact; (c) comments on alternative ways of reducing the environmental impact.
Insufficient	**Average**	**Good**	**Very good**	**Perfect**
Content Historical				
The assignment includes mistakes and inaccuracies regarding to the historical data as far as the development of the project or the area is concerned and influenced the design and the implementation of the project.	The assignmentrefers to historical data that influenced the development of the project or the area. Fundamental historical facts are missing.	The assignment is briefly referring to important historical data that influenced the development of the project or the area without commenting on the way they are linked to the project.	The assignment presents thoroughly and comments on the most important historical facts that influenced the construction and the operation of the project.	The assignment presents and comments on historical data on the development of the project, problems and solutions that were given in different phases of the project. Historical facts are linked to the area and work-related efforts made before the construction.
Content Social				
The assignment includes mistakes and inaccuracies about the social impact of the project on local or broad society but in not so much extended way.	The assignment outlines the social impact of the project on local or broad society but in not so much extended way. Significant impacts are	The assignment presents without commenting on the connection of the project with the local society or broad society. In addition	The assignment presents and comments on the connection of the project with the	The assignment presents and comments on the connection of the project with the

	missing.	it presents some advantages and disadvantages project implication to the local or broad society.	local or broad society. In addition, it presents the most important advantages and disadvantages project implication to the local or broad society.	local or broad society. In addition, it presents the advantages and disadvantages project implication to the local or broad society.
Scientific validity				
The data provided for the project are not linked with literature sources or the sources that are used are not valid and reliable.	The data for the project is linked with sources of low reliability, i.e. the author is messing, or the author is not reliable.	The data provided for the project are comprehensive and interrelated. The data are linked with sources mainly from professionals and private operators.	The data provided for the project are comprehensive and they are linked. Sources are accurate and they are used within the text and as well as in the end as reference.	The data provided for the project are linked with reliable and valid literature sources, such as scientific journals, scientific articles, / institutions, books, etc. The arguments are based on relevant literature sources. All sources are used within the text and as well as in the end as reference.
Structure and Organization				
The structure of the presentation is not distinct. In the home page there are no contents of the presentation.	The presentation is not followed by structure step making. The students may not be able to engage with the other parts of the presentation.	The structure of the presentation is organized according to independent. Sometimes it is not obvious how you return to the homepage. There is not	The structure of the presentation is distinct. In the home Page there are the contents of the presentation. The	The structure is organized according to the thematic axes It's easy to navigate into the presentation and you always

		always the option to return to the homepage.	navigation in the presentation is serial, one slide after the other without having the option of returning to the homepage.	know how to return to the homepage.
Form and Presentation Aesthetics				
There is few or no multimedia in the presentation. Slides contain a lot of text without highlighting the important information. There is no a proper formatting of presentation slides such as the size of letters in the titles and the text and the utilization of the color in the text.	Limited multimedia on slides that sometimes help the reader to understand the meaning of the text. There are slides with a lot of text without highlighting the important information.	In the presentation the multimedia takes a place in a harmony way. Slide widgets help the reader to understand the meaning of the text. Hyperlinks lead to websites, video or text files.	The slides combine picture and text in a harmony way, highlighting a single message. All the slides are entitled. The multimedia is used in a proper way to help the reader to understand the content of the most slides. There is a proper formatting.	The students seem to have an advanced level on the use of multimedia, something that helps the reader to understand the content of all slides. The formatting (colors, letter size / format) is proper, making it easy for the reader to understand the content of the slides.
Functioning				
There are spelling errors. There are up to 5 websites that are no longer available, pictures/ videos that are not displayed.	There are some spelling errors and some websites that are no longer available, pictures/ videos that are not displayed	Most graphics are displayed normally, and the hyperlinks are proper working. There are few spelling errors. There are no interactive	The graphics are proper displayed, and the hyperlinks are proper working. There are no	All the hyperlinks are proper working and the graphics are proper displayed. There are no

as well as some pictures / videos that are not displayed. There are no interactive activities into the presentation.	activities into the presentation that it would be useful for better understanding, or some of them are no proper working.	spelling errors. There are no interactive activities into the presentation.	spelling errors. There are interactive activities into the presentation that it is useful for better understanding.

2.4. Procedure and Data

Data were collected in one phase for all the participants. Rubrics were given to the participants on the last day of the implementation of the project, where 106 rubrics were collected. The sample of the survey was small - the research was conducted with students in only one university. The pilot tool was used on a limited sample and needs to obtain data for its validity and reliability.

3. Findings

The quantitative analysis of the data revealed statistically significantly differences in the students' self-assessment levels (as identified by the rubric) with respect to the students' gender and the department of study. Moreover, the tool allowed the students to evaluate the end product of their efforts, thus allowing for their realizing the usefulness of the rubric as a self-assessment tool.

More specifically, all the students of the two departments of ASPETE who took part in the study were self-assessed covering all the criteria (Content Scientific, Content Scientific, Content Scientific, Content Historical, Content Social, Scientific validity, Structure and Organization, Presentation Aesthetics, Presentation Functioning)with "very good"(median:4). However, the criterion "Content Financial" was self-assessed with "good" (Median: 3).

Table 2. Self – assessment covering all the criteria of the rubric

Criteria	Median
Content Scientific	4.0
Content Financial	3.0
Content Environmental	4.0
Content Historical	4.0
Content Social	4.0
Scientific Validity	4.0
Structure and Organisation	4.0
Presentation Aesthetics	4.0
Presentation Functioning	4.0

Gender differentiation exists in "Content Historical," where women in both Departments self – assessed with perfect in 54.5%. In the Department of Civil Engineers there is no statistically significant gender differentiation, while in the department of the Mechanical Engineers there was a difference in "Content Environmental" in which males chose" very good" and women self-assessed with" good ".

There was a statistically significant difference between the two departments based on "Content Historical" and "Presentation Aesthetics" that the Civil Engineers self – assessed more highly than the

Mechanical Engineers. Specifically, in "Content Historical" for Civil Engineers the median was 4.5, although in Mechanical Engineers it was 4. As far as "Presentation Aesthetics" is concerned, the median was 5 for Civil Engineers and 4 for Mechanical Engineers.

Table 3. Comparison between Departments

Criteria	Departments Civil Engineers Median	Mechanical Engineers Median
Content Scientific	4.0	4.0
Content Financial	3.0	4.0
Content Environmental	4.0	4.0
Content Historical	4.5	4.0
Content Social	4.0	4.0
Scientific Validity	4.0	4.0
Structure and Organisation	4.0	4.0
Presentation Aesthetics	5.0	4.0
Presentation Functioning	4.0	4.0

4. Discussion

The rubric we developed belongs to analytical rubrics, which focus on multiple aspects or components of performance and include several different quality indicators (Whittaker,et.al, 2001). The rubric of our study included the following criteria (each with pre-determined quality levels; Kasimatis & Papanikolaou, 2012): Quality and Content completeness, Scientific validity, Structure and Organization, Form and Presentation, which helped students focus on and assess all components of the end product. Students were able to use the rubric as a final check before submitting their project, as they were given the rubric on the last day of the project implementation. (Whittaker, et.al, 2001). During the course the students were aware of the criteria they had to be evaluated.

The findings of this study indicate that all the students of the study self – assessed highly (very good) the project and they only self - assessed "Content Financial" with "good". Also, they indicate that in the Civil Engineering Department, "Presentation /Aesthetics" was self-assessed higher than Mechanical Engineers, which could be interpreted due to their specialty. Gender differentiation exists in "Content Historical," where women in both departments' self – assessed with perfect in 54.5%.In

the Department of Civil Engineers there is no statistically significant gender differentiation. Gender differentiation exists in a study which aim is to measure the reliability of the rubric used in student's PowerPoint evaluation. In this study female students showed higher delivery performance than male students, as male students had a lack of English language proficiency, while females miss reference citation which can be corrected (Abouelkheir, 2017, p. 81). In another study, which focuses effectiveness of the rubric as an assessment tool for student peer-group evaluation in an effort to further explore the use and of the rubric, the rubric appears to be 'gender neutral' and the students' academic strength has no significant bearing on the way that they employ the rubric (Hafner & Hafner, 2010).

As far as the criteria are concerned, "Presentation and Organization" are some of the criteria that are self-assessed in other relative research. According to Abouelkheir (2017), "an evaluation rubric for grading the presentations allows faculty evaluators to objectively score student performances in the domains of presentation delivery and content" (p.1).

According to Jonsson, and Svingby (2007), when rubrics are used by students to assess their own performance, the students are encouraged to take responsibility for their own learning and they are able to appreciate the strengths and weaknesses of their learning work (e.g they self-assessed "Content Financial" lower). On the contrary, Orsmond and Merry (1996), argue that students might

not find the qualities in their work even if they know what to look for, since they have a less developed sense of how to interpret criteria.

Differences between instructor and student judgments might thus well be attributed to the students' lesser understanding of the criteria used and not to the performance as such. It is therefore argued that rubrics should be complemented with examples, written descriptions or actual work samples to illustrate the various levels of attainment (Busching, 1998;Wiggins, 1998).The findings could be a trigger for further research in which a comparison could be between the students' self-assessment of the project and the peer view assessment of the instructor. According to Orsmond, Merry & Reiling (2006), a comparison between the tutor and the student self-assessed mark reveals how important it is to consider the individual marking criteria rather than the overall mark.

Also, ICT could be used for self-assessment and peer view assessment. Online assignment submission can be viewed asynchronously by the teacher or the other students. Having access to assignments at a later date with teacher's comments helps the students reflect more deeply on their work. In our study the students could be able to view and complete the rubrics online and upload them reflecting their work, so they take considerable interest and initiative doing the work. Peer groups of students with the use of ICT are able to easily view their peers' assessment, so they are able to exchange ideas and expressions that promote cross-cultural understanding and developing of metacognitive and social skills (Umachandran, Amuthalakshm, Ferdinand-James, Sawicka & Jurcic, 2019). These flexible and alternative approaches to assessment break down some of the barriers to formal learning and assessment in the current literature, resulting in more stimulating self-directed learning. This kind of assessment provides quick evidence for students' self-correction and reflection (Said, Aravind, Ferdinand-James & Umachandran, 2019).

5. Conclusion

The rubric used in our study clearly delineated our expectations for the project and served as a guide for students. It was used to measure students' learning progress and to assign a final grade for the project, thus serving as a form of summative assessment (Jackson &Larkin 2002). The innovation of this research lies in the fact that its purpose was to investigate the effectiveness of employing rubric as a self-assessment technique of the project method, focusing on criteria that cover a wide range of quality performance and can involve students in constructive learning and self- assessment.

6. Recommendations

Our research seems to be useful, since the differences that were indicated can be used for future improvement and development of the rubric. Also, another survey is suggested in which students of another semester could evaluate the same projects using the same assessment rubric. Then a comparison could be between the students' self-assessment of the project and the peer view assessment of the students.

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