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Cultivation of 21st-century skills: Creating and implementing rubrics for assessing projects

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Abstract

The purpose of this study is to highlight the effectiveness of the implementation of the rubric for the project assessment in comparison with other traditional assessment techniques. The development of skills and the improvement of educational work are concerned. This processing tool automatically quantifies the gradient of the criteria and automatically completes the final descriptive evaluation. It has a modern pedagogical scientific approach and flexibility, which gives impetus to creative projects in school. Six teachers of a Greek high school in Athens participated in the study. The data were collected through a semi-structured interview. The results revealed that the rubric can replace any other traditional technique. The tool allowed the students and the teachers to communicate constructively. Teachers assessed the rubric in a positive way as the students were led to self-assessment processes through reflection and feedback and the development of cognitive and metacognitive skills.

Keywords: Authentic assessment, project, rubric, assessment criteria, reflection, 21st-century skills.

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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 fulfil the professional and social needs. Assessment, 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. These skills can be developed in authentic learning contexts. Authentic learning is described as the learning that has value in the real world. It is used to solve problems and to complete tasks of real life. In authentic environments, the students explore, discuss and construct knowledge through authentic activities that make sense in real life.

Authentic learning is based on the theory of Social Constructivism. Therefore, in order to maintain the social character of knowledge, authentic learning can provide feedback to the community by contributing to authentic assessment and its tools (Kasimati, 2015). Authentic assessment focuses on students using and applying knowledge and skills in real-life settings. The teachers and the students are responsible for their learning and both of them are involved in the assessment process.

In this context, the aim of this study is to highlight the effectiveness of the use of the rubric, which is an authentic technique, as a modern technique for teaching and assessing educational work. More specifically, our purpose is to explore the benefits of the implementation of the rubric for the project assessment in comparison with other traditional assessment techniques as far as the development of skills and the improvement of the educational work are concerned. For this reason, an analytic rubric was created in order to be used as a technique of assessment of the project. Project is an organised learning activity that takes place in the educational process and is developed as a free choice with a predefined plan and aims at exploring, organising 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 another definition 'it is every organised learning activity that takes place in the educational process, it is developed in a free choice with a predefined plan and aims at exploring, organising and managing knowledge, materials, values and actions' (as cited in Frey, 1986).

Project is seen as a key component of skills in various skill models. In Binkley et al. (2012), project is a part of the 'Ways of Working', which is the second group of the 10 skills of the 21st century. According to this model, communication must be rapid, concise and cognizant of cultural differences (Binkley et al., 2012).

Table 1. Ways of working – collaboration, teamwork

A. Knowledge	<ul style="list-style-type: none"> ● Interact effectively with others ● Work effectively in diverse teams ● Manage projects: know how to plan, set and meet goals and to monitor and re-plan in the light of unforeseen developments
B. Skills	<ul style="list-style-type: none"> ● Interact effectively with others ● Work effectively in diverse teams ● Manage projects: prioritise, plan and manage work to achieve the intended group result ● Guide and lead others
C. Attitudes/values/ethics	<ul style="list-style-type: none"> ● Interact effectively with others: conduct themselves in a respectable, professional manner ● Work effectively in diverse teams: respect for cultural differences ● Manage projects: persevere to achieve goals ● Be responsible to others

The term Project is also found as a skill in the Competence-based Learning Model (Deusto, 2008). In this model, the four core features of the model as they are represented in the following pyramid are

the Values, Attitudes, Competences and Learning Model that will further progress to autonomy and the meaningfulness of learning. As stated by Morin (2000) ‘a well-formed mind is a mind able to organise knowledge, thereby avoiding sterile accumulation’ (as cited in Deusto, 2008). Meaningful learning occurs when students are able to relate new information to prior knowledge and experience. In this regard, they become able to build and develop knowledge by linking the logical structure of the subject to their own perspective (Deusto, 2008).

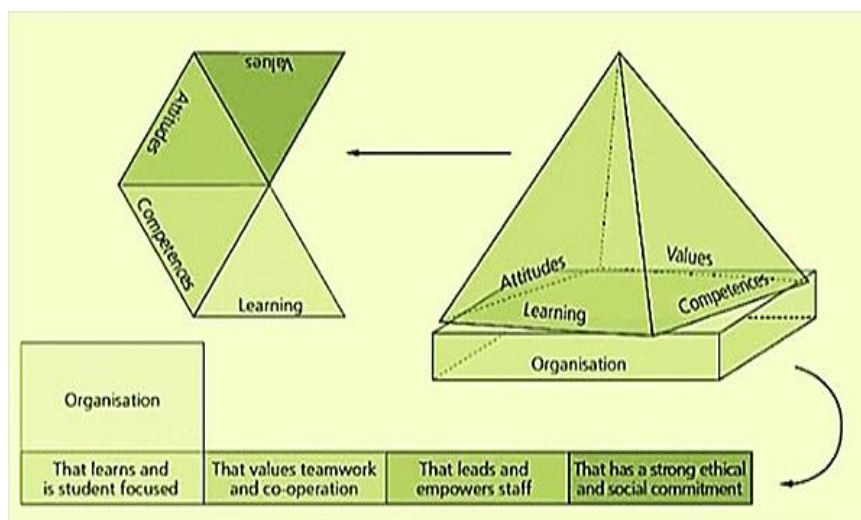


Figure 1. Project in Deusto model

In this model, the project belongs in general or transversal skills. More specifically, it belongs in Systemic Skills, which are related to the understanding of a whole set or system. They involve abilities related to an entire system. In specific, they require a combination of imagination, sensibility and ability, enabling one to see how the parts of a whole are related. Such skills include the ability to plan changes that will introduce improvements in overall systems and the ability to design new systems. These competences are built on previously acquired instrumental and interpersonal competences (Deusto, 2008).

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 & Retalis, 2015). 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 & Crawford, 1995). ‘Although the format of an instructional rubric can vary, 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’ (Andrade, 2000). More specifically, a rubric can be considered as a combination of:

- Criteria, the characteristics that a project must fulfil 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 (Petropoulou et al., 2015).

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 one level 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. Each is rated separately, 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 and c. additional information on each quality level of each criterion (Lantz, 2004). 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, 2003, p. 121).

2. Method

2.1. Purpose of the study

The purpose of this research is to develop a scientific, flexible and useful assessment tool for creative work and for the development of 21st-century skills through creative essays and project method. In specific, our purpose is triple:

- To highlight the effectiveness of rubric's use as a modern technique for teaching and assessing educational work
- To explore the benefits of the implementation of the rubric for the project assessment in comparison with other traditional assessment techniques
- To develop the students' skills and the improvement of the teachers' educational work

The study maintained a particular interest for the skills developed through the students' participation in the projects.

Research Questions:

- What criteria and elements are needed for the creation of a rubric?
- What are the teachers' attitudes towards the use of the analytic rubric?
- In what ways can a modern assessment tool of project contribute to the educational work?

2.2. Participants

Six teachers of a Greek high school in Athens participated in the study during 2018–2019. A number of 120 students participated in the project and their essays were assessed with the use of the analytic rubric. The students attended the courses of Literature, Mathematics, ICT and Sociology and participated in these projects.

2.3. Research limitations

The sample of the survey was rather small as the research was conducted with teachers in only one school. Moreover, the pilot tool was used on a limited sample and needs to obtain data for its validity and reliability. The creation of a meta-rubric can be an appropriate instrument in order to assess the effectiveness of the rubric we created as an assessment tool of the project.

2.4. Research strategy

The nature of this study was qualitative. The qualitative study regarded appropriate because the researchers were interested to investigate teachers' attitudes towards the rubric. In this study, the rubric that was employed included the following (each with pre-determined quality levels): Content Completeness, Structure and Organisation, Creativity, Development of Skills and Cognitive Concepts. The analytic rubric is an application made on a four-sheet excels: This tool automatically quantifies the gradient of the criteria and completes the final descriptive evaluation.

This approach supplies a framework for the thematic analysis of qualitative data and provides one way of thinking about how to manage themes and data; this process is likely to reflect the analyst's awareness of recurring ideas and topics in the data (Bryman, p. 587). A semi-structured interview was used as well as a research tool including the following thematic areas: Teacher's Use, Teacher's Interpretation, Teacher's Communication, Students' Perceptions and Future Use of the rubric.

Table 2. Parts of the analytic rubric (gradation criteria & indexes)

ΚΡΙΤΗΡΙΑ	ΔΕΙΚΤΕΣ	ΧΑΜΗΛΗ ΕΠΙΔΟΣΗ (1)	ΜΕΤΡΙΑ ΕΠΙΔΟΣΗ (2)	ΚΑΛΗ ΕΠΙΔΟΣΗ (3)	ΕΞΑΙΡΕΤΙΚΗ ΕΠΙΔΟΣΗ (4)	ΕΠΙΔΟΣΗ
Θ ΚΑΛΛΙΕΡΓΕΙΑ Α ΔΕΞΙΟΤΗΤΩΝ (4) : Διαβιώνοντας Σε Έναν Κόσμο	Θ.1. Ικανότητα του Υπεύθυνου Πολίτη	Η εργασία δεν καλλιεργεί στους εκπαιδευόμενους την ικανότητα του υπεύθυνου πολίτη σε εθνικό και παγκόσμιο επίπεδο	Η εργασία λίγο καλλιεργεί στους εκπαιδευόμενους την ικανότητα του υπεύθυνου πολίτη σε εθνικό και παγκόσμιο επίπεδο	Η εργασία αρκετά καλλιεργεί στους εκπαιδευόμενους την ικανότητα του υπεύθυνου πολίτη σε εθνικό και παγκόσμιο επίπεδο	Η εργασία στην ολότητα της καλλιεργεί στους εκπαιδευόμενους την ικανότητα του υπεύθυνου πολίτη σε εθνικό και παγκόσμιο επίπεδο	4
	Θ.2 Πολιτισμική Αφύπνιση	Η εργασία δεν καλλιεργεί στους εκπαιδευόμενους την πολιτισμική αφύπνιση	Η εργασία λίγο καλλιεργεί στους εκπαιδευόμενους την πολιτισμική αφύπνιση	Η εργασία αρκετά καλλιεργεί στους εκπαιδευόμενους την πολιτισμική αφύπνιση	Η εργασία στην ολότητα της καλλιεργεί στους εκπαιδευόμενους την πολιτισμική αφύπνιση	4
	Θ.3. Προσωπική και Κοινωνική Ευθύνη	Η εργασία δεν καλλιεργεί στους εκπαιδευόμενους την προσωπική και κοινωνική ευθύνη	Η εργασία λίγο καλλιεργεί στους εκπαιδευόμενους την προσωπική και κοινωνική ευθύνη	Η εργασία αρκετά καλλιεργεί στους εκπαιδευόμενους την προσωπική και κοινωνική ευθύνη	Η εργασία στην ολότητα της καλλιεργεί στους εκπαιδευόμενους την προσωπική και κοινωνική ευθύνη	4

Θ.4. Συσχέτιση η Ζωής και Καριέρας	Η εργασία δεν	Η εργασία	Η εργασία	Η εργασία στην	3
	καλλιεργεί	καλλιεργεί	καλλιεργεί	ολότητα της	
	στους	λίγο στους	αρκετά στους	καλλιεργεί στους	
	εκπαιδευόμενους τη	εκπαιδευόμενους τη	εκπαιδευόμενους τη	εκπαιδευόμενους	
	συσχέτιση	συσχέτιση	συσχέτιση	συσχέτιση	
	ζωής και	ζωής και	ζωής και	ζωής και	
	καριέρας	καριέρας	καριέρας	καριέρας	

92,86%

Table 3. Parts of the analytic rubric (correspondence between grades and descriptive assessment)

ΒΑΘΜΟΛΟΓΙΑ ΡΟΥΜΠΡΙΚΑΣ		ΠΕΡΙΓΑΦΙΚΗ ΑΞΙΟΛΟΓΗΣΗ	
ΚΡΙΤΗΡΙΑ	ΒΑΘΜΟΛΟΓΙΑ	ΑΔΥΝΑΜΙΕΣ	ΠΡΟΤΕΡΗΜΑΤΑ ΕΡΓΑΣΙΑΣ
ΡΟΥΜΠΡΙΚΑΣ		ΕΡΓΑΣΙΑΣ	
Θ		Θ	
ΚΑΛΛΙΕΡΓΕΙΑ ΔΕΞΙΟΤΗΤΩΝ (4) :		ΚΑΛΛΙΕΡΓΕΙΑ ΔΕΞΙΟΤΗΤΩΝ (4) :	
Διαβιώνοντας Σε Έναν Κόσμο		Διαβιώνοντας Σε Έναν Κόσμο	
Θ.1.		Η εργασία στην ολότητα της καλλιεργεί στους	
Ικανότητα του	4	εκπαιδευόμενους την ικανότητα του υπεύθυνου	
Υπεύθυνου Πολίτη		πολίτη σε εθνικό και παγκόσμιο επίπεδο	
Θ.2		Η εργασία στην ολότητα της καλλιεργεί στους	
Πολιτισμική Αφύπνιση	4	εκπαιδευόμενους την πολιτισμική αφύπνιση	
Θ.3.		Η εργασία στην ολότητα της καλλιεργεί στους	
Προσωπική και	4	εκπαιδευόμενους την προσωπική και κοινωνική	
Κοινωνική Ευθύνη		ευθύνη	
Θ.4.		Η εργασία καλλιεργεί αρκετά στους	
Συσχέτιση Ζωής και	3	εκπαιδευόμενους τη συσχέτιση ζωής και καριέρας	
Καριέρας			

3. Findings

The obtained research findings were based particularly on the purpose of the study and they were related to the research questions. These include teachers' perceptions towards the development of the 21st-century skills through the participation of the students in the project. The findings resulted from qualitative data collected through semi-structured interviews and were grouped into five categories according to the purposes of the study. The researchers divide the findings of the research into five categories, such as Teacher's Use, Teacher's Interpretation, Teacher's Communication, Students' Perceptions and Future Use of the rubric. As far as the use of the rubric is concerned teachers reported positive views on the categories of the criteria, such as the formulation and the flexibility of the tool. They answered '*... It's really the most readable rubric I've ever used, since the language is scientific, but at the same time it is clear about the purpose.*'

Teachers and students had a positive attitude towards the analytic rubric. They answered that it is a tool that they are going to use in the future. '*...We are going to use this rubric in the future for sure. It helped us to the educational work and gave us the opportunity to use it as an alternative technique of assessment.*' From their answers emerged that the rubric's final grade was in accordance with the academic grade and the previous performance of the students. In addition, the students had the opportunity to participate in the formative assessment and reflect on the development of their skills. The students self-assessed through reflection. They were able to find their weaknesses and the strong points of their essay '*...by using the rubric they know exactly the criteria must focus on to assess the skills developed by the students.*'

As far the communication is concerned the descriptive assessment of the rubric was used as a point of reference by the students and the teachers. According to it, they were able to acknowledge their skills *'...we communicate with the students in a constructive way. We discuss with them according to the descriptive assessment that was given to them'*. The teachers' answers revealed the students' perceptions about the use of the assessment rubric. They felt satisfaction as they had an important role in the implementation and the assessment of the project *'...they were satisfied from their participation in the assessment process. They felt that their role in assessment process was important, as they were able to interpret the grades they took.'* From the answers of the teachers emerged that the assessment of projects was fully covered by the rubric options (task, lesson, subject, skill range, learning level). *'...We can choose among different criteria and indicators, which cover different aspects of a subject in specific time'*.

To sum up, the analysis of the data revealed that the tool allowed the students to assess their efforts, thus allowing them to realise the usefulness of the rubric as an assessment tool. The students and the teachers had the opportunity to communicate in a constructive way. The students were led to self-assessment processes through reflection and feedback and the development of the 21st-century skills, such as team spirit, cooperation and time management.

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 helped the teachers and the students focus on and assess all components of the project.

Although there seem to be little information in the literature on the effectiveness of rubrics when used by students to assess their own performance (Jonsson & Gunilla, 2007), the students of our study knew the criteria of the rubric and they encouraged to take responsibility for their own learning. They were able to appreciate the strengths and weaknesses of their learning work.

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 teacher. According to Orsmond, Merry & Reiling (2006), a comparison between the teacher and the student self-assessed mark reveals how important it is to consider the individual marking criteria rather than the overall mark.

The Project-Based Learning has been implemented in the Avalon School of Minnesota, where the learning process is conducted on the principles of authentic assessment. Therefore, in this school assessment rubrics are used for the development of the skills. In the Lincoln School of Buenos Aires, as well there is a tradition of metacognitive learning methods through its 'Service Learning program'. It is a method that combines academic instruction, meaningful activities and critical thinking to stimulate learning and social responsibility. Therefore, the project method is highly valued and the school is constantly improving its assessment techniques.

The teachers by using the rubric were able to assess the achievement of the pupils and the pupils had the chance to be involved in their assessment through their participation in the project and in the assessment process. 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 assessment skills by becoming knowledgeable about the standards needed for success and d. they are able to use the rubric as a final check before submitting an assignment.

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 formative and summative assessment (Jackson & Larkin, 2002). The innovation of this study lies in the fact that its purpose was to investigate the effectiveness of employing rubric as an assessment technique of the project method, focusing on criteria that cover a wide range of quality performance and clearly communicate what is valued in the students' work. The analysis of the data revealed that the analytic rubric can be one of the most innovative assessment techniques as it enables teachers to approach the project by using innovative techniques providing them knowledge and skills to help students become familiar with the project method. In addition, it offers versatility, time-saving, validity and feedback on areas of strength and weakness.

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