INTEGRATING CORUBRIC WITH GAMIFICATION OF RESOURCES IN SCIENCE EDUCATION

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This paper shows an example of integrating the CoRubric assessment tool in an experience of designing gamified resources in science education with 43 pre-service science teachers from the University of Malaga (Spain). Participants had to design a gamified resource to teach science to secondary school students and explain it at a science fair. In addition, they had to design an e-rubric to evaluate the gamified resources made by their peers. Participants could improve their e-rubric design throughout the experience; on the one hand, by comparing it with that of their peers and, on the other hand, after attending the explanation of the different resources. This work analyses the participants' perceptions of the design and use of e-rubrics, finding significant progress in their design and gamified resources. Also, emotions of interest and concentration emerged during the experience.

Keywords: e-rubrics, gamification, science education, emotions

INTRODUCTION AND THEORETICAL FRAMEWORK

Assessment is an essential and challenging aspect of science education. One way to improve these processes is through the idea of "assessing for learning" (Folkes & Carmichael, 2006). Some evaluation suggestions focus on internalising and reflecting on assessment criteria (Lehesvuori et al., 2017). Different assessment methods encourage practice-based reflection, such as self-assessment activities (Hanrahan & Isaacs, 2001) that encourage self-regulation of learning (Steffens & Underwood, 2008), as well as receiving reflection on work. Another method is co-assessment, where students critique their peers, allowing them to learn about different problem-solving approaches (Boud et al., 1999). Together with expert evaluation, these methods are integrated into 360-degree assessment (Tee & Ahmed, 2014).

Among the electronic rubric platforms, CoRubric (Cebrián-Robles, 2016) (https://corubric.com) is a free platform for collaborative assessment that allows flexibility in design, grouping, 360-degree assessments, exportations, etc. CoRubric has already been applied to science education in scientific argumentation training programmes (Cebrián-Robles and Franco-Mariscal, 2018), to facilitate scientific practices (Cebrián-Robles, 2019) or in the evaluation of gamified resources (Franco-Mariscal et al., 2021).

Any classroom activity is susceptible to evaluation. Thus, the evaluation of educational resources is especially important because they need to be of adequate quality if they are to be used by other teachers. As resources of interest, those based on gamification stand out, with significant educational advantages such as motivating students, favouring active, cooperative and competitive learning, developing creativity and imagination, favouring the classroom climate, self-control or concentration on the task. In short, gamification can contribute to developing skills and positive perceptions of science, which will impact motivation to learn scientific content (Franco-Mariscal, et al., 2021).

This paper aims to study the impact of CoRubric when integrated into a gamification experience in science education with pre-service science teachers (PST).

RESEARCH METHOD AND DESIGN

The participants in this study were 43 PST from the University of Malaga. 60% were female, and the rest were male, aged between 21 and 39. On the one hand, they participated in an activity in which they had to design a gamified resource for the secondary classroom and exhibit it to their peers at a science fair. On the other hand, they had to design an e-rubric with CoRubric to evaluate the peer resources.

The e-rubric had to have a minimum of 3 assessment criteria and a maximum of 5; each assessment criterion could have several performance levels. The designed rubrics were placed in CoRubric, which allowed each PST to see the rubric of all their peers and use it to evaluate the gamified resources. The participants designed the initial e-rubric without knowing the specifics of the gamified resources that their peers would create. However, they had the opportunity to improve their e-rubrics. First, they compared their e-rubrics with their peers using the CoRubric platform (pre-fair e-rubric). Second, they improve their e-rubrics after listening to their peers' explanations of their gamified resources at the fair (post-fair e-rubric).

The instruments used to collect information were the e-rubrics created in CoRubric. So we could track their progress at three stages of improvement (1: initial e-rubric; 2: pre-fair e-rubric; 3: post-fair e-rubric). Also, we asked a question on learning perception using e-rubrics and a reflection on the emotions felt during the design and use. To measure the PSTs' perception of learning using e-rubrics, we asked them before and after the experience using a Likert scale of 1 to 5 points to gauge their knowledge of e-rubrics (1: I do not know anything, 2: I know a little, 3: I know it well, 4: I know it very well, 5: I can explain it to a friend). To reflect on their emotions, we provided a list of emotions (such as rejection, concentration, insecurity, interest, boredom, confidence, satisfaction, dissatisfaction, and shame). We asked the PSTs to choose and justify the ones they felt during the design and use of the tool.

RESULTS

On the evolution of e-rubrics at the three stages: Figure 1 illustrates the evolution of an e-rubric assessment criterion over time, as designed by a PST. In this case, the PST changed the assessment criterion's text from "originality" to "design and presentation of the resource" after observing the e-rubrics of other colleagues and improved the description of the levels. Additionally, after viewing the explanations of their peers' resources at the fair, the PST made further improvements to the e-rubric, specifically by adding performance-level descriptions that were related to the posters.

Figure 1. The evolution of an e-rubric assessment criterion over time designed by a PST

On their learning perception in rubrics design: Before the experience, 83.7% of the PSTs expressed "I do not know anything" (level 1) regarding the design and use of rubrics. As a result of the experience, there was a significant change in the PSTs' understanding of the design and use of rubrics, with 39.5% of the subjects expressing "I know it very well" (level 4) and 46.5% "I can explain it to a friend" (level 5).
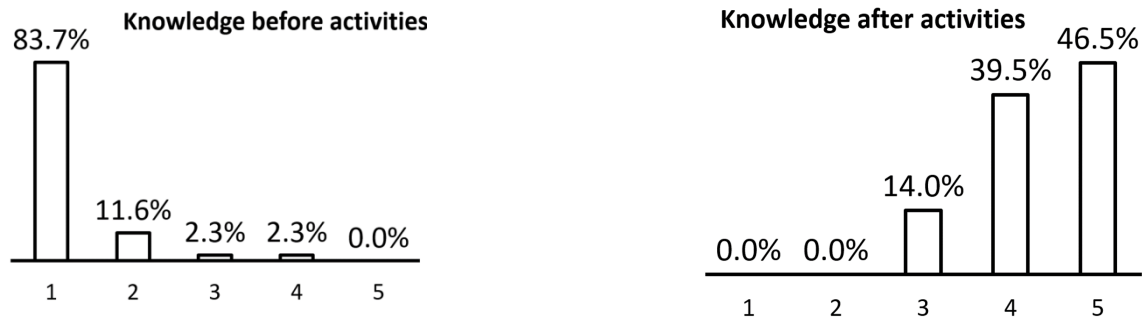

Figure 2. Perception of learning around e-rubrics before and after activities.

On emotions: The PSTs expressed interest (69.8%) and concentration (65.1%) as the core emotions during the experience. However, in some PSTs, other less favorable emotions appeared, such as insecurity (20.9%) or boredom (2.3%).

DISCUSSION OF FINDINGS AND IMPLICATIONS

This study shows that CoRubric integrated into a science education experience can promote reflection by PSTs to design and improve the evaluation criteria of their e-rubrics, in this case, for assessing gamified resources. The results indicate that PSTs perceive significant progress in the design and use of e-rubrics and an increase in interest and concentration.

Some factors contributing to these improvements are that the PSTs could access other e-rubrics of peers designed for the same purpose and their resource explanation at the fair. Undoubtedly, it would have been more efficient to have PSTs design the e-rubric after being presented with the gamified resources rather than beforehand, as was done in this experience. This prior task was carried out expressly to put the PSTs in the position of designing an e-rubric for production. In this case, the design of the gamified resources, whose characteristics were unknown at the beginning and presented a great diversity of types (card games, digital games, puzzles, board games, etc.). The aim was to design an e-rubric with assessment criteria and performance levels for assessing gamified resources, which could be refined later.

As an area for improvement, it is necessary to facilitate assessment in small spaces such as a science fair where computers are not available. As a potential proposal for improvement, we aim to develop mobile applications that integrate CoRubric e-rubrics in future studies.

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