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Journal of Technology,
Culture and Education

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Registrazione del Tribunale di Bari

n. 29 del 18/7/2005

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ISSN 2240-2950

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Exploring the potential of edu-breakout and classroom quizzes to gamify teaching at university: An exploratory Study with Italian and Spanish pre-service teachers

*Esther Edo-Agustín**, *Giovanni Bonaiuti***, *Arianna Marras***

DOI: 10.30557/QW000096

Abstract

This study explores the efficacy of integrating educational breakout games and classroom quiz into teacher training practices, focusing specifically on pre-service teachers enrolled in primary education programs in two distinct cultural contexts: Spain and Italy. Pre-service teachers represent a unique demographic, as they are future educators who will apply these pedagogical techniques in diverse classroom environments. By involving this cohort in gamified activities, the study aims to assess the impact of these immersive learning approaches on their motivation and perceptions regarding the use of gamified resources in their future teaching careers. The findings suggest that educational breakouts and interactive quizzes positively influence certain aspects of learning. In Italy, significant changes in perceptions were observed, with educational breakouts being seen as particularly motivating and useful for content review, while interactive quizzes were

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considered more motivating and suitable for university-level instruction. In contrast, no significant changes were detected in the Spanish cohort. These results raise the question of whether the differences observed in the Italian pre-service teachers' pre- and post-test responses are related to their experience designing edu-breakout games, as the level of exposure to gamified strategies as participants was similar in both the Spanish and Italian groups.

Keywords: Edu-Breakout, Gamified Learning, Teacher training, Classroom Quizzes, Student Engagement

Introduction

In today's educational landscape, fostering active student participation is a central objective, as traditional methods often fall short in engaging learners effectively. To address this, educators increasingly turn to innovative strategies, including gamified methods like escape rooms, educational breakouts (edu-breakouts), and classroom quizzes. Such strategies are designed to boost engagement and learning outcomes by integrating elements of competition, interactivity, and immediate feedback, thereby capturing students' attention and encouraging active involvement (Jabborova, 2023; Yaccob et al., 2022). Research has shown that gamified tools like educational breakouts enhance "collective intelligence", allowing students to collaborate and tackle problem-solving challenges more effectively (Piñeiro-Otero & Costa-Sánchez, 2015).

This study specifically evaluates gamified strategies' impact on pre-service teachers in Spain and Italy. Using pre- and post-experience questionnaires, the research explores participants' attitudes toward edu-breakouts and quizzes, highlighting variations in the efficacy of these methods across cultural contexts. The findings suggest that these interactive approaches positively influence motivation and engagement, providing valuable insights into how such methods can be adapted across diverse educational environments (Caponetto et al., 2014).

Moreover, the study contributes to redefining teacher training

pathways by offering empirical evidence on the potential of gamified learning to cultivate essential skills, such as teamwork and critical thinking, in future educators. These results reinforce the value of integrating gamified approaches into higher education, demonstrating how they can transform initial teacher training to better align with evolving educational needs globally (Yaccob et al., 2022).

Theoretical frame

Gamification in education is often misconstrued, with some educators merely associating it with games in classrooms (Edo-Agustín, 2023). Interest in gamified strategies has surged in recent years, demonstrated by a rise in academic research and teacher training programs (Fotaris & Mastoras, 2019; Veldkamp et al., 2020). This trend reflects a broader recognition of gamification's potential to foster exploratory environments that enhance engagement, promote experimentation, and encourage constructive risk-taking (Boillos, 2024; Zosh et al., 2022). In our research, gamification refers to the strategic use of game elements, like educational breakouts and quizzes, within learning activities rather than full game-based learning. Classroom quizzes are widely used in gamified learning as practical tools for reviewing knowledge and assessing retention. Research suggests that quizzes can enhance learning and improve performance, though excessive use may reduce motivation and increase stress (Sanchez et al., 2020; Yang et al., 2023). Effective use of quizzes thus requires strategic integration to balance benefits and potential drawbacks. Edu-breakouts, inspired by escape rooms, are another gamified approach, designed to foster teamwork and critical thinking through problem-solving. Unlike traditional escape rooms, edu-breakouts focus on structured challenges that align with academic content, promoting engagement and collaborative knowledge application (López-Pernas et al., 2019; Negre, 2017). This format promotes both team cohesion and individual skill development, establishing edu-breakouts as effective for creating interactive learning environments (Llorente-Cejudo et al., 2022; Nicholson, 2018). Moreover, interactive quizzes and edu-brea-

kouts may be conceptually linked to different educational paradigms: While quizzes can be traced back to behaviorist theories, focusing on stimulus-response patterns and reinforcement mechanisms (Skinner, 1953/1970), edu-breakouts are more aligned with constructivist perspectives, emphasizing collaboration, exploration, and the co-construction of knowledge (Nicholson, 2018). This theoretical distinction provides a meaningful framework for comparing the two strategies in terms of both didactic effectiveness and pre-service teachers' perceived engagement and appreciation.

Gamification aligns with educational objectives emphasizing critical thinking and problem-solving (Gupta et al., 2022). Current curricula are shifting to promote these competencies, increasingly through innovative teaching methods like gamified strategies (Lamberti et al., 2023). Training pre-service teachers in these methods can enhance their skills and understanding of how gamification may bolster learner engagement. Studies suggest that gamification can foster teamwork, social abilities, and creativity - often called soft skills (Friederich et al., 2018; Morrell et al., 2020). It can be argued that students are transformed from passive participants into designers of gamified experiences, which increases creativity and empathy as the learner's perspective is considered.

Building on this idea, the present study involves teacher candidates in designing gamified activities, letting them engage with edu-breakouts as both learners and designers (Moreno, 2019; Morrell et al., 2020).

Implementing gamified approaches, such as edu-breakouts, requires understanding their educational value and grasping game design principles. Integrating gamification into teacher training allows trainees to experience and learn elements essential for creating educational escape rooms. However, despite general design strategies, many studies lack guidance on designing escape rooms for educational purposes (López-Pernas et al., 2019).

The "Star Model" by Botturi and Babazadeh (2020) addresses these design challenges by integrating game and instructional design for structured learning. It guides goal-setting, audience targeting, and assessment planning, which allows pre-service teachers in our study

to explore escape room design and develop gamification skills despite practical challenges. For this reason, we chose to use this model to help future teachers learn how to utilize this type of gamified experience. Experimenting with gamified designs helped participants develop skills for applying gamification effectively, despite challenges such as preparation time and resources (Fotaris & Mastoras, 2019).

Gamified strategies like edu-breakouts and quizzes provide valuable tools for promoting active learning and soft skills.

Aims and research questions

In light of the growing interest in gamification within the international literature, the differences that may emerge across distinct yet culturally similar contexts have not been sufficiently investigated. Our study aims to address this gap through an initial exploratory investigation conducted in two comparable university settings located in different countries. According to studies such as Swacha (2021), Spain produces more research on gamification than other countries, such as Italy; a fact that has sparked particular interest in relation to the cultural differences between the two countries.

By involving pre-service teachers in both participant and designer roles, this study illustrates gamification's potential to create engaging, skill-centered learning environments. Integrating these methods in teacher training equips future educators to effectively implement gamified strategies, enriching classrooms across varied educational contexts.

Based on this framework, considering that there are important premises in the literature, our research questions are:

1. Do pre-service teachers understand the value of gamified learning experiences?
2. What role do interactive quizzes play in supporting learning within Spanish and Italian university contexts?
3. What role do edu-breakouts play in enhancing learning within Spanish and Italian university contexts?

Materials and method

Participants

To implement gamified strategies within a university course, an intervention protocol was developed for both the Italian and Spanish contexts. The study was carried out in parallel with two distinct groups, each composed of first-year students enrolled in a primary education teacher preparation program – some attending the University of Cagliari and others the University of Zaragoza. The Italian group consisted of 55 university students (*mean age* = 22.15 years; *SD* = 6.32), including 51 females (*mean age* = 22.2 years; *SD* = 6.55) and four males (*mean age* = 21.3 years; *SD* = 2.06). The Spanish group included 34 university students (*mean age* = 18.65 years; *SD* = 1.45), with 18 females (*mean age* = 18.3 years; *SD* = 1.03) and 16 males (*mean age* = 19 years; *SD* = 1.79). A substantial proportion of both Italian (82%; *N* = 45) and Spanish (76%; *N* = 26) students reported having no prior teaching experience, either in formal education or related settings.

Research Procedure and Instruments

Prior to the intervention, university students were asked to fill out an *ad hoc* questionnaire (Appendix) on their perceptions about the use of edu-breakouts and classroom quizzes (such as *Kahoot*) in teaching (T0). Subsequently, all participants were engaged in two hours of laboratory activity, spread over five weeks. After the intervention, the same questionnaire on students' perceptions and ideas was administered again (T1). The questionnaire consists of 14 items with a five-point Likert scale (from *not at all* to *very much*) (Supplementary Table 1). The design aims both to support the development of university study program content and to make future teachers aware of the potential of a gamified approach in teaching. We have obtained the informed consent of all university students participating in this study for the use

and processing of their data. The data collected will be handled with strict confidentiality, ensuring that all personal information is anonymized and used exclusively for research purposes. Our procedures comply with ethical guidelines and institutional regulations to safeguard the privacy and rights of the participants throughout the study.

Gamified teaching structures

In this study, a gamified teaching approach for pre-service teachers was implemented in both Spain and Italy, using classroom quizzes and edu-breakouts. Kahoot quizzes were employed twice weekly for five weeks to reinforce understanding and track progress. Edu-breakouts followed a structured format in both contexts, including a narrative briefing, clear objectives, competitive tasks, and a debrief, with each 90-minute session focused on teamwork, communication, and critical thinking as students collaborated to solve puzzles.

As part of our research design, we differentiated the Italian group from the Spanish group by allowing the former not only to experience an edu-breakout as students but also to collaboratively design one for their future primary school children. Working in small groups and using a structured design template, the Italian pre-service teachers defined the target audience, set clear learning objectives, and organized key elements such as the narrative structure, puzzles, required resources, setup, rewards or recognition systems, soft skills development, and strategies for classroom implementation. Their projects underwent a structured peer-review process assessing aspects such as thematic coherence, clarity of objectives, originality and quality of challenges, and feasibility. After receiving feedback, the groups refined their work and presented their final designs over a two-week, 10-hour period. Although the peer-review results were not formally presented as data, the activity led to meaningful engagement, greater professional awareness, and a deeper understanding of pedagogical tools. As emphasized in previous studies (Boz & Cetin, 2023; Moreno, 2019), engaging in both learning and design roles fosters reflective thinking and higher-order cognitive processes.

The Italian cohort's experience supports the idea that peer evaluation could serve as a valuable additional source of data to assess the effectiveness of such design-based learning interventions (Krathwohl, 2002; Morrell et al., 2020).

This role reversal allowed Italian university students to deeply explore the pedagogical aspects of gamified learning. Creating edu-breakouts fostered reflection on puzzle complexity, instruction clarity, and activity flow, while enhancing innovation and preparation for designing learning experiences. Experiencing both roles gave them a dual perspective, building empathy for learners and insight into gamified strategy challenges. In summary, while both groups benefited from the edu-breakout's collaborative elements, the Italian university students' role as designers enriched their critical thinking and educational design skills, emphasizing the importance of reflective practice in teacher training.

Data Analysis

The data were analyzed using the open-source software Jamovi (release 2.3). Group differences were explored through analyses of variance using repeated measures with time (T0;T1) as a within-subject factor. T-test paired couples was conducted to assess whether the implemented educational breakout had effects on the investigated dimensions.

Furthermore, qualitative analysis followed the principles of Grounded Theory. A continuous contrasting analysis was conducted to identify recurring themes and subcategories within the pre-service teachers' reflections. This systematic approach allowed for the categorization of key themes regarding the motivations for implementing gamified educational strategies and their perceived effectiveness in enhancing student performance.

Results

Quali-Quantitative results

We assessed the impact of edu-breakout activities on the perceptions and attitudes of Italian and Spanish pre-service teachers. Supplementary Table 2 (Appendix) presents the results for the Italian group, highlighting significant changes in their perceptions regarding edu-breakouts and the use of classroom quizzes at two time points ($T0$ and $T1$) following the intervention. Statistically significant differences emerged regarding the belief that such activities increase student motivation ($p = .009$) and are useful for content review ($p = .043$). The Italian group reported being highly motivated by the use of quizzes in learning ($p = .002$) and considered it an effective methodology for university teaching ($p = .027$). Supplementary Table 3 (Appendix) shows the results for the Spanish group, whose responses did not display statistically significant changes between $T0$ and $T1$ regarding their perceptions of edu-breakouts or classroom quizzes. An additional noteworthy finding, presented in Table 1, is that Spanish pre-service teachers reported greater prior exposure to gamified learning strategies compared to their Italian counterparts. This was evident in their responses to items related to both edu-breakouts and classroom quizzes.

Table 1.

Descriptive statistics of the Italian and Spanish sample on previous experience with gamified learning

Item s.	Italian Sample		Spanish Sample	
	M	SD	M	SD
13.	1.29	1.031	2.12	1.225
14.	2.75	1.391	3.59	1.104

The qualitative analysis, grounded in the principles of Grounded Theory, enabled a detailed exploration of the motivations that drive Italian and Spanish pre-service teachers to consider the use of gamified educational strategies in their future classrooms. Two main themes emerged from the analysis: The justifications for adopting such strategies and their perceived effectiveness in assessing student performance.

Justifications for Employing Educational Strategies in Future Teaching

Italian pre-service teachers identified several reasons for favoring gamified strategies in their future classrooms. A recurring theme was the desire to stimulate curiosity and encourage collaboration, with some emphasizing the value of using these methods “*to encourage curiosity and teamwork*” (Participant n. 9). Gamified approaches were also appreciated for their capacity to “*capture students’ attention and make learning more enjoyable*” (Participant n. 12), highlighting their potential to enhance engagement through interactivity.

Some participants acknowledged that the effectiveness of these methods depends on classroom dynamics, with one noting, “*It depends on the type of class I am facing... it could create even more chaos*” (Participant n. 25). This illustrates the need for flexible implementation tailored to specific teaching contexts. Others highlighted gamification’s ability to foster cooperation, soft skills, and active participation: “*It creates a climate of cooperation, stimulates soft skills, and promotes active learning*” (Participant n. 52). Overall, the Italian sample viewed gamified strategies as offering a productive balance between enjoyment and educational seriousness.

In contrast, Spanish pre-service teachers primarily saw gamified strategies as tools for reinforcing previously taught content. One participant remarked on their usefulness for “*reviewing content*” (Participant n. 5), reflecting a more pragmatic approach. Nevertheless, they recognized the motivational benefits of such methods, noting that they help “*bring knowledge closer to students... so they are motivated and can learn by applying content rather than memorizing*” (Participant n. 7).

Spanish participants also criticized conventional teaching as demotivating, suggesting that gamification enables alternative, more engaging learning experiences (Participant n. 29). Many saw it as a way to promote healthy competition, helping students to challenge themselves and improve performance: *“to strengthen healthy competitiveness and encourage students to surpass themselves”* (Participant n. 32).

Educational Strategies for Assessment

Regarding the evaluation of student performance, Italian pre-service teachers identified both strengths and limitations of gamified strategies. These methods were widely viewed as effective tools for reviewing key concepts, though less suitable for in-depth exploration. As one participant noted, *“they are useful for reviewing key concepts but don’t allow for a deep dive into the topics”* (Participant n. 12), indicating that gamification supports knowledge retention but may not promote comprehensive understanding.

They also emphasized the immediacy and accessibility of gamified evaluations: *“the strength lies in the immediacy of the game, which is accessible to everyone”* (Participant n. 43). At the same time, some raised concerns about the potential for oversimplification: *“A potential weakness could be the excessive simplification of questions and answers that may be reductive”* (Participant n. 45). These comments highlight the importance of well-designed assessment tools that both engage and intellectually challenge students. Moreover, gamified strategies were seen as helpful in reinforcing and consolidating content, as well as enhancing attention during lessons: *“They help reinforce and solidify concepts and stimulate attention during lectures to respond correctly”* (Participant n. 50).

Spanish pre-service teachers similarly recognized the value of gamified methods, particularly for content review. One participant stated, *“They are good, but if you use them to review content, not to teach it anew”* (Participant n. 27), confirming a shared view that these tools are best suited for reinforcement rather than initial instruction.

They also acknowledged the engaging nature of gamification, noting its role in sustaining attention: “*They are very useful and also captivating for learning, as they keep the subject’s attention high*” (Participant n. 29). However, concerns were raised about competitive dynamics, with one respondent warning, “*It is a good active evaluation instrument, but competitiveness can be counterproductive*” (Participant n. 31), suggesting the need for balance between competition and collaboration to ensure inclusivity. In summary, both groups valued gamified strategies for their ability to promote curiosity, motivation, and active learning, highlighting themes such as teamwork, attention, soft skills, and engagement across diverse educational settings.

Discussion

The results of this study reveal significant differences and similarities between Spanish and Italian pre-service teachers regarding the effectiveness of gamified educational strategies. Notably, Spanish participants exhibited no significant variation in their pre- and post-test responses across any items, suggesting a stable perception of these strategies. In contrast, Italian participants demonstrated substantial variation in their responses to items 1, 2, 10, and 12 (Appendix), which pertain to the usefulness of edu-breakout for motivating students and reviewing academic content. The observed impact on Italian pre-service teachers’ motivation aligns with findings by Moreno (2019), suggesting that active engagement through design may be particularly impactful.

The qualitative analysis sheds light on the underlying motivations that shape these perceptions. Italian university students articulated a variety of compelling reasons for adopting gamified educational strategies, with a prominent theme being the aspiration to cultivate curiosity and enhance collaboration among students. For instance, one respondent expressed the desire to “*encourage curiosity and teamwork*” (Participant n. 9), underscoring the belief that education should engage students in ways that foster their intrinsic motivation. Furthermore, participants recognized the potential of gamified ap-

proaches to capture students' attention, as one noted, *"I would use these gamified strategies to capture the students' attention and make learning more enjoyable"* (Participant n. 12). This conviction suggests that Italian future teachers regard student engagement as a vital aspect of the educational process.

In contrast, Spanish pre-service teachers articulated distinct motivations, primarily viewing gamification as an effective tool for content reinforcement. One respondent remarked, *"Surely, it is a very useful tool for my teaching work, mainly for the purpose of reviewing content"* (Participant n. 5), which indicates a more pragmatic approach to gamification. This divergence in perspectives highlights that while both groups recognize the value of gamified strategies, the context in which they are applied shapes their effectiveness and perceived utility.

The differences in perceptions between the two groups could also be influenced by the roles that university students assume in the learning process. While Spanish pre-service teachers primarily engage as participants in gamified activities, their Italian counterparts may have more opportunities to take on the role of creators or designers. This distinction is crucial: Allowing people to experience actions such as "creating" content mobilizes higher-order cognitive processes enabling deeper learning outcomes (Krathwohl, 2002). One Italian participant noted, *"It depends on the type of class I am facing... however, I believe it's a good way to check students' knowledge"* (Participant n. 25), which indicates an awareness that classroom dynamics can significantly affect the implementation of innovative teaching strategies. This suggests that the role of self-efficacy associated with being a creator of gamified experiences positively correlates with the perceived impact of these strategies (Boz & Cetin, 2023).

Familiarity with gamified experiences seems to influence attitudes toward these methods. Spanish university students reported more exposure to gamification throughout their education, which could affect their views on its effectiveness. This familiarity may result in a novelty effect, where they find game strategies less motivating compared to Italians, who see them as innovative and engaging (Sanchez et al., 2020).

Therefore, the greater motivation shown by Italian university students toward gamified methods may stem from their relative lack of prior exposure to these strategies. In summary, both Spanish and Italians ack-

knowledge the potential of gamified strategies to boost motivation and engagement, but the degree of impact varies. Qualitative insights reveal that Italian pre-service teachers tend to favor strategies that foster curiosity, collaboration, and active learning, whereas their Spanish counterparts place greater emphasis on reinforcing knowledge and sustaining motivation through engaging presentations. These findings highlight the importance of considering cultural differences, student roles, and familiarity with gamified methods when designing educational interventions. This study ultimately offers insights into how gamified teaching practices can be effectively integrated into university settings to create an engaging and motivating learning environment across diverse educational contexts.

Conclusions

This study demonstrates the positive effect of applying gamified strategies in the initial training of future teachers, emphasizing the importance of these methods in enhancing the educational experience. Notably, more significant changes in perceptions were observed among Italian pre-service teachers, suggesting that the context of implementation plays a crucial role in the effectiveness of these strategies. Both groups, however, highlighted the positive impact of edu-breakouts and classroom quizzes on various learning aspects, indicating a shared recognition of the benefits associated with gamified approaches.

Participants from both Italy and Spain valued the use of gamified strategies for their effectiveness in capturing students' attention and increasing motivation. Additionally, classroom quizzes were acknowledged as useful tools for reinforcing content knowledge. A key factor in the evaluation of these strategies is the observed familiarity of Spanish university students with gamified learning throughout their schooling. This prior exposure may condition their perceptions and experiences, potentially leading to a less pronounced impact compared to their Italian counterparts.

Furthermore, it is important to note that the relatively small sample size presents a limitation to the generalizability of these findings. Thus, while the results suggest promising avenues for the integration of gami-

fied strategies in teacher training, further research is needed to explore the long-term effects on learning outcomes and to address how demographic factors may influence students' experiences. Overall, this study underscores the potential of gamified approaches to foster engaging and effective teaching environments that promote active participation and collaboration among future educators. The findings suggest that incorporating edu-breakouts and quizzes into teacher training could enhance engagement, particularly if pre-service teachers participate as both learners and designers of these activities.

Regarding the limitations of the study, it is necessary to highlight the small groups size and the use of a questionnaire that was not validated according to psychometric properties. It is therefore necessary to investigate future research directions involving a larger group of pre-service teachers and a validated tool in both Italian and Spanish.

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