

Serious Games in Higher Education: A European Comparative Study on Teachers and Student Perceptions of Challenges and Opportunities

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Abstract

This study investigates the impact of Serious Games (SGs) within Higher Education, focusing on student engagement, collaboration, and academic performance. Based on a survey of teachers and students across 34 European universities, the research confirms that SGs are preferred, highly valued tools and significantly enhance learning outcomes by fostering critical and creative thinking and interpersonal relationships. Furthermore, group use was found to be superior to a combination of group and individual use, although further investigation is needed into the potential obstacles and dynamics that develop within the group during group use.

Keywords: Serious Games; Student Engagement; Academic Performance

1. Introduction

The long-standing European Strategies (2020 and 2030) have actively promoted the development of interconnected digital learning environments to foster instructional innovation within Higher Education. They envision the establishment of Learning Centers to train faculty in advanced pedagogical methods and to cultivate transversal skills among both students and staff. Against this backdrop a research team from the QUID (Quality of Teaching Innovation) group at Sapienza University conducted a study within the framework of the EU-funded project “Quality of Interaction of the Virtual Auditorium” (2024-2027), examining various instructional tools, including flipped classrooms, metacognitive approaches, GenAI, and robotics. This paper focuses on Serious Games (SGs). The primary objective of the study, conducted between 2024 and 2025, was to determine whether and how advanced educational tools enhance participation, student-teacher and peer-to-peer relationships, collaborative learning, and final academic performance. The research sought to identify convergent and divergent opportunities and limitations across 34 European universities, with a particular emphasis on SGs.

2. Literature Framework

The concept of SG has been defined in multiple ways. In this paper, we refer to the definition adopted by Dallaqua et al. (2024), according to which SG are games played on different platforms (computer, mobile, virtual, or board games) with an explicit educational purpose. They include technology-enhanced games and simulations, which allow to learn and experiment with processes and practices to apply in the real world, eg virtual reality-VR, that are three-dimensional computer-generated environments, updating in real time, and allowing human interaction through various input/output devices; and Augmented Reality-AR, that are system which combine real and virtual, are interactive in real time, and are registered in three dimensions) (Kaplan et al. 2021). Literature highlights several educational opportunities offered by SGs, which can be summarised into key dimensions. The first one concerns the learning process itself. Simulation in digital environments enhances the effectiveness of analog approaches—such as problem-based learning, project-based learning, and role-playing—by integrating them into a form of advanced experiential learning. This strengthens knowledge acquisition and critical thinking from a constructivist perspective (Amagir et al., 2022) and boosts learning motivation (Yamoul et al., 2023). Although some scholars note the risk of increased stress or cognitive load, SGs are designed to balance challenges with the student's cognitive progress. As Piaget noted, a collaborative approach is also essential for mitigating learning-related stress (Stoltz et al., 2024). Regarding motivation, authors highlight that SGs can incentivize unmotivated students and must activate both intrinsic and extrinsic factors to address diverse motivational needs (Ratinho & Martins, 2023).

Secondly, SGs amplify opportunities for cooperative tasks with teachers and peers. Scholars identify the main benefits of collaborative learning in higher education as increased engagement, classroom participation, and enhanced basic skills, communication, decision-making, and group problem-solving. However, teacher support is fundamental; faculty must provide clarity on technical usage, learning objectives, and the educational experience within digital environments (Dallaqua et al., 2024). In this context, collaboration translates not only into teamwork but also into debate and discussion with the instructor (Faisal et al., 2022). These moments are indispensable for cognitive development and fostering metacognitive awareness regarding the value of educational experience. Conversely, a potential drawback is the risk of excessive competition. Here too, the teacher's management of the SG is crucial in mitigating competitive scenarios in favor of creative and collaborative challenges (Axelsson et al., 2025).

The crux of any learning modality is performance—the assurance that educational experience produces effective learning results. Literature presents contradictory positions regarding the efficacy of SGs in this regard. This ambivalence depends on multiple factors: game design, narrative, applicability to specific contexts, and the synchronous or diachronic nature of the class. Performance varies based on whether the game is individual or group-based, personalized,

and whether the teacher possesses adequate management skills. While this heterogeneity prevents the definition of unique performance standards, scholars generally agree that when an SG meets specific design requirements, it effectively improves performance by creating progressive, balanced learning paths (Rodrigues, 2023). The optimal formula appears to be the integration of SGs with traditional classroom instruction and collegial discussion. Efficiency limits are often due to high development costs (skills, time, and money) rather than the tool's potential. They are highlighted in other studies (Yamoul et al., 2023), which also identify teacher-perceived limitations such as a lack of game literacy, difficulty integrating SGs into curricula and traditional assessment methods, and the time required to learn game rules. Recent Learning Analytics research applied to SGs highlights that AI-driven feedback improves personalization, generating positive cognitive, behavioral, affective, and motivational outcomes (Daoudi, 2022). Timely feedback facilitates reflective action, helping students improve without feeling inadequate (Feng et al., 2023). To understand performance potential, it is vital to verify the students' perception, as studies show a direct correlation between perceived value and cognitive performance. Using the Technology Acceptance Model, factors such as perceived ease of use, usefulness, enjoyment, interactivity, engagement, and collaboration are analyzed (Udeozor et al., 2022). Usability is critical to prevent abandonment due to technical difficulties (Zhao et al., 2022). Others have noted that VR and AR environments are more usable and effective than standard digital ones (Checa et al., 2023). Structural and graphic components, particularly narrative, are decisive; they allow students to immerse themselves in the story and face challenges under optimal cognitive conditions (Laurent et al., 2022). Narrative plots have strategic value, improving memory and motivation. Moreover, variable narrative paths—subject to player choice—are particularly stimulating (Feng et al., 2023).

Based on this framework, the research addresses the following questions:

- How do students and teachers perceive the use value of SGs?
- How do SGs incentivize a collaborative approach?
- Do SGs positively impact student performance?
- Do integrated technologies implement the effective use of SGs?

3. Research Design

The study utilized a semi-structured web survey administered to teachers and students across public (92%) and private (8%) universities in five countries (Switzerland, Spain, Greece, Romania, and Italy). Italy included 24 universities, while 10 were selected from the other countries based on proximity and cultural/educational similarity. This overrepresentation of Italian experiences compared to those of other countries is certainly a limitation of this study. The universities were chosen because, from an analysis of their institutional websites, they use advanced training methods and technologies and are equipped with advanced technologies

(considered mostly good by the teachers interviewed and belonging to public universities and excellent in public universities with a minimum variance (σ): 20.5). Universities were selected also based on the presence of Learning Centers, and the provision of innovative teaching courses (76% of the teachers who use SG have followed or are following them).

3.1. The Sample

Teachers (n=1,030) were recruited via institutional email using random stratification, targeting those active in advanced training methods and technologies. These teachers then invited their students, resulting in a student sample of 3,008 (41.3% undergraduate, 56.0% postgraduate, 2.7% PhD). The distribution is quite homogeneous between the two groups.

Table1. The sample of teachers and students. Source: data n.s processing (2025).

	Teachers	Students		Teachers	Students
Italy	89.2%	78.9%	Healthcare	15.8%	8.9%
Romania	4.3%	6.9%	Scientific Sciences	54.5%	57.7%
Greece	1.6%	4.3%	Socio-political Sciences	15.2%	17.6%
Spain	4.3%	3.3%	Humanities	14.5%	15.8%
Switzerland	0.6%	6.6%			
Age mode	46-55	18-22	non-tenured professors and lecturers	8.2%	
Males	53.2%	39.5%	researchers	18.2%	
Females	44.8%	58.2%	associate professors	43.3%	
Non-Binary	2.0%	2.3%	full professors	29.9%	
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Respondents	1.030	3.008	retired professors	0.4%	

The specific analysis presented in this paper focuses on a sub-sample of 121 teachers and 854 students who explicitly use SGs. The stratification of this sub-sample mirrors the structural characteristics of the main sample ($r:0.99$, $p < .001$).

Table2. The sample of teachers and students that use SG. Source: data n.s processing (2025).

They use SG	Teachers	Students		Teachers	Students
Yes	11.7%	28.4%	Healthcare	10.7%	4.5%
No	88.3%	71.6%	Scientific Sciences	48.8%	43.3%
n=	1030	3008	Socio-political Sciences	14.1%	23.1%
			Humanities	26.4%	29.1%

In this study, only this subsample was examined because it used SGs. In our opinion, this number is already a result, as it indicates that only a little over a third of teachers use SGs in their teaching compared to other innovative teaching tools.

3.2. Analytic Strategy

The two survey instruments were mirrored to allow for comparison. Exploratory objectives, and consequently thematic areas and questions into which the questionnaire is divided included understanding SG usage/appreciation (SGE) and identifying strengths/weaknesses perceived by two categories that, although they use them together, have different perceptions and evaluative perspectives. Mono- and bivariate analyses were conducted to construct indices for Experience evaluation (SGE) using advanced training methods and technologies, which measures the perceived usefulness and ease of use of digital tools, Usage Habits (SGH), Collaboration (CR), Relationship (RR) and Performance (PR), to measure the effectiveness of the teaching activities with the SGs with respect to the objectives of collaboration and performance of the training experience. Additionally, regarding the contribution of technology to supporting engaging games, the value of the combined use of Devices (DR), the Multimedia use of advanced technologies (MR) and the combination of elements in graphic design to Support learning/teaching (SR) was measured. Linear regression (Pearson's r) and non-parametric correlation (Spearman's ρ) were used to verify significance, alongside Z-Score tests where necessary. The regression analysis was extended to explore the relationship between the rates, to understand how much the impact of technology is strategic in implementing the effectiveness and appreciation of SGs. In this paper, the main results regarding strengths and limitations of the use of SGs in the classroom are reported and analyzed.

4. Outcomes

A primary finding indicates that SG usage in the examined universities is relatively low (see table 2) and often occasional, especially for carrying out a small number of lessons, or as support for exercises or laboratory activities planned during the course. Secondly, contrary to literature trends, usage is more widespread in Humanities and Political-Social sciences than in Medicine, though STEM remains a priority area (see table 2).

1) Evaluation (SGE): There is a notable similarity in evaluations between teachers and students, though teachers rate the experience slightly higher (Good: 41.3%) compared to students (More than positive: 44%). The correlation is weaker linearly ($r: 0.80$, $p < .001$) but significant between cohorts ($\rho: 0.90$, $p.0139$). However, a significant gap exists between disciplines: the correlation is low in Medicine ($r: 0.30$), weak in the Scientific Sciences area ($r: 0.67$), but high in Humanities area ($r: 0.80$), and very high in Political-Social sciences ($r: 0.95$). Given that mixed-use is prevalent in medical-scientific areas, this divergence in perspectives

between students and faculty may also influence assessment. Indeed, even about mixed or group use, the significance of the relationship between the two cohorts shows a similar trend: weak significance in the medical area ($r: 0.76$) and in the scientific area ($r: 0.77$), highly significant in the humanistic area ($r: 0.95$) and in the political-social one ($r: 0.92$).

2) **Collaboration (CR):** Research confirms that study groups in both cohorts perceive a clear preference for a collaborative approach. The **CR index** (combining teacher-student relations, relationship between teachers, commitment to teamwork, cultivating a sense of community and trust with the group) shows a strongly significant relationship ($r: 0.95$, $p: 0.90$, $p < .001$).

3) **Performance (RR/PR):** Similarly, regarding the PR index (constructed combining the variables relating to the development of individual knowledge, critical thinking, creative thinking, problem solving, strengthening communication, classroom participation, involvement in debates, and improving autonomy and responsibility in studying), results confirm that SGs perceived improved student learning according to both cohorts. Even in this case, the relationship is strongly significant ($r: 0.95$, $p: 0.90$, $p < .001$).

An additional index focusing on interactivity and feedback also shows strong significance: to further confirm the effectiveness of its use in improving performance, an index of the most appreciated elements of SG-based training was constructed, including variables related to usage such as interactivity, enjoyment, topic structure, adaptability to the teacher's teaching style, provision of immediate feedback, and the ability to learn from mistakes. The relationship (RR) was highly significant ($r: 0.93$, $p: 0.89$, $p < .001$). Finally, teachers' positive evaluation rates range between 60-80% for the majority of the sample (60.6%).

4) **Technology Integration:** Both students and teachers agree on the importance of integrated technological support. High appreciation was found for combined devices (DR), as mobile devices, PCs and tablets or game consoles ($r: 1$, $p: 0.90$, $p < .001$), multimedia integration like VR/AR/ XR/GenAI (MR) ($r: 0.99$, $p: 1$, $p < .001$), and structural design elements (SR) which make the game captivating and stimulating, such as captivating graphics, engaging narrative, intuitive gameplay, levels of knowledge progression, balancing of challenges ($r: 0.96$, $p: 0.94$, $p < .001$). Although the relationship is significant at a linear level in all scientific areas (r : medical 0.87, scientific 0.97, political-social 0.86, humanistic 0.83), cohort agreement is strong in Humanities ($p: 0.93$), but weak in Medicine ($p: 0.78$) and Scientific Sciences ($p: 0.77$), and very weak in Political-Social sciences ($p: 0.41$).

5. Discussion

Despite the currently limited diffusion of SGs in the examined universities, this study confirms that their use as an integrative activity is highly valued by both faculty and students, positively impacting academic performance, consistent with other studies (Rodrigues, 2023). The positive

feedback indicates that the games used were appropriate for the digital potential of the classrooms. This confirms the need to use games suited to user competencies and the teacher's ability to guide the experience, as indicated in the literature (Axelsson et al., 2025). In this regard, the research highlighted two important aspects: technological integration and the evaluation of usage dynamics. In the first case, it appears that game design—in terms of narrative, the combination of game elements, and the use of advanced technologies such as AR, VR, and AI—influences the overall evaluation of the SG training experience. As the data shows, the priorities differ by discipline: Humanities and Political-Social Sciences favor narrative and the levels of knowledge progression and the balance of challenges, while Medicine and Scientific Sciences prioritize intuitive gameplay, aside from the balance of challenges. Secondly, regarding the evaluation of use dynamics, more effective results are achieved when SGs are used in group settings, but they must, in any case, be set up appropriately for the discipline and the class. This suggests that when SGs are ill-suited to learning objectives, they do not meet the expectations of teachers and students and fail to generate educational value. This discrepancy is partly influenced by preferences for group vs. individual play (SGH). The option of using SGs at the individual level was residual in both cohorts, especially among teachers (6.3% for teachers and 21.1% for students). Students overwhelmingly prefer group usage (67.2%), while teachers are open to mixed modalities. The latter, although preferring the group option (46.5%), in some cases also foresee a mixed modality with moments of teamwork combined with individual activities (47.2% of teachers vs. 11.7% of students). Thus, regarding collaboration, the findings reinforce the efficacy of combining SGs with classroom debate. Finally, regarding performance, the confirmation is highly significant and consistent with recent studies discussed in the theoretical framework (Rodrigues, 2023; Udeozor et al., 2022).

6. Conclusion

While most existing literature relies on single-case studies with limited participants, the strength of this study lies in its broad scope, capturing common trends across diverse universities to provide comparative indications. Although contrasting results across the various subject areas, the preference for SGs has emerged. While this result cannot be considered definitive, it is worth noting that group use was also deemed superior to a combination of group and individual use. Future studies may explore the motivations behind the preference for group use and collaborative dynamics. We hypothesize that students prefer interaction with peers to transform an academic task into a shared social experience and, consequently, because they perceive a higher level of emotional engagement compared to student-machine interaction. Teachers also prefer to use group learning tools, such as other methodologies, because subject knowledge and soft skills are built precisely through social interaction. It will also be useful to explore the main obstacles to using group learning tools. Finally, we intend to deepen our analysis of learning outcomes using Bloom's taxonomy (1956) to better pinpoint the specific benefits of SG use.

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