

Gamification elements and their impacts on education: A review



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Abstract Gamification, the integration of game design elements in non-gaming contexts, has emerged as a popular strategy across various disciplines, particularly in education. This meta-analysis evaluates the impact of gamification on student engagement, motivation, and academic performance from 2021 to 2024. A systematic review was conducted following PRISMA principles, analysing studies sourced from major academic databases, including ScienceDirect, Google Scholar, and Scopus. Peer-reviewed publications focusing on gamification elements such as badges, leaderboards, and points were prioritized. Findings indicate that gamification significantly enhances student motivation, active participation, and academic success. Specific features like badges and leaderboards foster competitiveness and recognition, which are essential for promoting self-regulation and active learning. Points systems, on the other hand, provide immediate feedback and measurable goals, enabling learners to track progress effectively. Collectively, these elements create dynamic, interactive, and enjoyable learning environments that facilitate deeper engagement and comprehension. This review also highlights the diversity of gamified approaches tailored to educational settings, demonstrating their adaptability to various subjects and age groups. The implementation of gamification has been shown to bridge gaps in traditional pedagogical methods by introducing novel ways of capturing student interest and sustaining long-term involvement. However, the effectiveness of gamification is contingent on careful design and alignment with instructional objectives. Overall, the findings underscore the transformative potential of gamification in education. By integrating game mechanics into learning processes, educators can cultivate intrinsically motivated learners and foster improved academic outcomes. The study concludes with recommendations for future research to explore the longitudinal effects of gamification and its applicability across diverse educational contexts.

Keywords: learning achievement, student engagement, motivation

1. Introduction

Gamification has a rich history, dating back centuries as a tool for captivating and motivating individuals. Integrating game elements into nongame settings enhances engagement and drives motivation. Gamification employs game aspects and design in nongame contexts to enhance engagement and motivation (Christopoulos & Mystakidis, 2023; Rodrigues et al., 2019; Flores, 2015). It is extensively utilised in sales, marketing, health, HCLs, and education (Sharma et al., 2024; Minh et al., 2023; Krath et al., 2021). Point systems, badges, leaderboards, quests and challenges can be employed to incentivise competition and motivate individuals to explore novel products or services. The implementation of gamification techniques can enhance users' experience, increase user engagement and facilitate the establishment of clear goals.

1.1. Gamification in learning

The gamification of education refers to the implementation of game aspects in an educational setting as a means of enhancing student engagement. Gamification has been described as perfectly suited for the learning preferences of a contemporary cohort of learners (Li et al., 2023; Nguyen-Viet & Nguyen-Viet, 2023; Smiderle et al., 2020; Jain & Dutta, 2018). Owing to the impact that game aspects can have, numerous academics have investigated the impact of gamification in an educational setting, yielding positive outcomes on student engagement by applying gamification principles to influence the cognitive, emotional and social aspects of the learning process (Khoshnoodifar et al., 2023; Nguyen-Viet & Nguyen-Viet, 2023; Huang et al., 2020; Sanchez et al., 2020). With respect to the benefits associated with gamification in motivating students, we intend to incorporate gamification components into our next research on teaching and learning. This study was undertaken to analyse recent gamification research to achieve the desired outcome. We conducted this analysis to ensure that our study remains current and aligns with the prevailing research trend in gamification. The study has two primary objectives: 1) to identify the gamification features utilised in the examined studies and 2) to assess their effects on learning outcomes. The



findings provide more insights into the gaps that need to be addressed and help us determine the most effective parts of gamification to be implemented in our studies.

2. Materials and Methods

The current systematic review was conducted throughout the process of selecting articles to assess the impact of gamification in education, using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

At the beginning of the evaluation, we clearly defined and used the terms "gamification" and "education" as search terms. The search included related antecedents or phrases with comparable meanings, such as "online badges," "leaderboards," and "motivational affordance." These terms were included in the search filters on the basis of their identification as keywords in other gamification publications. The terms "game-based learning" and "serious game" were not considered in this study. Instead, the focus was on the use of the game itself rather than employing gamification techniques that include the usage of game-design components such as online badges and leaderboards. The search terms used were "gamification", "education", "motivation" and "engagement," rather than "game-based learning", "serious game" and "online game." Although the term "gamification" initially emerged in 2008, it was not until 2010 that it became extensively used in the scientific community.

Following the determination of the search string, the following step involved selecting the databases to search for scientific publications. Thus, a total of three databases were utilised, namely, ScienceDirect, Google Scholar and Scopus. The initial two databases serve as resources for scholarly investigation in the realm of education, whereas the third database functions as a reference source in the interdisciplinary sector. The examined period spans from 2021--2024, encompassing the last 4 years, to gather the most pertinent literature in this particular research area. The process of identifying descriptors was conducted by examining the title, abstract and/or keywords.

To conduct the literature review, it was important to establish a set of criteria for including and excluding studies. This helped to identify the most relevant research in this field. To be considered for this review, the research had to meet specific criteria. First, the effects of gamification on students' learning need to be examined. Second, it had to be published within the last 4 years (2021--2024). Third, only articles published in peer-reviewed journals were included. Finally, the articles had to be published in English only. For the purpose of this study, certain criteria were used to determine which studies should be included. Specifically, studies that did not focus on the impact of gamification on students; studies published before 2021 or after 2024; and studies published at conferences, book chapters, doctoral theses, or dissertations were excluded. Furthermore, any duplicate records found in multiple databases were eliminated.

Figure 1 outlines the step-by-step process followed for identifying, screening, and selecting studies for inclusion in the review. Initially, 351 studies related to the impact of gamification on learner outcomes were identified. During the screening phase, 295 duplicate records—articles that were listed multiple times across different databases—were removed to prevent redundancy. After a further review of titles and abstracts, an additional 110 records were excluded on the basis of relevance and alignment with the research focus. Among the remaining studies, 106 reports were marked as not retrieved, potentially because of issues such as access limitations or incomplete publication records. Finally, out of 80 articles assessed for eligibility, 68 were excluded because they either lacked data relevant to the review (e.g., focused on unrelated variables), did not present relevant outcomes, or provided insufficient evaluation metrics, such as a lack of experimental design comparing an experimental and control group. This limitation made conducting a meta-analysis unfeasible, resulting in 13 articles being included in the final review.

3. Results and Discussion

The results of the analysis conducted on the chosen papers are presented in Table 1, followed by an in-depth discussion of these findings. In general, the studies mentioned in Table 1 have included the components of gamification in the teaching and learning process, albeit in varying contexts. A total of 8 studies were undertaken at the university level, whereas four investigations were conducted at the school level for young children.

3.1. Game design elements for education

The incorporation of game design concepts in education has been extensively embraced to augment student engagement and improve learning results. Badges are a widely appreciated component utilised to acknowledge and incentivise students to successfully accomplish assignments and reach significant milestones (Velázquez-García et al., 2024). Within educational settings, badges function as crucial motivating instruments by acknowledging student accomplishments. The evidence indicates that badges have a positive effect on engagement and motivation. For instance, Velázquez-García et al. (2024) reported a significant 25% increase in involvement among students in higher education. Similarly, leaderboards promote competitiveness by openly assessing student achievement, a methodology that has been demonstrated to enhance both engagement and academic success (Raharjo et al., 2021; Alsadoon, 2022).

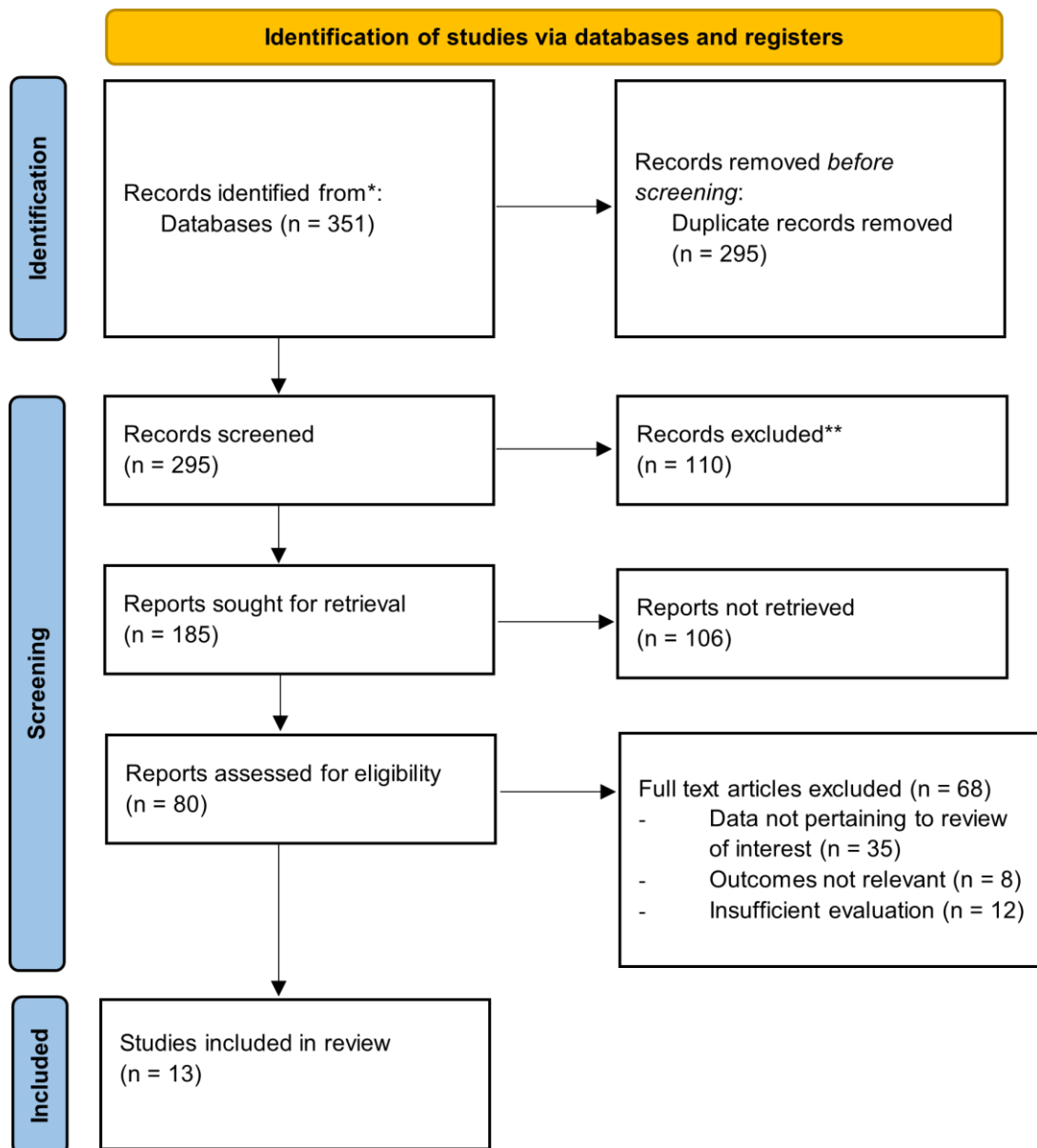


Figure 1 PRISMA flow chart of the systemic review.

Point-based systems provide prompt feedback and motivate students to actively participate in learning activities. Multiple studies conducted by Chans et al. (2021) and Raju et al. (2021) have shown substantial enhancements in motivation and engagement when points are employed. The number of experience points (XP) is a measure of cumulative achievement that promotes long-term student engagement by rewarding regular work (Raju et al., 2021). Challenges and missions provide organised activities that promote problem-solving and active participation, dramatically enhancing engagement, as demonstrated in a mathematics learning application (Atin et al., 2022). Commendations and accolades, such as certificates and virtual prizes, also increase motivation by providing official acknowledgement of accomplishments (Chans et al., 2021; Puig et al., 2023). In addition, levels and progress bars serve as visible indicators for pupils to track their advancement, motivating them to gradually attain objectives (Aguilos & Fuchs, 2022). Moreover, avatars and dashboards customise the educational experience, enabling students to monitor their advancement and independently manage their learning, thereby enhancing their engagement and self-regulation (Li et al., 2022).

Each component of gamification examined in the chosen research—badges, leaderboards, points, XP, challenges, accolades, levels, progress bars, avatars, and dashboards—serves a unique purpose in improving student motivation, involvement, and performance. Research suggests that these factors together promote a more captivating and gratifying educational setting, eventually leading to enhanced learning results. The gamification elements serve to inspire students by recognising their accomplishments, promoting rivalry, and providing tailored feedback, thereby enhancing the dynamism and enjoyment of the instructional process.

Table 1 List of recent articles related to gamification in education from 2021--2024.

Researcher(s)	Research focus	Target user	Gamification elements	Affected learning outcome
Raharjo et al. (2021)	Impact of gamification on active learning through an LMS called Student-Centered E-Learning Environment (SCeLE Fasilkom) used by the Faculty of Computer Science at Universitas Indonesia (UI).	University students	Badges Leaderboard Ratings and points	Active learning
Chans et al. (2021)	To present the results of implementing a gamification strategy in two chemistry courses to improve student motivation and engagement.	University students	Awards Points	Motivation Engagement
Raju et al. (2021)	Explore the effectiveness of gamification technique to improve the students' engagement in database subject	University students	Experience points	Motivation Engagement
Aguilos & Fuchs (2022)	To contribute to the body of knowledge by critically exploring how undergraduate students in Thailand perceive gamification	University students	Activity completion Awards Badges Levels Points	Motivation Engagement
Atin et al. (2022)	To develop a model and application of gamification-based mathematics m-learning by integrating the ARSC model and octalysis framework	School student	Restricted access Badges Challenges Missions Leaderboards Levels Points	Engagement
Alsadoon (2022)	To investigate the effects of a gamified e-learning environment on computer science learning for middle school students.	School student	Progress bars Badges Leaderboards Levels Points	Achievement Motivation Satisfaction
Jusas et al. (2022)	To analyse the effect of applying gamification in object-oriented programming (OOP) course for undergraduate students	University students	Experience points Interactive content Local team Global team	Engagement
Li et al. (2022)	To explore the effects of gamified systems and environment on children's self-regulated learning	School students	Avatars Challenges Dashboards Level Leaderboards Points Trophies	Self-regulated learning
Rahayu et al. (2022)	To examine students' behavioral change when using e-learning with gamification, investigate gamification elements that are important to students and how it influences students' motivation and engagement, and investigate whether population characteristics may influence students' motivation and engagement.	University students	Badges Leaderboards Points	Motivation Engagement
Alsadoon (2023)	To investigate the impact of an online gamified learning environment on university students' motivation and engagement in learning a computer essentials course	University students	Badges Leaderboards Points	Motivation Engagement
Puig et al. (2023)	To evaluate the engagement of students with gamification elements by means of a course composed of a knowledge "pill" related to the topic of	High school student	Awards Badges Challenges Points	Engagement



	“recycling plastics from the sea”, offered through the nanoMOOCs learning platform.			
Hellín et al. (2023)	The effectiveness of these tools in promoting engagement and motivation in important use cases, such as programming courses or other engineering subjects, as well as their ability to support learning.	University students	Badges Leaderboards Points	Motivation Engagement
Velázquez-García et al. (2024)	Analyse the impact of the use of digital badges, as a strategy of educational gamification.	Higher education students	Badges	

3.2. Gamification impacts on learning

Integrating gamification into education significantly influences student engagement, motivation, and learning results. Raharjo et al. (2021) reported that the implementation of gamification in a learning management system (LMS) environment improved the level of active learning among university students. The LMS was designed with gamification elements such as badges, leaderboards, and points to motivate students to actively participate and interact with the course material. Multiple studies have documented a rise in motivation and involvement as a result of including gamification components. Chans et al. (2021), Raju et al. (2021) and Aguilos & Fuchs (2022) reported significant increases in student motivation and engagement while using gamified educational environments of 30%, 85% and 40%, respectively.

In addition, Li et al. (2022) investigated the impact of gamified systems on the self-regulated learning of children. Their research emphasised the positive impact of including gamification features, such as avatars, challenges, and dashboards, on children's capacity to independently regulate their learning processes. This study revealed a significant 28% improvement in self-regulation skills as a result. Additionally, Rahayu et al. (2022) noted alterations in student behaviour when e-learning platforms that integrated gamification were used. In accordance with the study's findings, 70% of the students indicated that badges and leaderboards encouraged them to become more involved in the learning material.

3.3. Motivation and engagement

Effective learning relies on motivation and engagement, and gamification has been seen as a powerful method for achieving this. Research has consistently demonstrated that the implementation of gamification enhances students' inherent drive to engage in learning by rendering educational activities more pleasurable and gratifying. Chans et al. (2021) established that the inclusion of gamification features, such as prizes, points, and experience points, resulted in a considerable increase in student motivation. Specifically, 78% of the participants reported elevated levels of motivation compared with conventional learning approaches. In a similar vein, Raju et al. (2021) discovered that the utilisation of gamification features resulted in a heightened sense of motivation among 85% of students, leading to increased task completion. Furthermore, Velázquez-García et al. (2024) provided evidence supporting this claim by showing that the inclusion of digital badges in the classroom resulted in a 15% rise in student satisfaction and increased motivation among higher education students. These findings underscore the increasing impact of gamified approaches in encouraging active engagement among university students.

Gamification offers the advantage of increased engagement. Raharjo et al. (2021) reported that the implementation of leaderboards and badges in educational settings fostered a competitive and participatory learning atmosphere, resulting in a 25% increase in student engagement. In their study, Rahayu et al. (2022) discovered that a significant majority of students, specifically 70%, exhibited higher levels of involvement and interest in the course content as a result of the incorporation of gamification components such as badges and points. Hellín et al. (2023) validated these results, demonstrating that incorporating gamification components such as points and leaderboards effectively enhanced student involvement in programming classes, leading to a notable 30% surge in participation rates. The sense of accomplishment and contentment that arises from earning badges and observing one's name on a leaderboard can greatly enhance a student's involvement with educational content.

3.4. Learning achievement

The implementation of gamification in education not only serves as a source of motivation for students but also has a quantifiable effect on their academic performance. As stated by Alsadoon (2022), students enrolled in gamified courses had better learning results than those in conventional educational environments did, resulting in a 20% increase in exam scores. In a similar vein, Hellín et al. (2023) reported that students enrolled in engineering courses that incorporated gamification achieved marks that were 15% higher than their counterparts in courses that did not utilise gamification. These studies suggest that the use of gamification features enhances students' comprehension and retention of course material.

Several studies have also reported gains relevant to the subject matter. Jusas et al. (2022) documented a significant 25%

improvement in student performance inside a gamified object-oriented programming course, underscoring the efficacy of gamification in challenging academic domains. In agreement with the study conducted by Atin et al. (2022), the use of a gamification-based mathematics mobile learning application resulted in a significant 20% enhancement in both student performance and comprehension of mathematical topics. These studies emphasise the capacity of gamification to improve academic performance in different disciplines and educational levels. In addition, Puig et al. (2023) reported a significant 22% increase in knowledge retention among students who utilised gamified learning systems. Consistent with prior research, Velázquez-García et al. (2024) reported that a 20% enhancement in students' examination results in game-based courses that incorporate digital badges. The findings highlight the capacity of gamification to greatly enhance learning results and promote a more captivating educational setting.

4. Conclusion

The present review provides empirical evidence supporting the beneficial effects of gamification on student motivation, engagement, and academic achievement. By offering instant feedback, recognition, and competition, gamified features such as badges, leaderboards, and points contribute to the creation of more dynamic and rewarding learning environments. These characteristics facilitate active engagement and enhance the acquisition of knowledge at all educational levels. Although most research has concentrated on short-term impacts, the long-term ramifications, namely, whether these gains are maintained over time, remain mostly unknown. Future studies should incorporate longitudinal studies to investigate the enduring effects of gamification in various settings. An inherent constraint of this evaluation is the omission of papers lacking rigorous experimental designs, therefore diminishing the applicability of the conclusions. A comprehensive investigation in many cultural and educational contexts is necessary to obtain a thorough understanding of the possibilities and constraints of gamification. Thus, although gamification provides substantial advantages, further study is needed to evaluate its long-term impacts and improve its application in education.

Ethical Considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

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