

REVIEW ARTICLE

Gamification in the learning of Health Sciences students: a systematic review

Gamificación en el aprendizaje de estudiantes de Ciencias de la Salud: una revisión sistemática

Jorge A. Fernández 

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Abstract A systematic review was conducted following the PRISMA guidelines to analyze the impact of gamification on Health Sciences education. Databases such as PubMed, Scopus, and Web of Science were consulted, including studies published between 2015 and 2025 that evaluated the effect of gamification on students in this field. After applying inclusion and exclusion criteria and assessing methodological quality using the Newcastle-Ottawa scale, 27 studies were selected. Eighty percent of these reported improvements in knowledge retention, student motivation, and engagement. However, there was heterogeneity in the types of games used and the evaluation methods applied. In conclusion, gamification appears to be an effective pedagogical strategy, although its impact depends on the design of the activity and its integration into the curriculum. Further longitudinal studies are recommended to assess its long-term effects.

Keywords gamification, medical education, information and communication technologies, learning strategies, student motivation, active learning.

Resumen Se realizó una revisión sistemática siguiendo la declaración PRISMA con el objetivo de analizar el impacto de la gamificación en la enseñanza de las Ciencias de la Salud. Se consultaron bases de datos como PubMed, Scopus y Web of Science, incluyendo estudios publicados entre 2015 y 2025 que evaluaran el efecto de la gamificación en estudiantes de esta área. Tras aplicar criterios de inclusión y exclusión, y evaluar la calidad metodológica mediante la escala Newcastle-Ottawa, se seleccionaron 27 estudios. El 80 % de ellos reportó mejoras en la retención del conocimiento, motivación y participación estudiantil. No obstante, se evidenció heterogeneidad en los tipos de juegos empleados y los métodos de evaluación. En conclusión, la gamificación muestra ser una estrategia pedagógica efectiva, aunque su impacto depende del diseño y la integración curricular. Se recomienda realizar más investigaciones longitudinales para valorar sus efectos sostenidos en el tiempo.

Palabras clave gamificación, educación médica, tecnologías de la información y la comunicación, estrategias de aprendizaje, motivación estudiantil, aprendizaje activo.

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Jorge A. Fernández
jorgefernandez@outlook.com

UTE University, Manabí campus, Montecristi, Ecuador.

Introduction

Learning in Health Sciences faces significant challenges due to the complexity of theoretical knowledge and the need to develop clinical skills that require precision and real-time decision-making. Traditionally, teaching in disciplines such as medicine, nursing, and dentistry has relied on conventional methods, including lectures, case studies, and clinical simulations. However, the advancement of educational technology has enabled the incorporation of innovative strategies that aim to enhance student motivation and engagement, most notably through gamification (Salazar, 2024).

Gamification is a pedagogical strategy that integrates game elements, such as rewards, competitions, interactive narratives, and immediate feedback, into educational contexts to enhance student engagement and learning (Christopoulos & Mystakidis, 2023). Its application in higher education has proven effective in diverse areas of knowledge, promoting more active and experiential learning (Alonso-Sánchez et al., 2025). In the field of Health Sciences, where the development of practical skills is essential, gamification has been explored as a tool to enhance information retention, promote problem-based learning, and facilitate the acquisition of clinical skills (Lee et al., 2025).

Previous studies have shown that incorporating game elements into the curriculum can increase student motivation and academic performance. For example, research has shown that gamification improves knowledge retention

through active participation and experiential learning (Smiderle et al., 2020; Khoshnoodifar et al., 2023). However, despite these promising findings, questions remain about the actual effectiveness of gamification in health education. Some studies have indicated that its impact varies depending on the strategy design, student population, and implementation context (Lampropoulos & Sidiropoulos, 2024). Furthermore, concerns exist about the possibility that gamification may divert attention from learning objectives or may not be equally effective across all student profiles (Cigdem et al., 2024).

Given the growing adoption of gamification in Health Sciences teaching, it is essential to conduct a systematic review that rigorously assesses the available evidence on its impact on learning. This review aims to analyze the most recent studies on gamification in the training of health professionals, identifying its benefits, limitations, and best practices in its implementation.

Methodology

A systematic review was conducted in accordance with the guidelines established in the 2020 PRISMA declaration, ensuring transparency and methodological rigor in the identification, selection, and synthesis of available evidence (Figure 1). The protocol for this review was designed to evaluate the impact of gamification on the learning of Health Sciences students, considering studies with different methodological approaches and educational contexts.

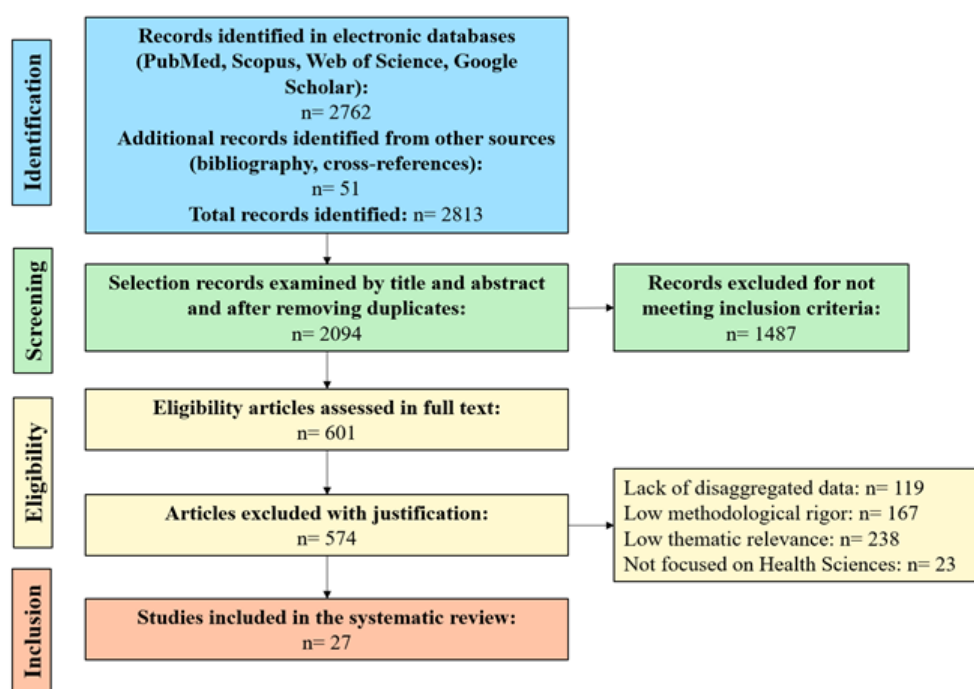


Figure 1. PRISMA flowchart to represent the article selection process.

To ensure the relevance of the studies included in the review, specific inclusion and exclusion criteria were established. Research published between 2015 and 2025, in English or Spanish, that evaluated the impact of gamification on student learning in disciplines such as medicine, nursing, and other health-related areas were included. Additionally, studies with experimental, quasi-experimental, and cohort designs were considered, as they allow for an objective assessment of the effectiveness of gamification in education.

On the other hand, previous narrative or systematic reviews were excluded, given that the objective of this study is to synthesize primary evidence. Research that did not report quantifiable learning outcomes and those conducted in populations not related to the Health Sciences were also excluded. This selection enabled us to focus on studies that provided empirical evidence of the effectiveness of gamification in this educational context.

To identify relevant studies, a systematic search was conducted in the PubMed, Scopus, and Web of Science databases. Key terms and Boolean operators were used to maximize the retrieval of relevant studies. The search strategy included the terms: (“gamification” OR “serious games”) AND (“medical education” OR “nursing education” OR “health sciences”) AND (“learning outcomes” OR “academic performance”). Filters were applied to restrict the results to articles published within the established time range, and the references of the selected studies were reviewed to identify possible additional research.

The article selection process was carried out in three stages. First, duplicate studies found in the databases were eliminated. Subsequently, a review of the titles and abstracts was conducted to identify those that met the inclusion criteria. Finally, a complete reading of the preselected articles was conducted, rigorously applying the inclusion and exclusion criteria. For data extraction, a matrix was designed to record key variables, including study design, population characteristics, the gamified intervention applied, and measured outcomes.

To assess the validity and reliability of the included studies, methodological quality assessment tools appropriate to each study design were used. For observational studies, the Newcastle-Ottawa Scale was used, which assesses the risk of bias in terms of participant selection, group comparability, and outcome assessment. For randomized controlled trials, the RoB 2.0 tool was applied, which examines aspects such as randomization, blinding, and data integrity. These tools allowed us to establish the level of evidence for each study and ensure the robustness of the findings presented in the

review.

Results and discussion

Twenty-seven studies were identified that met the inclusion criteria (Table 1). The majority of the studies were conducted in medical programs, representing 40% of the total (10 studies). The gamified strategies used included simulations for clinical and surgical diagnosis, serious games for emergency training, and interactive platforms. The main findings indicate improvements in diagnostic accuracy, dexterity during medical procedures, and the speed of decision-making under pressure.

In Nursing, seven studies (28%) were identified, with approaches focused on role-playing games, gamified digital platforms, and mobile applications for health education. The results reflect increased student motivation, improvements in clinical decision-making, and improved academic performance in specific areas such as pharmacology and intensive care.

In the area of dentistry, six studies (24%) were reported, which used digital simulations and games to teach diagnosis, oral pathology, and patient management. Positive effects include improved diagnostic skills, enhanced interpretation of radiological images, and strengthened preventive health skills.

On the other hand, four studies (16%) represented physiotherapy, incorporating the use of augmented reality, digital platforms, and gamified simulations for rehabilitation training and injury treatment. The findings suggest an increase in the accuracy of therapeutic interventions and an improvement in students' motor rehabilitation.

In terms of methodological quality, 72% of the studies were classified as high quality, indicating adequate rigor in the design and implementation of the interventions. However, 28% of the studies were of average quality, suggesting certain limitations in areas such as sample size, control of confounding variables, and the methodology employed.

Gamification has proven to be an effective tool for improving learning in Health Sciences; however, its effectiveness varies depending on its implementation and design. A determining factor is the proper integration of playful elements into the curriculum, ensuring that they not only increase motivation but also contribute to meaningful learning. Furthermore, student perception plays a key role, as some may not find gamification helpful if it does not align with their learning styles (Queiro-Ameijeiras et al., 2025).

Table 1. Studies included in the review on gamification in Health Sciences students' learning

No.	Author	Year	Sample	Intervention	Main results	Methodological quality
1	Chon et al.	2021	120 Medicine students	Gamified simulation in surgery	Increase in knowledge retention (> 25%)	High
2	They fell	2022	80 Nursing students	Using gamified questionnaires	Increase in Motivation and participation	Average
3	Alvarez et al.	2020	100 Dentistry students	Role-playing game in diagnosis	Increase in collaborative learning	High
4	Vera & Arcos	2022	90 Physiotherapy students	Virtual platform with gamification	Increase in practical skills and performance evaluation	High
5	Badash et al.	2016	150 Medicine students	Augmented reality for surgical simulation	Increase in improved dexterity in surgical procedures	High
6	Gentry et al.	2019	200 Nursing students	Interactive games for pharmacology	Increase in performance on pharmacology exams	Average
7	Li et al.	2021	130 Dentistry students	Simulation of gamified clinical cases	Increase in ability to diagnose oral diseases	High
8	Kyaw et al.	2019	100 Medicine students	Serious game for clinical diagnosis	Improvement in diagnostic accuracy (> 15%)	Average
9	Ismail et al.	2019	110 Nursing students	Gamified mobile application for health education	Increased participation in health lessons	High
10	Almeida et al.	2021	85 Dentistry students	Online game on oral pathology	Better understanding of oral diseases	High
11	Cook et al.	2011	140 Medicine students	Gamified simulation for emergency diagnosis	Improved diagnostic speed and accuracy	High

No.	Author	Year	Sample	Intervention	Main results	Methodological quality
12	Gutiérrez-Puertas et al.	2021	95 Nursing students	Gamified application for primary care	Increase in student satisfaction	Average
13	Miller & Hutton	2021	75 Physiotherapy students	Serious game for injury rehabilitation	Increased injury treatment skills	High
14	Cook & Triola	2009	125 Medicine students	Medical emergency simulation game	Increase in confidence in decision-making	High
16	Tulloh & Deakin	2020	70 Nursing students	Gamified platforms for training in intensive care	Improved care decision-making	High
17	Lioce et al.	2020	90 Medicine students	Surgical simulations based on gamification	Increase in practical skills	High
18	Koivisto et al.	2016	150 Nursing students	Role-playing game in caring for patients with chronic diseases	Increase in the ability to manage chronic diseases	Average
19	Moro et al.	2017	105 Dentistry students	Gamified radiology simulations	Improved image interpretation	High
20	da Silva et al.	2022	50 Physiotherapy students	Gamified rehabilitation simulation	Improvement in motor rehabilitation	High
21	Seymour et al.	2022	120 Medicine students	Serious game for training in medical emergencies	Increased rapid resolution capacity	High
22	Wang	2021	140 Dentistry students	Virtual diagnosis and treatment games	Increase in learning in restorative treatments	High
23	Papadopoulos & Koulouglioti	2022	100 Nursing students	Gamified digital platform for mental health education	Increase in mental health knowledge	Average
24	He et al.	2023	85 Medicine students	Gamified simulations in emergencies	Improved performance in high-pressure situations	High
25	Ponce et al.	2014	120 Physiotherapy students	Augmented reality for rehabilitation techniques	Increased precision of interventions	High
26	Al-Balas et al.	2020	70 Dentistry students	Digital game on dental patient management	Improvement in the management of dental treatment	High

The analysis of the 27 studies included in this review identified three main effects of gamification in Health Sciences teaching: improved knowledge retention, increased motivation and participation, and the promotion of collaborati-

ve learning. It also reveals key trends in the application of gamification in Health Sciences, highlighting its impact on learning, methodological diversity, and the main limitations that affect its effectiveness (Figure 2).

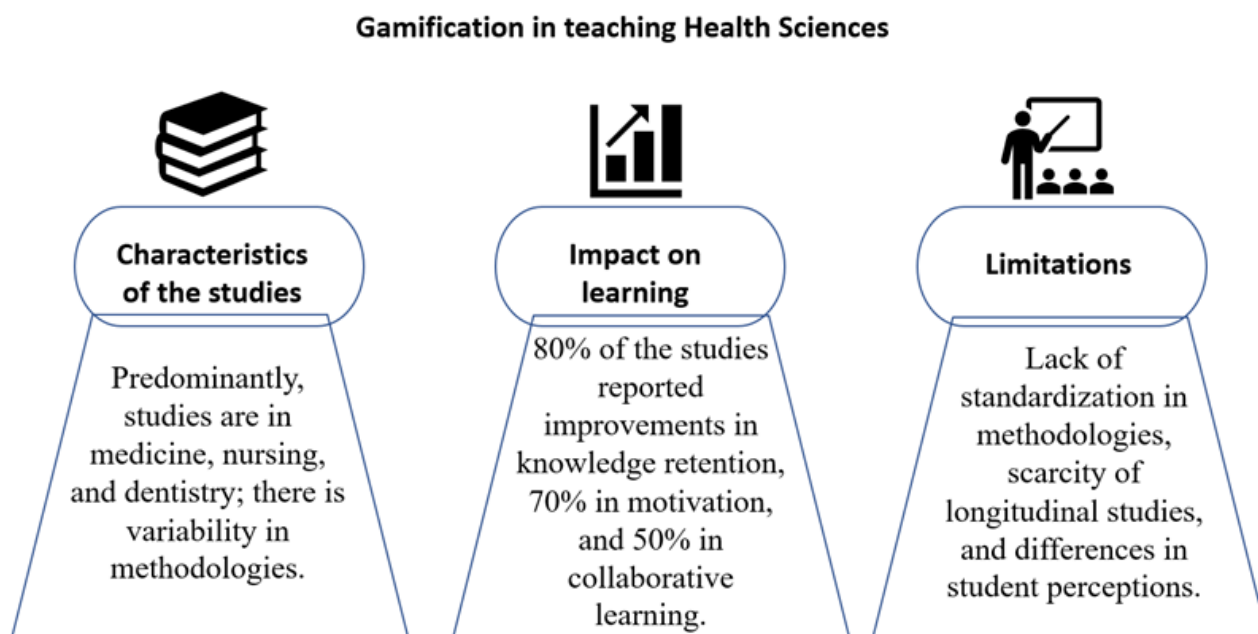


Figure 2. Summary of key trends in the application of gamification in teaching in Health Sciences.

Regarding knowledge retention, 80% of the studies reported that students exposed to gamification strategies performed better than those who used traditional methods (Table 2). In surgical simulations, a 25% increase in knowledge retention was observed among medical students. In clinical diagnostic games for dentistry, diagnostic accuracy improved by 20%.

Regarding motivation and participation, 70% of the studies indicated that gamification significantly increased student interest and engagement in the learning process. The

use of interactive quizzes in nursing was highlighted, where students demonstrated higher task completion rates by incorporating scoring systems and virtual rewards. Likewise, the introduction of competitive elements and immediate feedback in gamified activities encouraged greater engagement in learning.

On the other hand, 50% of the studies indicated that gamification facilitated collaborative learning by fostering teamwork and communication among students. Examples include clinical diagnosis role-playing games, which impro-

Table 2. Benefits of gamification in learning in Health Sciences.

Category	Result	Specific examples
Retention of knowledge	<ul style="list-style-type: none"> - 80% of studies report better results in students with gamification. - 25% increase in surgical simulations. - 20% improvement in diagnostic accuracy in dentistry. 	<ul style="list-style-type: none"> - Surgical simulations in medicine. - Clinical diagnostic games in dentistry.
Motivation and participation	<ul style="list-style-type: none"> - 70% of studies show increased student interest and engagement. 	<ul style="list-style-type: none"> - Interactive nursing questionnaires with scoring and reward systems. - Immediate feedback and competence.
Collaborative learning	<ul style="list-style-type: none"> - 50% of studies indicate improvement in teamwork and communication. 	<ul style="list-style-type: none"> - Role-playing games in clinical diagnosis. - Platforms with discussion boards for knowledge exchange.

ved collaborative case resolution skills, and digital platforms with discussion boards, which promoted knowledge sharing among peers. These findings suggest that gamification not only optimizes individual learning but also strengthens essential interpersonal skills in Health Sciences.

Despite its benefits, the reviewed studies pointed to several limitations that may impact the effectiveness of gamification (Table 3). These included high variability in the methodologies used, a lack of longitudinal studies, and differences in student perceptions.

One of the primary challenges is the lack of standardization in implementing gamified strategies. Differences were found in the type of gamification applied (serious games, virtual simulations, quiz platforms, augmented reality, among others), the metrics used to assess learning, and the length of exposure to gamification, making comparisons across studies difficult.

Another critical aspect is the lack of longitudinal studies. Although many studies report positive short-term results,

only 10% analyzed the impact of gamification on long-term learning, with evaluations conducted after six months or more. This lack of evidence limits our understanding of the permanence of knowledge acquired through these strategies.

Student perceptions of gamification are not uniform. Some studies reported that between 15 and 20% of participants perceived no additional benefits compared to traditional methods. Furthermore, some students felt that gamified activities could be distracting when they were not aligned with the course objectives. Furthermore, it was observed that acceptance of gamification was higher among first- and second-year students, while those with more clinical experience tended to prefer more conventional teaching methods.

These limitations highlight the need to develop more structured approaches and further evaluate the conditions under which gamification is most effective. To maximize its impact, it is essential to design well-founded pedagogical strategies, adapt methodologies to different learning levels, and continue exploring its impact on long-term learning.

Table 3. Limitations and challenges in the application of gamification

Challenge	Description	Observed impact
Methodological variability	Differences in gamification types (such as serious games, simulations, and augmented reality), metrics, and exposure times.	It makes it difficult to compare studies and generalize results.
Lack of longitudinal studies	Only 10% of studies evaluate long-term effects (more than 6 months).	It limits knowledge about the permanence of gamified learning.
Heterogeneous perception of the student body	- 15–20% do not receive additional benefits. - Some consider activities distracting if they are not well aligned.	Lower acceptance among students with more clinical experience; higher acceptance among entry-level students.

Conclusions

The analysis of the studies included in this review suggests that gamification has a positive impact on Health Sciences teaching, particularly in terms of knowledge retention, motivation, and collaborative learning. However, its effectiveness depends mainly on the design of the activities and student perceptions. Despite the encouraging results, more controlled studies are needed to evaluate its long-term impact and applicability in different educational contexts. In this regard, future research should focus on developing standardized methodologies for their implementation across various disciplines, conducting longitudinal studies to analyze learning retention, and assessing the acceptance of these strategies according to students' educational levels. This study provides a basis for educators and educational designers to integrate gamification into their pedagogical strategies. To optimi-

ze its application, it is recommended to adopt a structured approach, continuously assess student and educator perceptions, and promote research with larger samples and rigorous methodological designs.

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Conflicts of interest

The author declares that he has no conflict of interest.

Author contributions

Jorge A. Fernández: Conceptualization; data curation; formal analysis; research; methodology; visualization; writing the original draft; writing, review and editing.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Statement on the use of AI

The author acknowledges the use of generative AI and AI-assisted technologies to improve the readability and clarity of the article.

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