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REVIEW ARTICLE

Gamification as an active learning strategy through clinical cases: impact on medical training

Gamificación como estrategia de aprendizaje activo a través de casos clínicos: impacto en la formación médica

Mayda Beltrán[1] • **Denise Vega**[2]

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Abstract Gamification has become an innovative educational strategy, especially in medical training because it promotes active learning and student engagement. This review article aims to analyze the impact of gamification in medical education, identifying its benefits, limitations, and the challenges associated with its implementation. Recent studies evaluating the use of gamified elements, such as serious games, interactive applications, and clinical simulations, in teaching theoretical and practical skills were reviewed. The results indicated that gamification enhances motivation and enjoyment of learning, promotes critical thinking development, and facilitates knowledge retention, even in complex clinical scenarios. However, barriers such as resistance to change from teaching staff and the need for adequate technological resources were also identified.

Keywords gamification, active learning, interactive teaching, medical training, barriers in education, pedagogical strategies.

Resumen La gamificación se ha consolidado como una estrategia educativa innovadora, especialmente en el ámbito de la formación médica, debido a su capacidad para fomentar el aprendizaje activo y el compromiso estudiantil. Este artículo de revisión tiene como objetivo analizar el impacto de la gamificación en la educación médica, identificando sus beneficios, limitaciones y los desafíos asociados con su implementación. Se revisaron estudios recientes que evalúan el uso de elementos gamificados, como juegos serios, aplicaciones interactivas y simulaciones clínicas, en la enseñanza de habilidades teóricas y prácticas. Los resultados indicaron que la gamificación mejora la motivación y disfrute del aprendizaje, promueve el desarrollo del pensamiento crítico y facilita la retención de conocimientos, incluso en escenarios clínicos complejos. Sin embargo, también se identificaron barreras como la resistencia al cambio por parte del personal docente y la necesidad de recursos tecnológicos adecuados.

Palabras clave gamificación, aprendizaje activo, enseñanza interactiva, formación médica, barreras en educación, estrategias pedagógicas.

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Mayda Beltrán
labaut0515@gmail.com

[1]Instituto de la Visión, Portoviejo, Manabí, Ecuador.
[2]Hospital de Especialidades, Portoviejo, Manabí, Ecuador.

PUBLIS EDITORIAL

Introduction

In the last decade, gamification has emerged as one of the most innovative and effective pedagogical strategies across various fields of education, particularly in medical training. This approach leverages game principles and elements like rewards, challenges, and instant feedback to create a more engaging, interactive, and motivating learning environment. In medical education, gamification facilitates theoretical content teaching and enhances practical training through clinical simulations and interactive cases. These methodologies allow students to confront real or hypothetical scenarios in a controlled manner, promoting the development of clinical skills such as diagnosis, decision-making, and teamwork (Cascella et al., 2023).

Gamification has gained prominence in medical education as an innovative tool to improve learning and the training of healthcare professionals. Its roots lie in using game techniques to foster motivation and engagement in non-game educational settings. This strategy has been implemented in medical education to improve knowledge retention, critical thinking, and practical skills through simulations and interactive clinical cases (Xu et al., 2023).

Several studies have shown that gamification can transform the educational experience by promoting more dynamic and autonomous learning while improving students' perception of the teaching-learning process. In particular, incorporating serious games and interactive platforms in medical training programs has allowed students to face complex clinical scenarios safely, encouraging decision-making and problem-solving in real time (Dorado & Chamosa, 2019; Smiderle et al., 2020).

Active learning focused on direct student participation, has been significantly strengthened with the integration of gamification, allowing for better knowledge retention and more effective autonomous learning. However, despite its benefits, the implementation of gamification in medical education faces challenges, such as resistance from some faculty to adopt new technologies and the need for adequate infrastructure for successful implementation. This review article analyzes the impact of gamification in medical education, evaluating its benefits, limitations, and the challenges that persist in its adoption (Hellín et al., 2023).

Methodology

This article is based on a systematic review of the scientific literature related to the topic of interest. To collect and analyze previous studies, a descriptive and qualitative approach was employed. Articles were searched in widely recognized academic databases such as PubMed, Scopus, Web of Science, and Google Scholar to obtain relevant and up-to-date studies.

The following inclusion and exclusion criteria were defined for the collection of studies. The inclusion criteria were: (1) studies published in the last ten years, (2) articles in English and Spanish, (3) research addressing the main topic of the review, and (4) articles with full-text access. Exclusion criteria included irrelevant studies, conference abstracts, and articles without peer review.

Boolean operators were used to optimize the search. Combinations of terms were made using AND, OR, and NOT to include or exclude specific concepts. The keywords used included gamification, medical education, educational technologies, and innovative medical training (Kalogiannakis et al., 2021). The searches were expanded to several databases, and references were managed with the Zotero tool to ensure proper organization (Khan et al., 2022).

Results and discussion

A total of 39 articles were retrieved through the search in several academic databases. After applying the inclusion/exclusion criteria, 23 articles that did not meet the requirements were removed. In the end, 16 articles were selected for analysis in the review.

Table 1 overviews various studies exploring gamification in medical education, particularly in resolving clinical cases. For the analysis, the studies were grouped into three main areas: diagnostic decision-making, improvement of clinical skills, and motivation and learning.

Ishizuka et al. (2023) and Pawar & Pawar (2024) highlighted the use of decision-making cards (DMC) in improving diagnostic decision-making, with a particular focus on awareness of medical costs and clinical thinking. Both studies demonstrated how this gamified tool helps students improve clinical judgment in practical scenarios.

Gamified clinical simulations in the United Kingdom (Gajardo et al., 2023) and Chile (Alzghoul, 2024) enhance clinical judgment and decision-making under pressure, especially in emergencies. Gamification allows for the simulation of realistic scenarios where students develop practical and problem-solving skills under stress.

Research in the United States (Gajardo et al., 2023) and Australia (XXV National Congress and I International Congress of the Spanish Society of Medical Education, 2023) highlighted that online gamification improves clinical reasoning and increases motivation and knowledge retention.

Table 1. Gamification in clinical case resolution in Medicine

Reference	Type of gamification	Country	Main result
Ishizuka et al. (2023)	Decision-making cards (DMC)	Japan	Gamification improves diagnostic decision-making and increases awareness of medical costs
Huang et al. (2024)	Online gamification methods	United States	Improves students' clinical reasoning ability
Wang et al. (2024)	Key gamification elements	China	Identifies key elements for effectively applying gamification in medical education
Xu et al. (2023)	Game-Based Learning (GBL)	China	GBL methods provide immersive experiences and improve learning outcomes
Do et al. (2023)	Gamified vs. non-gamified online educational modules	Australia	Gamification improves student motivation and knowledge
Huang et al. (2024)	Gamified clinical simulations	United Kingdom	Gamified clinical simulations contribute to better clinical judgment and decision-making
Ishizuka et al. (2023)	DMCs for diagnostic decision-making	Japan	Increases cost awareness and improves decision-making
Fica et al. (2023)	Medical emergency simulation	Chile	Significant improvement in decision-making ability and stress management in emergencies
Yu et al. (2023)	Virtual role-playing games	Spain	Increased student motivation and a better understanding of doctor-patient interactions
Aldalur & Alain (2023)	Points, levels, and rewards	Mexico	Students showed greater retention of clinical knowledge and diagnostic skills
Leon & Peña (2022)	Educational escape room	Argentina	Stimulates critical thinking and problem-solving under pressure, especially in complex diagnostic situations
Salazar et al. (2019)	Interactive simulators	Chile	Effective use for evaluating the development of clinical skills, emphasizing cohort practice
Sánchez et al. (2008)	Strategy games with clear goals	Mexico	Participants showed increased adherence to ethical and practical principles in managing critical situations
Wang et al. (2024)	Key gamification elements	China	Identifies key elements for effectively applying gamification in medical education
Do et al. (2023)	Gamified *vs*. non-gamified online educational modules	Australia	Gamification improves student motivation and knowledge

This gamification is applied through interactive educational platforms, promoting a better understanding of clinical concepts and improving learning outcomes.

Other approaches, such as virtual role-playing games in Spain (Pons & Sonsoles, 2020), educational escape rooms in Argentina (Padilla et al., 2024), and interactive simulators (Fica et al., 2023), focus on critical thinking, problem-solving, and teamwork. These modalities help students better understand doctor-patient interactions and tackle complex diagnostic situations.

Table 2 summarizes the leading countries in using gamification as an active learning strategy through clinical cases in medical training. It highlights the main conclusions from recent research on the impact of gamification in medical education.

These countries lead the implementation of gamified strategies for medical education, adapting them to their specific educational needs. Japan uses decision-making cards (DMC) to improve diagnostic decision-making, while in the United States, game-based learning (GBL) predominates to develop clinical reasoning. In the United Kingdom, gamified clinical simulations are key to optimizing clinical judgment and decision-making in realistic scenarios. Spain employs virtual role-playing games to foster doctor-patient interaction and intrinsic student motivation, and Mexico focuses on point, level, and reward systems to strengthen clinical knowledge retention. These strategies demonstrate how gamification can enhance essential skills in medical training, promoting motivation, active interaction, and meaningful learning.

In the context of medical education, each gamified strategy has unique strengths. As used in the United Kingdom, gamified clinical simulation is highly effective for developing practical skills and decision-making in environments that mimic real medical scenarios, which is critical in medical training. This approach promotes experiential learning and the direct application of knowledge in practical situations. However, in Ecuador, a context with limited resources in certain institutions, it might be more feasible to implement strategies requiring less infrastructure, such as using points, levels, and rewards, as applied in Mexico. This approach is adaptable, cost-effective, and can incentivize active participation and clinical knowledge retention without relying on advanced technology. Therefore, a combination of clinical simulations in institutions with greater resources and more accessible techniques, such as points and rewards, could be the most effective strategy to address the diverse needs of the medical education system in Ecuador.

Tabla 2. Leading countries in the use of gamification as an active learning strategy

Country	Gamification approach	Reference
Japan	Use of decision-making cards (DMC) to improve diagnostic decision-making.	Xu et al. (2023)
United States	Game-based learning (GBL) to improve clinical reasoning.	Xu et al. (2023)
United Kingdom	Gamified clinical simulations to improve clinical judgment and decision-making.	Ishizuka et al. (2023)
Spain	Virtual role-playing games to improve doctor-patient interaction and motivation.	McLean (2016)
Mexico	Use of points, levels, and rewards to improve retention of clinical knowledge.	Chans et al. (2021)

The impact of gamification in education varies depending on the regions studied, which are influenced by sociocultural factors and the availability of technological resources. In developed countries, such as the United States and the United Kingdom, gamification has shown a significant positive impact, primarily due to advanced infrastructure, trained faculty, and greater cultural acceptance of innovative educational technologies. For example, in these regions, gamified clinical simulations have optimized the development of clinical skills and decision-making in controlled and realistic environments.

In contrast, although similar benefits in terms of motivation and learning have been documented in developing countries, the implementation of these strategies faces significant barriers. These include limited technological infrastructure, resistance to change from faculty, and budget constraints. Studies conducted in the Ecuadorian context, for instance, highlight that, despite the growing adoption of ICTs and gamification, challenges related to connectivity and access to

proper tools persist.

Additionally, Hellín et al. (2023) and Gajardo et al. (2023) reported that, in developing countries, the effectiveness of gamification largely depends on the adaptability of strategies to available resources. For example, using low-cost gamified approaches, such as point and reward systems, has proven effective in overcoming technological barriers and promoting learning in resource-limited environments. This highlights the need to design contextualized educational interventions that align with local capabilities and promote the sustainable development of medical education.

Conclusions

Gamification in medical education has proven to be an effective tool for improving students' diagnostic skills and clinical decision-making. By implementing games and simulations, students can experience medical situations in a controlled environment, strengthening their ability to face real-life challenges. Various studies indicate that gamification increases student interest and motivation, leading to more interactive and participatory learning. Furthermore, it has been shown that serious video games and gamified platforms enhance knowledge retention and its application in emergency medical contexts. This is because it combines playful elements with teaching, facilitating theoretical and practical content absorption. Additionally, gamification has been shown to contribute to the development of specific skills for emergency medicine, improving students' speed and effectiveness in responding to critical situations. Gamification optimizes the educational process and allows future healthcare professionals to gain experience in solving complex cases, better preparing them for their professional practice.

References

Aldalur, I. & Perez, A. (2023). Gamification and discovery learning: Motivating and involving students in the learning process. *Heliyon*, 9(1), e13135. https://doi.org/10.1016/j.heliyon.2023.e13135

Alzghoul, B. (2024). The Effectiveness of Gamification in Changing Health-related Behaviors: A Systematic Review and Meta-analysis. *Open Public Health Journal*, *17*, e18749445234806. https://doi.org/10.2174/0118749445234806240206094335

Cascella, M., Cascella, A., Monaco, F., & Shariff, M.N. (2023). Envisioning gamification in anesthesia, pain management, and critical care: basic principles, integration of artificial intelligence, and simulation strategies. *Journal of Anesthesia, Analgesia and Critical Care*, *3*(1), 33. https://doi.org/10.1186/44158-023-00118-22

Chans, G.M., & Portuguez, M. (2021). Gamification a s a Strategy to Increase Motivation and Engagement in Higher Education Chemistry Students. *Computers*, *10*(10), 132. https://doi.org/10.3390/computers10100132

Do, M., Sanford, K., Roseff, S., Hovaguimian, A., Besche, H., & Fischer, K. (2023). Gamified versus non-gamified online educational modules for teaching clinical laboratory medicine to first-year medical students at a large allopathic medical school in the United States. *BMC Medical Education*, *23*, 959. https://doi.org/10.1186/s12909-023-04951-5

Dorado, C., & Chamosa, M.E. (2019). Gamificación como estrategia pedagógica para los estudiantes de Medicina nativos digitales. *Investigación en educación médica*, *8*(32), 61-68. https://doi.org/10.22201/facmed.20075057e.2019.32.18147

Fica, A., Burgess, V., González, T., & Rojas, M. (2022). Gamificación en Medicina de Urgencia. *Revista Española de Educación Médica*, *3*, 58-68. https://doi.org/10.6018/edumed.531501

Gajardo, A.D., Murillo-Zamorano, L.R., López-Sánchez, J., & Bueno-Muñoz, C. (2023). Gamification in Health Care Management: Systematic Review of the Literature and Research Agenda. *Sage Open*, *13*(4). https://doi.org/10.1177/21582440231218834

Hellín, C.J., Calles-Esteban, F., Valledor, A., Gómez, J., Otón-Tortosa, S., & Tayebi, A. (2023). Enhancing Student Motivation and Engagement through a Gamified Learning Environment. *Sustainability*, *15*(19), 14119. https://doi.org/10.3390/su151914119

Huang, W.D., Loid, V., & Sung, J.S. Reflecting on gamified learning in medical education: a systematic literature review grounded in the Structure of Observed Learning Outcomes (SOLO) taxonomy 2012-2022. *BMC Medical Education*, *24*(1), 20. https://doi.org/10.1186/s12909-023-04955-1

Ishizuka, K., Shikino, K., Kasai, H., Hoshina, Y., Miura, S., Tsukamoto, T., Yamauchi, K., Ito, S., & Ikusaka, M. (2023). The influence of Gamification on medical students' diagnostic decision making and awareness of medical cost: a mixed-method study. *BMC Medical Education*, *23*, 813. https://doi.org/10.1186/s12909-023-04808-x

Kalogiannakis, M., Papadakis, S., & Zourmpakis, A.I. (2021). Gamification in Science Education. A Systematic Review of the Literature. *Education Sciences*, *11*(1), 22. https://doi.org/10.3390/educsci11010022

Khan, K.S., Bueno-Cavanillasa, A., & Zamora, J. (2022). Revisiones sistemáticas en cinco pasos: II. Cómo identificar los estudios relevantes. *Medicina de Familia – SEMERGEN*, *48*(6), 431-436. https://doi.org/10.1016/j.semerg.2021.12.006

Leon, A., & Peña, M. (2022). Gamification tools in the learning of shipbuilding in the undergraduate marine engineering education. *30*(2), 458-471. https://doi.org/10.1002/cae.22465

McLean, S.F. (2016). Case-Based Learning and its Application in Medical and Health-Care Fields: A Review of Worldwide Literature. *Journal of Medical Education and Curricular Development*, 27, S20377. https://doi.org/10.4137/JMECD.S20377

Padilla, J.M., Parra, M.C., & Flores, M.P. (2024). Escape Rooms virtuales: una herramienta de gamificación para potenciar la motivación en la educación a distancia. *Revista Iberoamericana de Educación a Distancia*, *27*(1). https://doi.org/10.5944/ried.27.1.37685

Pawar, V.V., & Pawar, D. (2024). Gamification in medical education: A new approach. *Oral Oncology Reports*, 9, 100209. https://doi.org/10.1016/j.oor.2024.100209

Pons, L., & Sonsoles, I. (2020). Evaluación de una propuesta de aprendizaje basado en juegos de rol llevada a cabo en la asignatura de Cultura Científica de Bachillerato. *Revista de Estudios y Experiencias en Educación*, *19*(39), 123-144. https://dx.doi.org/10.21703/rexe.20201939pons7

Salazar, P., Manterola C., Quiroz G., García, N., Otzen, T., Mora, M., & Duque, G. (2019). Estudios de cohortes. 1ª parte. Descripción, metodología y aplicaciones. *Revista de Cirugía*, *71*(5), 482-493. https://dx.doi.org/10.35687/s2452-45492019005431

Sánchez, A.J., Miranda, M.T., & Guerra, E. (2008). Estudio estadístico del consumo de suplementos nutricionales y dietéticos en gimnasios. *Archivos Latinoamericanos de Nutrición*, *58*(3). https://www.alanrevista.org/ediciones/2008/3/art-2/

Smiderle, R., Rigo, S.J., Marques, L.B., Peçanha de Miranda, J.A., Coelho, M., & Jaques, P.A. (2020). The impact of gamification on students' learning, engagement and behavior based on their personality traits. *Smart Learning Environments*, *7*, 3. https://doi.org/10.1186/s40561-019-0098-x

Wang, Y.F., Hsu, Y.F., Fang, K.T., & Kuo, L.T. (2024). Gamification in medical education: identifying and prioritizing key elements through Delphi method. *Medical Education Online*, *29*(1), 2302231. https://doi.org/10.1080/10872981.2024.2302231

Xu, M., Luo, Y., Zhang, Y., Xia, R., Qian, H., & Zou, X. (2023). Game-based learning in medical education. *Frontiers in Public Health*, *11*, 1113682. https://doi.org/10.3389/fpubh.2023.1113682

XXV Congreso Nacional y I Congreso Internacional de la Sociedad Española de Educación Médica (SEDEM). (2023). *Educación Médica*, *24*(2023), S8-S28.

Yu, H., Isahakyan, A., van Merrienboer, J.J.G., Köhler, S.E., & Asoodar, M. (2023). Second language learning role-play: effects of patient and doctor roles on motivation and competence. *Frontiers in Medicine*, *10*, 1163267. https://doi.org/10.3389/fmed.2023.116326

Conflicts of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: Mayda Beltrán, Denise Vega. **Research:** Mayda Beltrán, Denise Vega. **Methodology:** Mayda Beltrán, Denise Vega. **Visualization:** Mayda Beltrán, Denise Vega. **Writing the original draft:** Mayda Beltrán, Denise Vega. **Writing, review and editing:** Mayda Beltrán, Denise Vega.

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