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SHORT COMMUNICATION

The logical circle of gamification in medical teaching

El círculo lógico de la gamificación en la docencia médica

Joshua Israel Culcay Delgado[1]

[1]Universidad San Gregorio de Portoviejo, Carrera de Medicina. Portoviejo, Ecuador.

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Corresponding Author
Joshua Israel Culcay Delgado

ABSTRACT

Introduction: medical education faces an unprecedented challenge: transcending traditional memorization methods to develop professionals with critical thinking skills. In this context of urgency and transformation, gamification has been given limited space and no pedagogical framework to support it. Even though, as demonstrated in this paper, this is not a mere trend. On the contrary, if well-founded and supported by an appropriate conceptual model, it can be transformed into a solid teaching strategy with a high impact on meaningful learning.
Results: "The logical circle of gamification" postulates the true potential of the game-based teaching strategy. This lies in an iterative and systemic process designed to catalyze meaningful and lasting learning. This model, based on an exhaustive review of the literature, argues that the benefits of gamification do not operate in isolation but are integrated into a virtuous cycle that drives excellence. The Logic Circle is shown to facilitate a vital transition from memory to practice, forcing students to apply their knowledge in dynamic and realistic scenarios actively.
Conclusions: beyond the individual, the Logic Circle enhances teamwork and collaboration, replicating the complex dynamics of a hospital setting and preparing students for the reality of interdisciplinary practice. Each of these elements intertwines and reinforces each others, fueling students' intrinsic motivation and ensuring active and sustained participation.

Keywords: Gamification; Pedagogy; Medical Education; Model.

RESUMEN

Introducción: la educación en medicina se enfrenta a un desafío sin precedentes: trascender de los métodos tradicionales de memorización para forjar profesionales con pensamiento crítico. En este contexto de urgencia y transformación, se ha venido dando espacio limitado y sin marco pedagógico que lo ampare a la gamificación, pese a que como se demuestra en el presente trabajo ésta no es una mera tendencia, por el contrario, bien fundamentada y con el modelo conceptual adecuado puede transformarse en una estrategia didáctica sólida y con alto impacto en el aprendizaje significativo.
Resultados: "El círculo lógico de la gamificación", postula el verdadero potencial de la estrategia didáctica basada en juegos, este reside en un proceso interactivo y sistémico, diseñado para catalizar un aprendizaje significativo y duradero. Este modelo se fundamenta en una revisión exhaustiva de la literatura, argumenta que los beneficios de la gamificación no operan de forma aislada, sino que se integran en un ciclo virtuoso que impulsa la excelencia. Se demuestra que el círculo lógico facilita una transición vital de la memoria a la práctica, obligando a los estudiantes a aplicar activamente sus conocimientos en escenarios dinámicos y realistas.
Conclusiones: más allá de lo individual, el Círculo Lógico potencia el trabajo en equipo y la colaboración, replicando las dinámicas complejas de un entorno hospitalario y preparando a los estudiantes para la realidad de la práctica interdisciplinaria. Cada uno de estos elementos se enlaza y se refuerza mutuamente, alimentando la motivación intrínseca del estudiante y asegurando una participación activa y sostenida.

Palabras clave: Gamificación; Pedagogía; Educación Médica; Modelo.

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INTRODUCTION

Traditional teaching methods and the need for innovation

Health sciences education is at a critical crossroads. We observe that traditional pedagogical models, centered on lectures and the memorization of vast amounts of information, are increasingly insufficient to prepare future medical professionals due to the increasingly dynamic and technological clinical environment.[1] Diaz et al.[2] in their research on teacher competencies in health sciences, highlight the need for an approach that fosters the ability to synthesize, think critically, and solve problems as close to reality as possible. The teaching-learning process has historically been characterized by student passivity, while the active entity in this process has been the teacher, a model that directly conflicts with the need to develop active and applied skills but is also undermined by the teacher's limited ability to develop adequate rhetoric that stimulates student motivation and active participation, where students learn from their mistakes without consequences in their evaluation.[3,4,5] The adoption of Information and Communication Technologies (ICTs) is therefore considered an obvious response to this reality, as they allow the limitations of the physical classroom to be transcended.[6] However, it is important to understand that mere technological integration is not enough; it must be guided by a pedagogical framework that guides its use and application and is also planned in the curriculum of each medical school, thus aiming to achieve meaningful learning objectives.[7] In line with this line of thinking, it is worth quoting the United Nations Educational, Scientific and Cultural Organization (UNESCO),[8] which in 1998, already raised the need for higher education that was relevant, fostered critical thinking, and contributed to social development, principles that remain as relevant today as they were then. This article aims to propose and describe the 'Logical Circle of Gamification', a conceptual model that outlines the interconnected components of gamification and explains its mechanism for promoting meaningful learning in medical education.

DEVELOPMENT

Beyond gaming, a pedagogical catalyst

The incorporation of technology into medical education is not a recent phenomenon. From the emergence of the first computer-assisted learning materials[9] to the development of advanced simulation environments,[10] the medical world has constantly sought new tools to improve teaching. This vibrant evolution, however, has revealed the existence of a significant pedagogical gap.[2] Gamification should be described as one of the most promising teaching strategies for closing the gap between the theory of how to innovate, how to use ICTs, and the practice of doing so in medical education.Unlike traditional (recreational) games, which are inflexible tools with a specific educational, informational, or evaluative purpose·gamification consists of applying game elements and mechanics, such as keeping score, awarding badges, creating leaderboards, and setting challenges for students. Gamification in teaching is not just about playing, but participating in a game that is structured, intentional, responds to a training objective, and has been included in the curriculum and academic planning, seeking to foster motivation and commitment in the student.[13,14] These elements have been shown to have the potential to transform monotonous tasks into engaging experiences, capturing students' attention and encouraging active participation.[3,15] This is not a contemporary phenomenon. Malone[16] already theorized about the intrinsic motivation produced by challenge, curiosity, and control. Today, we can identify these principles as the basis of gamification.

The Logical Circle of Gamification: Conceptualization

Talking about the "logical circle of gamification" does not imply citing a limited set of techniques, but rather referring to an interactive and continuous pedagogical model, a virtuous cycle where each component is linked to the next. This concept differs from the simple application of game elements by emphasizing the interconnection between game mechanics and a specific learning outcome.[11] The circle begins with a challenge, which prompts the student to take action. The action generates immediate feedback, which in turn encourages correction and repetition. This process culminates in the acquisition of a skill and generates a sense of achievement that fuels the motivation to start the cycle again.[11] This view aligns with constructivist theories, such as that of Vygotsky[17], which emphasize learning as a social and guided process. The logical circle, therefore, becomes a framework for understanding and designing learning experiences that are intrinsically motivating and efficient in knowledge construction. This approach proves to be superior to a fragmented application of elements that may respond independently to the essence of gamification, but whose benefits are diluted during their execution because they are not linked in a logical and dynamic circle. This is due to their systematic interconnection and intrinsic design, which guarantee meaningful and deep learning. (figure 1)

Benefits of the logical circle of gamification in medical education

This model is based on the analysis of five key pedagogical benefits that make up this logical circle and have been identified in recent academic literature.[18,19] First, we must describe the benefit of moving from memory to practice, supporting this assertion by stating that gamification forces an active application of knowledge. The cycle begins with the application of knowledge to a challenge (practice), after which instant feedback (an interconnected element) validates or refutes the decision, prompting the student to review and retain the relevant theory (memory) in order to succeed at the next level or attempt. It is this loop of action - result - reflection - new action that ensures active retention.[18] Second, we must analyze the ability of simulation to improve skills in a safe environment; this is not only a fundamental element in 21st-century medical education, but also a global objective that responds to patient safety.[10] The safe environment is not an end, but a means; here, the quality of simulation repetition is developed.[10,12] Each attempt generates data that provides feedback to the student, allowing them to identify weaknesses and progressively refine their technique or clinical judgment. The reward (point/badge) motivates repetition until mastery is achieved.[14] Third, the crucial role of learning from error without consequences is examined, a fundamental element for experimentation and

the development of confidence.[11] This benefit operates as the engine of the cycle, as failure triggers the need for change; the game guides the student toward the correct solution or penalizes them without real harm. In the words of Malone[16], this mechanism is intrinsically motivating, as the player returns to the cycle not out of external obligation, but to overcome the obstacle and move forward, thus integrating error as a catalyst for learning.[20] Fourth, it is discussed how cooperative games foster teamwork and collaboration, replicating essential dynamics of medical practice.[20] The interconnection here is social and crucial because complex challenges require coordination of roles,[7] where individual success depends on team performance. It is then possible to describe a cycle of collaboration - success - social recognition (leaderboard, team badge) that reinforces the interpersonal skills and effective rhetorical communication[4] necessary in the medical environment. Analyzing in detail the logical circle of gamification in medical teaching, we see how all these elements are addressed and combined to generate sustained motivation, which is the fifth benefit described in this model. Motivation is the sustained result of the entire cycle. The gamified elements (challenge - feedback - reward) create an environment that turns academic work into a rewarding activity. This intrinsic motivation[18] ensures persistence, which is critical to mastering the vast and complex amount of medical knowledge. Intrinsic motivation is, in turn, the engine that keeps the logical circle in motion (figure 1).

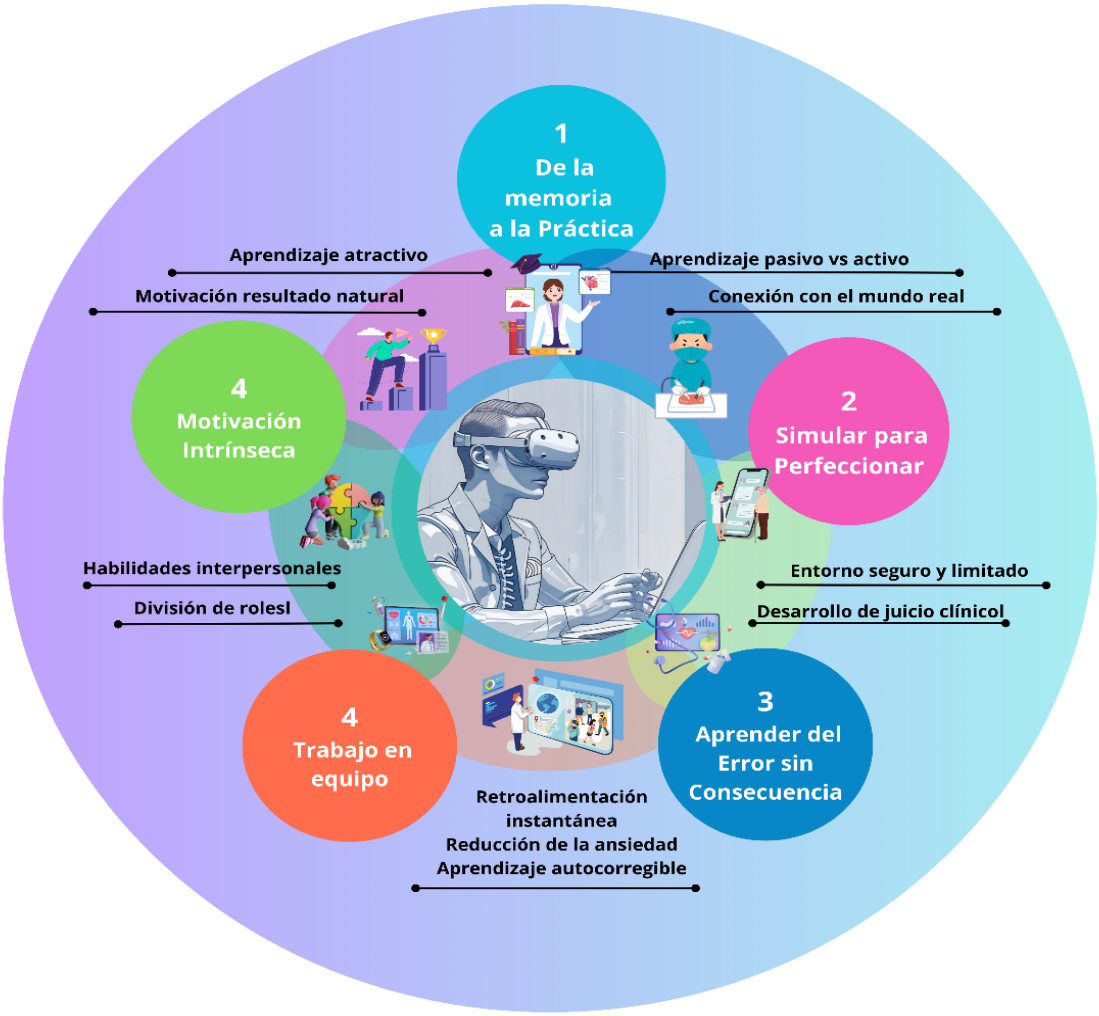

Figure 1. Logical circle of gamification in medical teaching

The main objective of this conceptual model is to demonstrate that gamification is a comprehensive and coherent pedagogical strategy capable of training competent, proactive, and collaborative professionals, thereby dispelling uncertainty.[11] Its relevance lies in the fact that, by providing a clear conceptual framework, it facilitates implementation and promotes a more in-depth discussion about its real potential. It is therefore possible to infer that medical educators, by understanding the logical circle of gamification, can design experiences that are not only attractive and not necessarily based on ICTs, but also become a transformative axis of the medical curriculum, aligning with the needs of a society that demands ethical and highly trained professionals (figure 1).

CONCLUSIONS

It can be reliably concluded that gamification, when articulated under the “Logical Circle of Gamification” model, transcends the surface of playful entertainment and consolidates itself as a pedagogical model of undeniable scientific and ethical value for medical education.

This model guides students through an interactive process that converts theoretical knowledge into functional skills through the

integration of practical application, simulation in controlled environments, and immediate feedback.

The Logical Circle not only facilitates the acquisition of knowledge, but also encourages self-correction and resilience, skills that are considered soft but are essential in the pursuit of humanized healthcare.

This approach has proven capable of training competent, proactive, resilient professionals with a deep social conscience, positioning it as the ideal model for redefining medical education in the 21st century.

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CONFLICT OF INTEREST

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AUTHOR CONTRIBUTION

Conceptualization: Joshua Israel Culcay Delgado.
Data curation: Joshua Israel Culcay Delgado.
Formal analysis: Joshua Israel Culcay Delgado.
Research: Joshua Israel Culcay Delgado.
Methodology: Joshua Israel Culcay Delgado.
Project management: Joshua Israel Culcay Delgado.
Resources: Joshua Israel Culcay Delgado.
Software: Joshua Israel Culcay Delgado.
Supervision: Joshua Israel Culcay Delgado.
Validation: Joshua Israel Culcay Delgado.
Visualization: Joshua Israel Culcay Delgado.
Writing – original draft: Joshua Israel Culcay Delgado.
Writing – revision and editing: Joshua Israel Culcay Delgado.

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