RESEARCH
www.commprac.com
ISSN 1462 2815

THE POWER OF GAMIFICATION IN MEDICAL EDUCATION- A NARRATIVE REVIEW

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DOI: 10.5281/zenodo.10148706

Abstract

In the dynamic landscape of modern education, the integration of innovative pedagogical strategies has become essential to engage and empower learners effectively. One such groundbreaking approach that has been gaining prominence in recent years is the incorporation of gamification principles into educational contexts, particularly in the field of medical education. Gamification introduces an innovative and engaging approach to medical education, leveraging elements from the world of games, such as competition, rewards, challenges, and interactivity, to create immersive and effective learning experiences. This transformative approach enhances motivation and retention and fosters critical thinking, problem-solving skills, and teamwork among the students, all of which are essential attributes for healthcare professionals. This paper explores the profound power of gamification in medical education, delving into its theoretical foundations, practical applications, and the multitude of benefits it offers to both educators and learners. Through a comprehensive examination of case studies, best practices, and the research findings published in various databases PubMed/Medline, Web of Science, Scopus, and Google Scholar (2003-2023), we aim to shed light on how gamification is revolutionizing the way medical knowledge is acquired and retained, ultimately shaping the future of healthcare education.

Keywords: Gamification, Medical Education, Need.

INTRODUCTION

Technology has gained considerable prominence over the last few decades, with the potential for a substantial future impact on Healthcare Professions Education (HPE) (1). The present phase, often referred to as the "information age" or the "knowledge-centered society," is marked by the widespread utilization of Information and Communication Technologies (ICTs). This phenomenon is accompanied by a growing requirement for inventive educational techniques and instructional methodologies that foster continuous learning throughout an individual's life (2).

Though reforms in the newer medical curriculum have started the impact teaching-learning modalities, learning theory in HPE predominantly centers around the cognitive and psychomotor dimensions, with limited focus on the emotional and social aspects of learning (3). Incorporating technology and introducing games in education has been advocated by researchers(3–8), who argue that technology is vital for learning, as it addresses students' emotional and social dimensions of learning.

Rapid advancements in Web 2.0 and digital games have positioned these technologies as ideal solutions to address the shortcomings of the education system,

while simultaneously increasing student motivation and teacher acceptance (9). With this background a narrative review was conducted with the aim to shed light on how gamification is revolutionizing the way medical knowledge is acquired and retained, ultimately shaping the future of healthcare education.

METHODOLOGY

In the search strategy, a systematic approach was employed. Databases such as PubMed, Scopus, Web of Science, and Google Scholar were utilized for article retrieval. Keywords such as "medical education," "gamification," "serious games," "gamified learning," and "game-based learning" were employed to optimize search results. The inclusion criteria encompassed articles published in English, peer-reviewed, and specifically focused on gamification in medical education within the timeframe of 2003 to 2023. Non-English articles were excluded. In total, 35 articles were included in the review.

The process for selecting and analyzing studies was carried out in a structured manner. To select relevant studies, a three-step approach was followed. First, the screening phase involved evaluating the titles and abstracts of retrieved articles to identify potentially relevant studies. Those that passed this initial screening proceeded to a more comprehensive full-text review. During this full-text review, the articles were carefully assessed to determine their relevance to the research objectives. Studies that met the predefined inclusion criteria, such as being published in English and focusing on gamification in medical education from 2003 to 2023, were included in the review.

For data extraction, a systematic approach was applied to the selected articles. Specific data points, including author(s), publication year, gamification use, educational outcomes, and its impact, were extracted. A narrative synthesis approach was employed to the extracted data to ensure a comprehensive and rigorous review of the literature on the power of gamification in medical education.

The Rise of e-Learning

In the realm of medical education, a noticeable shift has occurred with the extensive integration of Web 2.0 in educational settings. This shift accentuates aspects like user engagement, knowledge dissemination, connectivity, collaboration, and the exchange of ideas to augment the efficacy of the teaching-learning process (10). As traditional learning methodologies encounter challenges due to evolving social patterns and global health concerns, educators are actively embracing innovative solutions.

The demand for e-learning within HPE has been steadily rising, as medical students seek accessible avenues to acquire knowledge and skills relevant to their degrees. Simultaneously, notable societal shifts are unfolding, including the expansion of various life paths for students. These paths encompass diverse career options, the necessity to acquire new skill sets, and the flexibility of work schedules. Collectively, these factors contribute to the mounting demand for on-demand learning in HPE (12).

The advent of the COVID-19 pandemic further expedited the transition to remote learning, compelling institutions in the medical education sphere to develop effective methods for delivering top-tier education online. Numerous studies underscore the value of technology in the context of HPE, even in challenging scenarios such as a pandemic. This includes the utilization of online education and blended learning to

cultivate digital proficiency among users (2–8). Even esteemed medical institutions like Harvard Medical School were compelled to adapt by incorporating blended learning methods for medical students (13,14). This digital educational framework, concentrating on collaborative learning, showcased the feasibility and efficacy of e-learning for medical professionals.

Moreover, the recognition of online universities by official accrediting bodies has contributed to the soaring popularity of digital education within the medical domain. For instance, Maryville University's online nursing degree program has received official recognition from the Commission on Collegiate Nursing Education (CCNE), despite its wholly online delivery (15). This endorsement underscores the credibility and effectiveness of e-learning, thereby reinforcing the movement toward remote learning in medical education.

Even the Sustainable Development Goals (SDGs) for 2030 recommend the integration of quality education with innovation in Goal 4 by emphasizing the importance of 'Ensuring inclusive and equitable education and promoting lifelong learning opportunities for all' (16). In alignment with the SDGs, India's National Education Policy (NEP) 2020 underscores the significance of innovation and the inclusion of ICT in higher education (17). Following the NEP, the National Medical Commission (NMC) of India has introduced a reform in the MBBS curriculum through the implementation of Competency-Based Medical Education (CBME) to promote skill-based education and enhance students' higher-order thinking skills by incorporating technology (18). Thus, e-learning plays a vital role in the future of medical education in India, as it integrates quality education with innovation, aligning with global goals (SDGs) and national policies (NEP), while also addressing the specific needs of medical education through CBME. These initiatives collectively contribute to improving education, fostering inclusivity, enhancing lifelong learning, and preparing students for the challenges and opportunities of the modern world.

Digital Education- Gamification, Game-Based Education, and Serious Games

Incorporating games and innovative approaches in HPE is constantly seeking to improve teaching and learning and ultimately patient care and outcomes. Digital Education is one such innovation in HPE. Gamification, Game-Based Education (GBE), and serious gaming are three terms often used in the context of Digital Education, but they refer to different approaches and have distinct characteristics (Table 1) (5,19–21).

Table 1: Playful Learning Paradigms: Distinguishing Gamification, Serious Games, and Game-Based Education (19–25)

Interaction Aspect	Gamification	Serious Games	Game-Based Education
Learning Environment	Digital platform with gamified elements including rewards, points, and leaderboards	Immersive simulations of real-world medical scenarios where learners make decisions	Modules and activities with game mechanics for engagement
Engagement and Motivation	Points and credits earned for completing modules/topics, challenges, and quizzes motivate learners to participate actively	Decision-making scenarios with immediate feedback enhance problem-solving and critical thinking	Puzzles, role-playing exercises with game-like interactions

Skill Acquisition	Provides supplementary learning materials and resources through rewards and points	Offers practical learning experiences through interactive decision-making scenarios	Reinforces theoretical concepts and practical skills through interactive challenges and exercises
Knowledge Retention	Gamified elements enhance the memorability of concepts and information	Learners make decisions and see consequences, enhancing knowledge retention	Practical exercises reinforce long-term retention
Feedback and Reflection	Instant feedback on quiz performance and module completion	Immediate feedback on decisions and outcomes	Immediate feedback on results and practical exercises
Progression and Mastery	Learner's progress through levels by earning points and achieving milestones	Learners advance through levels by completing scenarios and mastering content	Learners advance through modules, levelling up, and specializing in areas of interest
Collaboration and Competition	Leaderboards encourage healthy competition among learners	Collaborative challenges promote teamwork and knowledge-sharing	Peer interaction through challenges, shared experiences, and peer feedback
Real-World Application	Encourages skill development that can be applied in real-world medical settings	Immersive scenarios closely resemble real medical cases	Reinforces theoretical knowledge in practical scenarios

Gamification is defined as the "use of game-like elements in non-game contexts" (20). It involves adding game mechanics, such as leaderboards, badges, points, and challenges, to make a task or activity more motivating, engaging, and enjoyable. Gamification aims to internalize the desired behaviors and create a sense of accomplishment or progress, without inevitably providing a full-fledged game experience (19,20). Whereas GBE is the use of games or game-like simulations to teach specific skills or knowledge (22). Unlike gamification, Game-Based Education (GBE) incorporates real games into the learning process. GBE strives to enhance learning by creating a more interactive, immersive, and enjoyable experience for learners. It achieves this by offering students a hands-on opportunity to experiment, explore, and solve problems within a secure and captivating learning environment.

On the other hand, Serious gaming is the use of games or game-like simulations for purposes other than entertainment, such as training, simulation, or therapy. Serious games are designed to replicate real-life scenarios and challenges and provide learners with a realistic and interactive experience that can help them develop skills, knowledge, or attitudes (22).

It is essential to recognize that the choice between gamification, serious games, or game-based education should depend on specific learning objectives, the target audience, available resources, and the desired level of immersion and interactivity. In some situations, serious games or game-based education may be more appropriate for achieving specific learning outcomes or simulating complex scenarios. The effectiveness of each approach ultimately depends on the context and its alignment with educational goals. The importance of gamification over game-based and serious games lies in its unique advantages. It is more cost-effective, easier to access and engage students, can be implemented quickly without significant lead time, is scalable, making it suitable for large groups of learners, and can be applied to a wide range of topics. Additionally, it focuses on enhancing students' engagement and motivation.

Gamification Scope:

Gamification in medical education entails the strategic integration of game elements and mechanics into the learning process. This approach extends beyond traditional didactic methods, incorporating interactive and engaging elements to enhance the educational experience (26).

Among digital education trends, gamification is an emerging one in medical education, with growing evidence suggesting that the use of game mechanics in healthcare training can increase student engagement, motivation, and learning outcomes by integrating gamified elements into the learning process. Several studies have shown that gamification in tasks, readings, and classroom activities improves students' learning in terms of knowledge and academic performance (26–29). A randomized trial conducted by Kerfoot BP demonstrated that incorporating these adaptive game mechanics in medical education can increase learning effectiveness by over 35%. A series of studies conducted by Kerfoot BP, Dankbaar MEW, BP K, Hanari J, Md M, Gue, et al., and Matzie KA et al. reported that gamification in medical education improves academic performance, ranging from 15 to 40% among medical students (4, 26, 30–36).

Gamification not only enhances academic performance but also boosts students' motivation. In the educational context, motivation is considered one of the critical factors contributing to academic success. Self-determination theory distinguishes types of motivation into extrinsic, intrinsic, and demotivation (37). Lai et al. (38) reported that gamification results in better engagement and motivation compared to traditional teaching methods. Similarly, Krishnamurthy et al. (39) found that gamification improves students' learning, engagement, and cooperation interactively, increasing intrinsic motivation. They also noted that gamification is beneficial for remote learning, risk-free healthcare decision-making, learning analytics, and providing immediate feedback.

Pesare E et al. (23) conducted a study on gamification to promote engagement and motivation in medical learning contexts. They reported that gamified elements enhance the learning experience of medical students, paramedical students, and patients, increasing their motivation to acquire high levels of knowledge and skill. So, the use of game mechanisms, such as levels, points, leaderboards, and a competitive atmosphere, can elevate students' intrinsic and extrinsic motivation to engage in these learning activities (32, 40).

To provide quality education through remote setups, universities have developed various online tools and applications. Among these, gamification applications have emerged as powerful strategies to engage and educate medical students. By integrating gaming elements and principles, these applications enhance the learning experience and help students achieve their desired outcomes. Educators and game developers collaborate to design game-based applications that seamlessly merge lessons and courses with interactive gaming experiences. These applications not only facilitate learning but also enable students to measure their progress and competencies through game feedback. The need for gamification is represented in table 2 (8,24-28).

Table 2: Need for Gamification

Need	Description
Changing Learning Preferences	Learners of the digital age expect interactive and engaging experiences, making gamification appealing.
Enhanced Motivation	Gamification taps into intrinsic motivation, making learning enjoyable and rewarding.
Complex Medical Concepts	Gamification simplifies complex medical topics, aiding comprehension and mastery.
Clinical Decision-Making	Gamified scenarios refine clinical decision-making skills in a safe, risk-free environment.
Continuous Learning	Gamification supports lifelong learning by offering flexible, on-demand educational experiences.
Adapting to Technology	Gamification aligns medical education with modern learning tools and tech-driven practices.
Addressing Burnout	Infusing fun and accomplishment via gamification helps alleviate stress and burnout in medical education.

Benefits of Gamification in Medical Education

Engaging and Motivating Students: Gamification enhances learner engagement by making educational content more captivating, interactive, and enjoyable. It leverages the innate human inclination for competition, rewards, and challenges to maintain learners' interest and motivation. Through rewards and badges, instructors and game developers incentivize students to study and actively participate in the learning process. For example, the game Kaizen, developed by James H. Willig, MD, and his colleagues from the University of Alabama Birmingham, incorporates scoring features into an online multiple-choice quiz game. Students earn bonus points as they progress to higher levels and consistently answer quizzes, serving as extrinsic motivation to reach specific goals (41). By tapping into students' competitive spirit and desire for achievement, gamification encourages active involvement and enthusiasm for learning.

Enhancing Information Retention

Gamification improves knowledge retention through memorable and interactive experiences. The use of game mechanics like repetition, spaced learning, and feedback loops optimizes the retention of complex medical concepts. Medical education games and apps often incorporate various cues, such as text, auditory elements, and visual aids, to enhance retention. Anki Flashcards, a popular app among medical students, utilizes analytics to track the difficulty of each question and adjust the frequency of tough questions for better retention (42). By incorporating gamified elements into the learning process, students are more likely to retain and recall information effectively. This approach not only enhances learning outcomes but also ensures that students are well-prepared to apply their knowledge in real-world medical scenarios.

Adaptive and Team Learning:

Gamified platforms can be designed to adapt to individual learner's needs, providing personalized learning pathways that cater to different learning styles and paces. Multiplayer and collaborative game elements encourage peer interaction and teamwork, fostering communication skills and collaboration among future healthcare professionals (30-34).

The Future of Gamification in Medical Education

Gamification has demonstrated its potential to transform medical education by engaging students, simulating real-world scenarios, and enhancing information retention. As technology advances and new educational tools emerge, the possibilities for gamification in the healthcare classroom are boundless. Future research should focus on refining existing conceptual frameworks and exploring other game attributes and modalities applicable to various contexts, including postgraduate education (43). Additionally, incorporating more theory-driven approaches to gamification can unlock deeper insights into the underlying mechanisms and enhance the effectiveness of gamified learning experiences (32,39,43).

As the healthcare industry continues to evolve, medical professionals must embrace innovative approaches to education. Gamification offers a powerful tool to revolutionize medical learning, providing students with engaging, immersive, and effective educational experiences. By harnessing the power of games, educators can unlock the full potential of their students, shaping the healthcare professionals of tomorrow.

CONCLUSION

The integration of gamification in medical education represents a paradigm shift in how students learn and engage with complex healthcare concepts. Through online learning platforms and educational apps, gamification brings fun, interactivity, and motivation to the learning experience. By enhancing information retention, and fostering active student participation, gamification has the potential to revolutionize medical education. As the healthcare industry continues to embrace digital practices, it is crucial to explore and leverage the power of gamification to equip future medical professionals with the skills and knowledge they need to excel in their careers.

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