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Medical Education with a Flavor of Play: Keys to Sustaining the Impact of Gamification on Learning

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Introduction

Gamification refers to the application of game elements and mechanics in non-game contexts—such as education—with the aim of enhancing motivation, engagement, and user interaction by tapping into the intrinsic human drive for achievement, competition, and success. By transforming routine processes into engaging and purposeful experiences, gamification can facilitate improved learning, productivity, and behavioral change[1]. Within the context of medical education, gamification has emerged as an innovative strategy to boost student engagement, participation, and learning outcomes.

However, a major challenge lies in sustaining its long-term effectiveness in enhancing clinical knowledge and skills. Core elements—such as feedback, challenges, competition, rewards, and social interaction—are critical for fostering motivation, but if not carefully designed, their impact may be short-lived and gradually diminish.

Most existing studies are short-term, often due to constraints such as limited funding, the fixed duration of academic courses or training programs, and logistical challenges in sustaining interventions over longer periods, making it difficult to assess the persistence of positive effects[2]. Despite promising early outcomes, the enduring efficacy of gamification—particularly in maintaining learner engagement beyond the initial novelty phase—over extended periods or after its discontinuation remains uncertain, highlighting key research gaps such as the need for longitudinal follow-up studies, personalization strategies, and the integration of emerging technologies to enhance sustainability.

Another significant challenge is the gradual decline in learner engagement. While novelty and competition may initially boost participation, repetitive game elements and limited intrinsic motivation -defined as the internal drive to engage in an activity for its inherent satisfaction rather than for external rewards or pressures- can reduce involvement over time[3]. For instance, in a longitudinal study, Hanus and Fox (2015) found that a gamified university course with points, badges, leaderboards, and GradeCraft-based progress tracking led to lower intrinsic engagement over the semester compared to a traditional format, highlighting the potential long-term drawbacks of extrinsically focused designs[4]. Additionally, a key issue lies in ensuring that virtual rewards translate into genuine, lasting motivation to apply knowledge and skills in real-world clinical settings.

Drawing on field expertise and a targeted review of relevant peer-reviewed literature, the authors outline strategies to strengthen and sustain gamification's impact on medical students' knowledge and skills (Figure 1):

Providing Meaningful and Immediate Feedback: Feedback is one of the most impactful elements of gamification, playing a pivotal role in maintaining learner motivation and enhancing the learning process. It serves as a key mechanism to increase engagement and deliver a positive user experience. However, if feedback is superficial, impersonal, or delayed, it may fail to sustain long-term motivation. Therefore, feedback should be meaningful -defined as timely, specific, and directly related to the learner's performance-, immediate, encouraging, and continuous to exert a lasting influence on behavior change and knowledge retention[5, 6]. For instance, some educational applications offer immediate and meaningful feedback to students following each response they select.

Integrating Intrinsic and Extrinsic Motivation: Motivation is a central determinant in the success of gamification and a critical factor in sustaining learner engagement throughout the educational process. One of the key challenges in gamification is the gradual decline in user engagement over time. This is often due to an overreliance on extrinsic motivators (e.g., points and rewards), without sufficient reinforcement of intrinsic drivers such as the sense of achievement and personal growth[3, 7]. A well-balanced integration of intrinsic and extrinsic motivations can enhance the durability of gamification's educational impact. In the initial stages, points, badges, and leaderboards may successfully attract users and initiate engagement. Over time, however, learners should be guided toward self-directed engagement by offering meaningful challenges and choices within the learning path—encouraging participation driven by a desire for personal development and

knowledge acquisition rather than external rewards[8]. It is also important to consider that excessive competition has the potential to negatively affect user loyalty and diminish intrinsic motivation for some learners[9, 10]. In contrast, fostering social interactions—such as collaborative problem-solving, participation in discussion forums, learning groups, and cultivating a sense of shared identity and belonging—can bolster both intrinsic and extrinsic motivation[11, 12]. Learning dashboards that visualize users' progress over time would contribute to sustaining long-term motivation[13].

Integrating Gamification into Real Clinical Environments: A major limitation in the current use of gamification in medical education is the disconnect between virtual learning and its real-world application. Many gamified platforms focus primarily on theoretical knowledge. However, to achieve long-term impact and improve clinical performance, these systems need to be effectively integrated into real clinical environments[14]. For instance, the use of gamified simulations for Electronic Health Records (EHRs) remains largely unexplored[15]. A gamified clinical application could be designed to integrate seamlessly with EHR systems and deliver interactive, case-based scenarios derived from actual medication orders. For example, when prescribing a drug for a patient with renal impairment, the application—through the automatic analysis of patient data—could display a gamified prompt (e.g., suggesting a dose adjustment based on the patient's GFR). Upon selecting the correct option, the user would receive points, achievement badges, and immediate, evidence-based feedback. Additional game-based mechanics—such as progress bars to visualize documentation completeness, time-limited challenges for guideline adherence, and leveling systems that reflect skill progression—could further enhance user engagement, support intrinsic motivation, and facilitate the adoption of advanced EHR features, all while maintaining alignment with real-world clinical priorities. Moreover, incorporating team-based leaderboards to compare departmental performance, as well as allowing users to customize their workspace or professional avatar, can foster a sense of healthy competition and organizational belonging. These strategies not only mitigate the monotony of routine documentation tasks but also create tangible pathways for advancement, thereby reducing the risk of clinician burnout.

Combining Game-Based Learning with Reinforcement Strategies Such as Self-Regulated Learning (SRL): Incorporating approaches such as SRL has proven effective in improving academic performance, self-efficacy, and learning motivation among students. Compared to game-based learning alone, this integrative approach provides a more effective framework for enhancing learning outcomes while simultaneously increasing both intrinsic and extrinsic motivation[16]. For instance, an application can present interactive clinical scenarios—such as managing a COPD patient—while allowing learners to set personal goals, track their performance through individualized dashboards, and receive tailored feedback and learning resources. Gamified elements such as points, badges, and leaderboards increase extrinsic motivation, while SRL components foster intrinsic engagement by encouraging reflection, self-monitoring, and adaptive learning. This integration effectively bridges surface engagement with deeper, sustained learning outcomes.

Continuous Evaluation and Optimization of Gamified Systems in Medical Education: To preserve and enhance the educational effectiveness of gamification, ongoing evaluation and iterative improvement of gamified systems are essential. Failure to review and update these systems can lead to diminished user engagement and reduced long-term impact[7]. Strategies such as monitoring user interactions and behavioral patterns, identifying underperforming components, collecting user feedback, and implementing corrective actions are critical to maintaining the efficacy of serious games[17]. Additionally, regularly updating the content of gamified platforms is crucial. One of the key factors contributing to decreased user engagement is the repetition of challenges and their misalignment with individual skill levels and needs. Many studies have shown that while generic, fixed challenges may be engaging initially, they often fail to sustain learner motivation over time. As such, designing dynamic, personalized challenges, regularly introducing new content, periodically rotating rewards, and implementing innovative incentive systems—such as seasonal challenges or special missions—are considered effective strategies to enhance the long-term impact of gamification[18, 19].

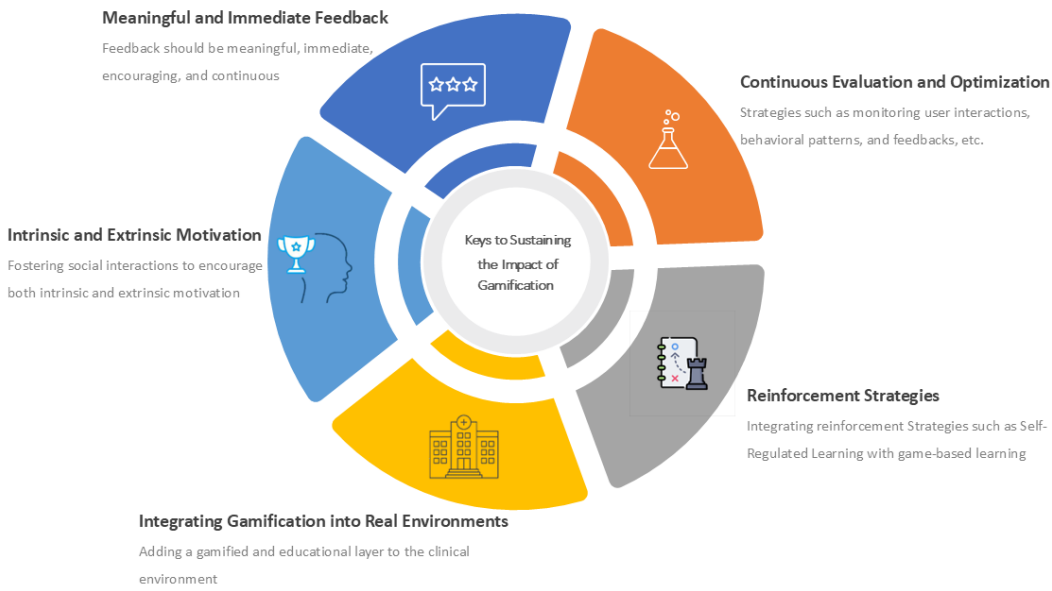

Figure 1. Strategies to enhance the durability of gamification's impact on medical students' knowledge and skill acquisition

Conclusion and Recommendations for Future Research

Gamification represents a powerful tool in medical education; however, its long-term effectiveness depends on meticulous design and the implementation of appropriate strategies. Integrating intrinsic and extrinsic motivational factors, delivering dynamic challenges and meaningful feedback, and embedding gamified systems within real clinical environments can significantly enhance their educational impact. As a comprehensive practical recommendation, educators should implement pilot gamified interventions that combine: (1) adaptive learning paths to sustain intrinsic motivation, (2) a structured, timely, and meaningful feedback loop after each activity, (3) periodic individual and team-based challenges to maintain engagement, and (4) real-world clinical scenarios to enhance relevance. These pilots should be evaluated over at least one academic term, collecting both quantitative performance metrics and qualitative learner feedback to address both short-term and long-term efficacy. Findings from these pilots can then guide optimization before large-scale integration. Future research should focus on the development of advanced gamification technologies and the evaluation of their sustained effects on medical students' clinical performance.

Ethical Considerations

Not applicable.

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Conflict of Interest

Nothing to declare.

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