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Perspective

Leveling Up Medical Education: A Perspective on Exploring Traditional and Blended Gamification with Emerging Technologies

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ABSTRACT

The evolving landscape of medical education necessitates innovative teaching strategies that address both the complexity of clinical training and the diverse needs of learners. This commentary examines the comparative impact of traditional versus blended gamification on student engagement and skill development in medical education. Traditional gamification, characterized by non-digital methods such as role-playing and case-based competitions, enhances retention and practical skills through interactive, behaviorist-driven approaches but is constrained by physical classroom requirements. In contrast, blended gamification integrates digital technologies—including virtual reality, artificial intelligence, and adaptive learning platforms—with conventional instruction, offering personalized, scalable, and immersive learning experiences that foster digital literacy and critical thinking. Despite the advantages of blended methods in improving practical skills and engagement, challenges persist, including financial barriers, unequal access to technology, and potential reductions in face-to-face interaction. The article underscores the importance of balancing innovation with inclusivity, recommending that educational administrators provide robust support and strategic planning to ensure equitable adoption and effective implementation. Ultimately, a hybrid approach that combines traditional and blended gamification can create a comprehensive, competency-focused framework, preparing future healthcare professionals to meet the ethical, technological, and collaborative demands of modern medicine.

Keywords: Game-based Learning, Problem-Based Learning, Medical, Education, Team-Based Learning, Teaching, Learning

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Introduction

The "changing terrain of education" reflects a global shift toward innovative teaching methods that address diverse student needs and technological advancements (1). In medical education, this evolution is critical due to the field's inherent complexity, which requires mastery of theoretical knowledge, practical skills, and ethical decision-making (2). Gamification has emerged as a transformative tool in this context, integrating game-like elements such as points, badges, leaderboards, and narrative-driven challenges into instructional frameworks. For example, anatomy courses may utilize competitive quizzes where students earn points for accurate diagnoses, while virtual patient simulations award badges for clinical reasoning under time constraints (3). These strategies not only enhance engagement but also mirror real-world medical teamwork, fostering collaboration and communication skills essential for future physicians (4). Immediate feedback mechanisms, such as post-simulation debriefings, further reinforce learning by enabling iterative improvement (5).

In addition to technical expertise, contemporary medical education prioritizes comprehensive competencies such as empathy, resilience, and effective communication to address disparities in health equity and foster patient trust. International collaboration plays a crucial role in standardizing these competencies, thereby preparing healthcare professionals to address global health challenges. This shift highlights a dual emphasis: utilizing innovation to enhance skill development while grounding training in the humanistic principles that characterize ethical practice. Ultimately, this evolving framework ensures that clinicians are not only proficient in their technical abilities but also capable of navigating the complex ethical and technological challenges of 21st-century medicine. The purpose of this commentary is to explore the impact of traditional gamification compared to blended gamification on student engagement.

Traditional and Blended Gamification

Both traditional and blended gamification approaches are grounded in behaviorist theories, utilizing game elements to diversify instructional methods and tailor educational experiences to individual learners. These approaches prioritize observable and measurable outcomes, using visible changes in behavior as markers of academic achievement, rather than focusing on internal cognitive processes. By aligning with behaviorist theory, these methods emphasize the role of external stimuli and employ strategies designed to encourage lasting behavioral change and skill acquisition (6).

Traditional gamification, based on non-digital techniques, is especially valuable in low-resource settings or where hands-on experience is essential. Examples include role-playing ethical dilemmas during simulated patient interactions and case-based competitions mimicking diagnostic challenges without digital tools (7, 8). By transforming routine tasks into interactive experiences, traditional gamification improves the retention of complex medical concepts and procedural skills. It promotes competition and recognition through leaderboards and badges, with prompt feedback mechanisms that help correct errors and reinforce learning. These methods have been shown to increase student engagement and retention but are limited by their reliance on physical classroom settings, which can restrict scalability in remote or resource-limited environments (9, 10).

Blended gamification integrates digital resources like virtual reality surgical simulators and pharmacology apps with traditional teaching methods. These platforms offer personalized learning experiences by using artificial intelligence to adjust content difficulty based on individual performance. Collaborative learning goes beyond the classroom, featuring virtual reality modules that simulate rare surgical scenarios for safe practice and gamified quizzes that track progress in pharmacology (11, 12). This approach enhances digital literacy and critical thinking, which are essential

skills in modern healthcare that relies on telemedicine and electronic health records. However, its effectiveness depends on sufficient institutional resources, equitable access to technology, and faculty training, emphasizing the need for tailored adaptations in underserved areas (13).

Blended gamification leverages advanced digital technologies to facilitate safe surgical training and personalized assessments, fostering teamwork through collaborative interactions beyond traditional settings. Studies indicate that blended methods can significantly improve practical skills, though challenges such as financial constraints, digital literacy gaps, and reduced face-to-face interaction remain (13-15).

Integration of Emerging Technologies in Medical Gamification

Recent studies emphasize the integration of cutting-edge technologies, such as Artificial Intelligence (AI), Virtual Reality (VR), and Augmented Reality (AR), to enhance gamification in medical education. AI-driven adaptive learning platforms customize challenges and feedback to individual learner performance, boosting motivation and engagement (16, 17).

VR and AR offer immersive simulations of complex clinical scenarios, enabling learners to practice decision-making and procedural skills in a risk-free environment, which also fosters interprofessional collaboration across physical boundaries (18). For instance, the innovative "CARBGAME" project utilizes card and board games to actively engage medical students in biochemistry, resulting in significant improvements in academic performance and learner satisfaction (18, 19).

Challenges and Future Directions

Despite promising outcomes, gamification in medical education faces challenges including financial constraints, unequal access to digital tools, and variability in digital literacy among learners and educators (21, 22 Ref 20 ????).

reduced face-to-face interaction in blended or fully digital gamification may impact the development of interpersonal skills, necessitating thoughtful integration of collaborative elements (23).

Future research should focus on longitudinal studies that assess the impact of gamified learning on clinical competence and patient outcomes, as well as strategies to bridge digital divides and train faculty in the effective implementation of gamification (24-26). Additionally, expanding gamification frameworks to include motivational and affective learning outcomes, as suggested by the SOLO taxonomy—a model that describes levels of increasing complexity in students' thinking and understanding—could deepen the understanding of its educational impact (27).

This discussion highlights the connection between the "evolving landscape of education" and the specific requirements of medical training, emphasizing how both traditional and blended gamification methods improve engagement and provide learners with skills relevant to modern healthcare challenges. Future initiatives should strive to strike a balance between innovation and inclusivity to promote equitable adoption across various educational settings.

Recommendations for Educational Administration

Effective integration of gamification in medical education requires strong administrative support and strategic planning. Educational administrators play a pivotal role in creating an environment conducive to innovation and sustained success. The following recommendations can guide administrators in facilitating gamification initiatives:

1. Allocate Adequate Resources

• Financial Investment: Provide dedicated funding for acquiring necessary technologies such as virtual reality equipment, software licenses, and AI platforms.

• Human Resources: Hire or train specialized staff (e.g., instructional designers, IT support) to develop and maintain gamified learning modules (28).

2. Foster Faculty Development and Support

• Professional Training: Organize workshops and continuous professional development programs focused on gamification principles, digital tools, and pedagogical strategies.

• Encourage Collaboration: Promote interdisciplinary collaboration among faculty, IT specialists, and educational designers to create high-quality gamified content (29).

3. Ensure Infrastructure and Technology Access

• Equitable Access: Guarantee that all students and faculty have access to required hardware and reliable internet connectivity, especially in remote or underserved areas.

• Technical Support: Establish responsive technical support teams to assist users promptly and minimize disruptions (29).

4. Promote a Culture of Innovation and Inclusivity

• Encourage Experimentation: Support pilot projects and innovative teaching methods without penalizing initial failures.

• Inclusive Design: Advocate for gamification solutions that accommodate diverse learners, including those with disabilities or limited digital literacy (28-30).

5. Implement Evaluation and Quality Assurance Mechanisms

• Data-Driven Decision Making: Use analytics from gamification platforms to monitor student engagement, performance, and satisfaction.

• Feedback Loops: Regularly collect feedback from students and faculty to refine gamification strategies and address challenges (30).

6. Align Gamification with Institutional Goals

• Strategic Planning: Integrate gamification initiatives into the institution's broader educational mission and strategic plans.

• Accreditation and Standards: Ensure gamified learning activities meet accreditation requirements and align with competency frameworks.

Conclusion

The integration of both traditional and blended gamification methods represents a pivotal advancement in medical education, offering a dynamic and adaptable framework for developing essential clinical competencies. Traditional gamification techniques foster practical collaboration and hands-on skills, particularly in settings where resources are limited or direct interpersonal interaction is vital. Meanwhile, blended gamification leverages digital innovations—such as virtual reality, artificial intelligence, and adaptive learning platforms—to personalize instruction, enhance engagement, and cultivate digital literacy. The choice of strategy should be guided by institutional resources, specific educational goals, and the readiness of educators to adopt new technologies. By thoughtfully combining these approaches, medical education can deliver an interactive, inclusive, and competency-based learning environment that prepares future healthcare professionals to meet the ethical, technological, and collaborative demands of modern medicine. Ultimately, a balanced and context-sensitive adoption of gamification ensures that learners not only acquire technical expertise but also develop the humanistic and adaptive skills necessary for success in an evolving healthcare landscape.

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Authors' Contribution

LM conceptualized the perspective and drafted the initial manuscript. MK and SA

contributed to the critical revision of the manuscript for important intellectual content. All authors reviewed and approved the final version of the manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest and affirm that they have reviewed and approved the manuscript. Leili Mosalanejad, in her capacity as a member of the editorial board, refrained from participating in the peer review and decision-making processes related to this manuscript. The peer review process was managed by a chairperson who is not an author of the paper.

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