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ORIGINAL

The impact of gamification in research and education: a communication review

El impacto de la gamificación en la investigación y la educación: una revisión de la comunicación

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ABSTRACT

Introduction: traditional educational studies often focus on standard teaching methods and textbook-based learning. However, to enhance the effectiveness of learning and make it more engaging, it is widely recognized that classroom instruction should incorporate interactive activities. These interactive methods can be introduced by integrating playful classroom games, utilizing modern teaching techniques, and engaging students through methods that spark interest and motivation
Objective: gamification offers a simple yet powerful approach to motivate students, encourage learning, and promote the development of essential life skills. By fostering creativity and imagination, gamification helps boost student engagement and makes the learning process more dynamic and enjoyable. Gamification, the incorporation of game-design elements in non-game contexts, has emerged as a potent tool in both research and education.
Method: this review provides an in-depth analysis of the impact of gamification on research and education, drawing from current studies and publications.
Result: the review highlights key areas where gamification has been applied, its benefits, and the challenges faced in both fields.
Conclusion: the conclusion emphasizes the growing importance of gamification and suggests future directions for research and implementation in educational settings.

Keywords: Gamification; Learning; Teaching; Research.

RESUMEN

Introducción: los estudios educativos tradicionales suelen centrarse en métodos de enseñanza estándar y en el aprendizaje basado en libros de texto. Sin embargo, para mejorar la eficacia del aprendizaje y hacerlo más atractivo, se reconoce ampliamente que la enseñanza en el aula debe incorporar actividades interactivas. Estos métodos interactivos pueden introducirse mediante la integración de juegos lúdicos en el aula, la utilización de técnicas modernas de enseñanza y la participación de los estudiantes a través de métodos que despierten el interés y la motivación.
Objetivo: la gamificación ofrece un enfoque sencillo pero poderoso para motivar a los estudiantes, fomentar el aprendizaje y promover el desarrollo de habilidades esenciales para la vida. Al fomentar la creatividad y la imaginación, la gamificación ayuda a impulsar el compromiso de los estudiantes y hace que el proceso de aprendizaje sea más dinámico y agradable. La gamificación, la incorporación de elementos de diseño de juegos en contextos no lúdicos, ha surgido como una potente herramienta tanto en la investigación como

en la educación.
Método: esta revisión ofrece un análisis en profundidad del impacto de la gamificación en la investigación y la educación, a partir de estudios y publicaciones actuales.
Resultados: la revisión destaca las áreas clave en las que se ha aplicado la gamificación, sus beneficios y los retos a los que se enfrentan ambos campos.
Conclusiones: la conclusión enfatiza la creciente importancia de la gamificación y sugiere futuras direcciones para la investigación y la implementación en entornos educativos.

Palabras clave: Gamificación; Aprendizaje; Enseñanza; Investigación.

INTRODUCTION

The rise of gamification over the past decade has significantly influenced many fields, including education and research. Gamification uses game elements such as points, badges, leaderboards, and challenges to motivate and engage participants in traditionally non-game environments. This review aims to explore the effects of gamification in education and research by analyzing contemporary studies that investigate its impact on student engagement, learning outcomes, and motivation. Gamification is defined as the application of game-design elements, such as competition, rewards, and feedback systems, to non-game contexts. It draws on the inherent motivational mechanics of games—such as achievement, progression, and social connection—to influence behavior and engagement. It is often confused with game-based learning, where actual games are used as educational tools, but gamification focuses on integrating game-like elements into educational content without transforming the content into a game.

Gamification, which involves applying game-like elements to non-game contexts to encourage specific behaviors and experiences[1,2] has remained a popular topic in both industry and academic circles since it gained prominence in the early 2010s. This concept has seen particular growth in educational settings.[3] The idea of integrating gamification into education and learning has deep historical roots, as game design and educational theories often rely on similar psychological principles (Landers, 2014). With advancements in technology fostering more digital learning environments and enabling the use of features derived from video games to create engaging and immersive educational experiences, the trend of gamifying learning continues to gain momentum. Previous reviews of gamification literature have highlighted that education and learning are the most frequently studied areas in empirical gamification research.[4] While several reviews on gamification in education exist, many have focused on specific aspects or limited their scope. For example, Caponetto et al.[5] and Marti-Parreño et al.[6] primarily conducted bibliometric analyses and focused on terminological aspects. Marti-Parreño et al.[6] also classified the different constructs studied in the literature. Some reviews were restricted by the number of studies included, such as de Sousa Borges et al.[7], who reviewed only 26 studies, and Dicheva et al.[8], who examined 36 studies. Dichev and Dicheva (2017) expanded their scope slightly to 63 studies, while Nah et al. (2014) reviewed 15 studies. Despite these efforts, it is clear that many reviews have been narrow in their approach, and a significant portion of the existing literature remains unexplored.[9]

The Scope of Gamification in Research and Education

In the education sector, gamification has been employed to enhance student participation, motivation, and learning outcomes across all age groups. In research, it has been used to improve engagement with scientific content, citizen science projects, and to foster collaboration among scholars. With digital technology becoming more integrated into classrooms and research platforms, gamification offers an opportunity to leverage these tools in ways that traditional methods might not.

This communication review analyzes various studies published between 2015 and 2024 that have examined gamification in research and education. The following sections will explore gamification's impact, benefits, and challenges in detail.

DEVELOPMENT

This section provides a concise overview of several key literature reviews on gamification in higher education, which are relevant to the focus of our systematic review. The aim is to later compare our results with the findings of these previous studies, offering a more grounded perspective on the progress made in integrating gamification into e-learning within higher education contexts. This comparison will help highlight any significant developments or trends in the field.

Gamification in education

The incorporation of gamification in education has sparked significant interest, particularly in higher

education, where educators seek new methods to enhance student engagement. Several studies have analyzed the direct impact of gamified learning environments on students' performance, participation, and motivation.

Table 1. Systematic literature reviews on Gamification

Author(s) & Year	Focus/Objective	Key Findings
Dichev, C., & Dicheva, D. (2017)[9]	Critical review of the effectiveness of gamification in education	Dichev and Dicheva (2017) conducted a critical analysis of the progress in educational gamification. Their research highlighted the need for additional studies to deepen our comprehension of how specific game elements influence behavior and motivation, as well as how these elements operate effectively within educational settings. Gamification shows potential in enhancing learning, but evidence of long-term effects remains limited.
Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017) [10]	Investigates how specific game design elements impact student motivation in learning environments	Game elements like points, badges, and leaderboards significantly impact motivation and satisfaction of psychological needs.
Subhash, S., & Cudney, E. A. (2018)[11]	Systematic review of gamified learning strategies in higher education	Gamification improves student engagement and academic performance, but there are challenges in sustainable implementation.
Hamari, J., Koivisto, J., & Sarsa, H. (2014)[12]	Comprehensive review of empirical studies on gamification across various fields	Gamification shows positive effects on user engagement and motivation, but success depends on context and implementation.
Domínguez, A., Saenz-de-Navarrete, J., de-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J. J. (2013)[13]	Practical outcomes of applying gamification in educational settings	Gamification can enhance learning experiences, but it may not always lead to higher academic performance if not used appropriately.
Ibáñez, M. B., & Delgado-Kloos, C. (2018)[14]	Systematic review categorizing gamification studies based on educational contexts and outcomes	Gamification is applied across different educational contexts, showing potential for improving engagement and knowledge retention.
Mekler, E. D., Brühlmann, F., Tuch, A. N., & Opwis, K. (2017)[15]	Analyzes how individual gamification elements affect motivation and performance	Badges and leaderboards improve performance, but they can sometimes hinder intrinsic motivation if overused.
Yildirim, I. (2017)[16]	Examines the impact of gamification on achievement and attitudes in science education	Gamification boosts student achievement and positive attitudes towards science, especially in complex subjects.
Landers, R. N. (2015)[17]	Proposes a theoretical model linking serious games and gamification in education	Serious games and gamification share common elements that can be combined for enhanced learning outcomes.
Huang, B., & Hew, K. F. (2018)[18]	Explores the design and outcomes of a gamified flipped classroom model	Gamification in a flipped classroom increases student engagement and improves learning efficiency.
Gaalen et al. (2021)[19]	Explored the various game attributes utilized in gamified environments	In a recent review, van Gaalen et al. (2021) analyzed 44 research studies within the field of health professions education. Their research explored the various game attributes utilized in gamified environments and aimed to gain insight into the application of theoretical frameworks during the gamification process.
Zainuddin et al., 2020)[20]	Explored a research question closely aligned with our area of investigation, focusing on the theoretical frameworks employed in gamification research.	In their 2020 study, Zainuddin et al. explored a research question closely aligned with our area of investigation, focusing on the theoretical frameworks employed in gamification research. Their findings revealed that, among studies that explicitly reference theoretical foundations, self-determination theory was the most frequently cited, followed by flow theory and goal-setting theory. However, many studies did not include any clear theoretical basis.

Enhancing Student Engagement

One of the most frequently cited benefits of gamification in education is its ability to increase student engagement. According to recent studies, gamified environments in the classroom can foster a more interactive learning experience by providing immediate feedback, clear goals, and a sense of achievement. Research by Ali et al.[20,21] showed that students in a gamified setting participated more actively in discussions and collaborative projects compared to students in traditional classroom settings. In another study by Haque et al.[23] the use of leaderboards, badges, and rewards increased student attendance and engagement in online

courses. Gamification's ability to provide real-time feedback also helps students assess their learning progress and adjust their strategies accordingly. When students can visualize their achievements—whether through digital badges or leaderboard positions—they are more likely to remain motivated and focused on their tasks.

Improved Learning Outcomes

The positive impact of gamification on learning outcomes is another critical area of study. While engagement is essential, gamification's ability to improve knowledge retention and comprehension is equally important. In a study conducted by Landers et al.[24], students who participated in gamified quizzes demonstrated higher test scores and better content retention compared to their peers in non-gamified learning environments. Further, the study highlights how incorporating game elements such as progression bars, quests, and levels in mathematics and science courses improved students' mastery of complex topics. This research emphasized that the interactive nature of gamification helped break down difficult concepts into manageable tasks, allowing students to tackle challenges progressively.

Motivation and Self-Efficacy

Motivation is another key benefit of gamified education. Deci and Ryan's Self-Determination Theory (SDT), which postulates that autonomy, competence, and relatedness drive human motivation, has often been cited in gamification research. Gamified systems, by offering autonomy through choice-based tasks, competence via rewards, and relatedness through collaboration, help meet these needs. A study by Hamari et al.[12] suggested that students exposed to gamified learning systems exhibited higher levels of intrinsic motivation, with gamification encouraging a growth mindset. Additionally, gamification helps enhance self-efficacy—the belief in one's ability to succeed in specific tasks. When students are rewarded for completing tasks and see visible signs of progress, their confidence in their abilities improves, which encourages them to engage further with the learning material.

Collaborative Learning and Social Connection

Gamification also facilitates social learning by promoting teamwork, collaboration, and peer interaction. In multiplayer gamified settings, students often work together to complete tasks or compete against one another, fostering a sense of community and shared purpose. Research by Zainuddin et al.[20] on gamified collaborative learning platforms found that students were more likely to collaborate, share knowledge, and offer peer support in gamified environments than in traditional ones. Moreover, the introduction of leaderboards and team-based challenges can create healthy competition among students, motivating them to perform better while also learning from each other. This aligns with the research by Deterding et al.[25], which highlighted that social gamification mechanics positively impacted students' ability to work in teams and develop communication skills.

Cognitive and Behavioral Impact

The cognitive benefits of gamification extend beyond increased motivation. Gamified environments support active learning, where students are not merely passive recipients of information but active participants in their educational journey. Instructors can utilize gamification to encourage problem-solving, critical thinking, and collaboration, particularly in subjects like STEM (science, technology, engineering, and mathematics). Research shows that gamification positively impacts cognitive load by allowing students to absorb information at their own pace. Interactive quizzes and scenario-based learning can simulate real-world problems, helping students apply theoretical knowledge to practical contexts. Additionally, the use of time-based challenges and rewards improves students' focus and perseverance, promoting deeper cognitive engagement.

Collaboration and Peer Learning

Gamification fosters collaboration by encouraging students to work together to achieve common goals. Multiplayer games, team-based competitions, and cooperative problem-solving tasks promote peer learning and communication skills. Students who participate in gamified environments often develop a sense of community and belonging, which is crucial for their emotional and social development. Collaborative learning through gamification has been found to improve teamwork skills and foster a positive learning atmosphere. Tools such as Classcraft, for instance, allow students to collaborate in teams to solve challenges, with rewards distributed based on collective effort. This encourages students to rely on each other's strengths and fosters a cooperative learning environment.

Emotional Engagement and Feedback Systems

Gamification's reliance on feedback and rewards taps into the emotional and psychological aspects of learning. Learners who are rewarded with positive reinforcement (such as points or badges) experience

increased confidence and self-efficacy. The immediate nature of feedback in gamified environments encourages learners to continue participating, as they are constantly aware of their progress. However, research also highlights the need for balance. Overemphasis on rewards can lead to extrinsic motivation, where students participate solely for the sake of earning points or badges rather than for intrinsic learning. Therefore, well-designed gamified systems need to balance rewards with meaningful learning experiences.

Gamification in research

Beyond education, gamification has made significant strides in the research domain. Researchers are increasingly adopting gamification to enhance participation, improve data collection, and drive collaboration among scientific communities.

Enhancing Participation in Research Studies

Participation in research studies, especially those that rely on surveys, data collection, or citizen science, can often be challenging due to a lack of motivation or interest from participants. Gamification has been employed to tackle this issue by making participation more engaging and rewarding. According to a study by Bowser et al.[26], gamified citizen science platforms saw a marked increase in user participation when game elements like points, badges, and rewards were integrated. Participants were more likely to remain engaged with the project, and the quality of the data collected improved. Gamification has also been shown to improve response rates in academic surveys and online experiments. In a study by Chittaro et al.[27], the inclusion of game-like rewards in online surveys increased completion rates and participant retention.

Improved Data Collection and Analysis

Gamification has had a substantial impact on the quality of data collection in research settings. With the addition of game elements, researchers have been able to maintain participants' interest throughout lengthy or repetitive tasks, leading to more accurate and complete datasets. This has been particularly effective in fields such as psychology, sociology, and behavioral economics, where long surveys or complex data collection processes often lead to participant fatigue. In behavioral experiments, gamification has been used to simulate real-world scenarios, allowing researchers to collect more meaningful data on decision-making, risk assessment, and problem-solving.

Collaboration and Knowledge Sharing in Research

Another area where gamification has made a difference is in fostering collaboration and knowledge sharing among researchers. Gamified platforms and tools encourage scientists to collaborate on research projects, share data, and work together in a more interactive environment. The creation of virtual research communities with leaderboards, badges, and progress tracking helps foster a sense of competition and cooperation, which in turn boosts research productivity. Gamified environments have been shown to facilitate crowdsourcing and open innovation in scientific research. Studies such as those have demonstrated how gamified platforms for collaborative problem-solving enabled researchers from different disciplines to contribute to a common project, leading to more comprehensive solutions.

Challenges of gamification

While gamification offers numerous benefits, there are also challenges to its implementation in both education and research.

Overemphasis on Rewards

One common criticism of gamification is that it can lead to an overemphasis on extrinsic rewards, such as points and badges, at the expense of intrinsic motivation. According to a study, the constant pursuit of rewards can sometimes detract from the learning experience, as participants may become more focused on accumulating points than on mastering the subject matter. This is a key challenge in designing gamified systems that balance extrinsic rewards with intrinsic motivation.

Accessibility and Inclusivity Issues

Another challenge is ensuring that gamification is inclusive and accessible to all users. Not all students or participants are motivated by the same game elements, and what works for one group may not be effective for another. For instance, leaderboards and competitive elements may motivate some individuals, but discourage others who prefer collaborative or self-paced learning environments. Research emphasized the need to design gamification strategies that accommodate diverse learning preferences and skill levels.

Technical and Implementation Barriers

In research, the use of gamification often requires sophisticated digital platforms, which can pose technical and financial barriers to implementation. Small research projects or institutions with limited resources may find it difficult to develop and maintain gamified systems. Similarly, in education, teachers and administrators may lack the technical expertise to effectively implement gamification in their classrooms.

CONCLUSION AND FUTURE DIRECTIONS

The impact of gamification in research and education has been profound, offering new ways to engage participants, enhance learning, and foster collaboration. However, to fully harness its potential, educators and researchers must carefully design gamified systems that balance extrinsic rewards with intrinsic motivation, ensure accessibility, and provide sufficient technical support. As the digital world continues to evolve, future research should focus on exploring more personalized gamification strategies that cater to individual learning styles and preferences. Additionally, the use of advanced technologies, such as AI-driven adaptive gamification, can help create more tailored learning experiences, making gamification even more effective in diverse educational and research settings. Gamification is not just a tool for engagement—it is a transformative approach that can revolutionize the way we learn, research, and collaborate in the 21st century. By continuing to refine and adapt these systems, we can ensure that gamification remains a valuable asset in both educational and research environments.

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CONFLICT OF INTEREST

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