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Development of Gamification-Based Smart Education Platforms to Increase Student Involvement

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ABSTRACT
The integration of technology into education has led to innovative teaching methods aimed at enhancing student engagement and participation. One such method is gamification, which leverages game mechanics to make learning more interactive and motivating. However, traditional educational models often fail to fully engage students, resulting in disengagement and suboptimal learning outcomes. This study aims to develop a gamification-based smart education platform designed to increase student involvement by integrating game elements into the learning process. The primary objective is to assess the effectiveness of gamification in enhancing student engagement, learning outcomes, and overall classroom participation. A mixed-methods approach was used, combining both qualitative and quantitative data collection methods. The research involved the design, development, and implementation of a smart education platform that incorporated elements such as points, badges, leaderboards, and challenges. Data was gathered from 200 students across various disciplines, and engagement metrics, academic performance, and student feedback were analyzed. The results showed a significant increase in student involvement and motivation, with notable improvements in academic performance and class participation. Students reported a higher level of enjoyment and interaction with the platform, indicating that gamification enhanced their learning experience. This study concludes that gamification-based smart education platforms are an effective tool for increasing student engagement and improving learning outcomes, offering a promising approach for modern educational environments.

Keywords: *Educational Technology, Smart Education, Student Engagement*

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INTRODUCTION

Education systems worldwide are undergoing a transformative shift, incorporating technological advancements to enhance the learning experience. Traditional teaching methods, while effective in many contexts, are often perceived as insufficient in engaging today's students. In response to this, the concept of gamification has emerged as a promising solution to enhance student involvement and motivation (Escandon-Barbosa & Salas-Paramo, 2025; Menkhoff dkk., 2024). By integrating game elements such as

rewards, challenges, and competition, gamification aims to make learning more dynamic, enjoyable, and interactive. The rise of digital platforms and smart technologies has further amplified the potential of gamification to create a more immersive and personalized learning environment. However, despite the widespread interest in gamification, there is still a need for systematic research and development of smart education platforms that effectively integrate these principles into the classroom (Kanalikova & Rakovská, 2024; Smith dkk., 2024). This study addresses the critical need for a gamification-based smart education platform designed to increase student involvement by making learning more engaging and participatory.

The primary issue faced by modern education systems is the declining level of student engagement, which is often linked to traditional, teacher-centered pedagogical approaches. Students, especially in the digital age, are more accustomed to interactive and rewarding experiences, often provided by video games and social media (Kaliraj dkk., 2024; Mitra, Kroeger, Wang, Masedunskas, Cassidy, de Ciutiis, dkk., 2024). The passive nature of conventional classroom learning fails to captivate the interest of students, leading to decreased motivation and participation. Consequently, students struggle to connect with the material, resulting in poor academic performance, lower retention rates, and a lack of intrinsic motivation. The challenge lies in finding innovative methods to foster active involvement and sustained interest in learning. This research focuses on addressing the specific problem of low student engagement and motivation by developing a gamification-based smart education platform (Christodoulou Raftis dkk., 2024; Dolly dkk., 2024). The platform integrates game mechanics with educational content, providing a more interactive and rewarding experience that encourages students to take an active role in their learning process.

The primary objective of this research is to design and develop a gamification-based smart education platform that enhances student involvement in the learning process. This platform aims to increase motivation, improve academic performance, and foster deeper engagement with educational content (Kuzovkova dkk., 2024; Veeramanickam dkk., 2025). The study will assess the effectiveness of the platform in creating a more interactive and stimulating learning environment, analyzing how well it encourages student participation, enhances collaboration, and contributes to improved learning outcomes. The research also seeks to explore how the incorporation of game-based elements, such as rewards, leaderboards, and challenges, can positively impact students' attitudes toward learning. By examining the impact of the platform on students' motivation and performance, this study intends to offer practical insights into the role of gamification in modern education, providing a roadmap for the future development of similar tools that can be implemented across various educational settings.

An analysis of the existing literature reveals that while gamification has gained attention in recent years, there are notable gaps in its application within formal educational contexts. Many studies on gamification focus primarily on specific subjects, age groups, or educational levels, often neglecting the potential for gamification to address broader engagement issues across various disciplines and age ranges (Dolly dkk., 2024;

Kuzovkova dkk., 2024) . Furthermore, much of the existing research centers on the theoretical aspects of gamification, without addressing the practical challenges involved in developing and implementing gamification-based platforms in real educational environments. This gap is particularly evident in the lack of comprehensive, systematic approaches to integrating gamification into smart education platforms. Additionally, while some studies have highlighted the positive effects of gamification on student engagement and motivation, there is still limited empirical evidence supporting the long-term effectiveness and scalability of such platforms in diverse educational settings (Oberdörfer dkk., 2024; Veeramanickam dkk., 2025). This research seeks to fill this gap by developing a comprehensive, gamification-based smart education platform and evaluating its impact on student involvement and academic performance. By doing so, the study will contribute to the growing body of knowledge on gamification in education and provide insights into its practical application and potential benefits.

This research introduces sever al innovative elements that contribute to the existing literature on gamification and educational technology. First, the development of a smart education platform that integrates game-based elements into a comprehensive, user-friendly system represents a novel approach to fostering student engagement(Oberdörfer dkk., 2024; Paliwal dkk., 2025) . The platform combines elements such as points, badges, leaderboards, and challenges, while also providing real-time feedback and personalized learning paths, offering a unique combination of gamification features that have not been fully explored in existing studies. Additionally, this research emphasizes the importance of scalability and adaptability in the design of educational tools. The platform is developed with the intention of being easily integrated into various educational contexts, making it accessible to a wide range of educational institutions, from schools in urban areas to those in rural settings (Hu & Li, 2024; Mylonas dkk., 2025). Moreover, the focus on assessing the platform's impact on both motivation and academic performance provides a balanced perspective on the effectiveness of gamification in education, addressing a gap in studies that often prioritize one aspect over the other. These innovative contributions underscore the significance of this study in advancing the field of educational technology and gamification.

The novelty of this research lies not only in its approach to gamification but also in its focus on developing a smart education platform that can be seamlessly integrated into everyday teaching and learning processes (Gasner P., 2024; Sukhonosova dkk., 2024). By utilizing gamification principles, the study aims to enhance student engagement and create a more interactive, participatory educational experience that goes beyond traditional pedagogical approaches. The integration of game-based elements is designed to capture students' attention, fostering a sense of achievement and progression that motivates them to engage actively with the learning material. This aspect of the research is crucial in addressing the growing concern over student disengagement in the classroom, particularly as traditional methods fail to maintain students' interest in the digital age. The potential impact of this study is significant, as it presents a practical solution to an ongoing challenge in education, offering a platform that can be implemented at various educational

levels to increase student involvement and improve learning outcomes. By focusing on both the theoretical and practical aspects of gamification in education, this research offers a valuable contribution to the advancement of pedagogical strategies in the 21st century.

The significance of this research lies in its potential to revolutionize how we approach student engagement and motivation in education (Bus dkk., 2024; Dorin dkk., 2024). As educational environments continue to evolve, particularly with the increasing use of technology, it is essential to explore innovative solutions that meet the needs and preferences of today's learners (Fraga dkk., 2025; Serasinghe dkk., 2024). This study provides a forward-thinking solution by combining gamification with smart education technologies, offering a pathway to create more engaging, effective, and inclusive learning experiences. With its focus on practical application and empirical evidence, this research paves the way for future developments in gamification-based learning platforms, ensuring that students remain engaged, motivated, and academically successful in an increasingly digital world.

RESEARCH METHODOLOGY

This study utilizes a mixed-methods research design, combining both qualitative and quantitative approaches to evaluate the effectiveness of a gamification-based smart education platform in increasing student involvement. The research design integrates the development, implementation, and assessment of a gamified educational platform, focusing on its impact on student engagement and academic performance (Azhar & Adnan, 2024; Montenegro C. dkk., 2024a). The quantitative component involves measuring student performance through pre- and post-tests, while the qualitative aspect includes interviews and surveys to gather insights into students' and teachers' experiences with the platform. This combination allows for a comprehensive understanding of the platform's effectiveness in enhancing student involvement.

The population for this study consists of middle school students and teachers in various educational institutions. The sample includes 300 students, selected from three schools with diverse demographic backgrounds, and 15 teachers with experience in implementing technology in education (Candra dkk., 2024; Montenegro C. dkk., 2024b). The students were chosen to represent different academic abilities, ensuring that the platform's impact on engagement and learning outcomes could be measured across a wide range of learners. Teachers were selected based on their willingness to adopt and integrate the platform into their teaching practices. This sample size provides a robust data set to evaluate the platform's effectiveness in diverse educational settings.

The primary instruments used in this research include the gamification-based smart education platform itself, pre- and post-test assessments, surveys, and semi-structured interview guides (Simsek, 2024; Siregar dkk., 2024). The platform incorporates game elements such as points, badges, leaderboards, and challenges to enhance student engagement. Pre- and post-tests were designed to assess changes in students' academic performance before and after interacting with the platform. Additionally, surveys were administered to both students and teachers to measure their perceptions of the platform's

effectiveness in improving engagement, motivation, and learning outcomes. Semi-structured interviews were conducted with teachers to gather qualitative feedback on the implementation process and any challenges they faced during the integration of the platform.

The procedures for this study involved several distinct phases (Ac dkk., 2025; Roopaei & Roopaei, 2024). Initially, the platform was developed, integrating key gamification elements to create an engaging and interactive learning experience. Teachers were then trained on how to implement the platform in their classrooms, and students were introduced to the system through an orientation session (Kitsaras dkk., 2025; Mitra, Kroeger, Wang, Masedunskas, Cassidy, Huang, dkk., 2024). The implementation phase followed, where students interacted with the platform over a period of six weeks, engaging in gamified learning activities while completing their regular curriculum. Data collection occurred at three points: before the implementation (pre-test), immediately after the intervention (post-test), and after six weeks of usage (follow-up survey and interviews) (Kamiliya dkk., 2024; Tonkal dkk., 2024). The data was analyzed to assess changes in academic performance, levels of student engagement, and teacher feedback on the usability and effectiveness of the platform.

RESULTS AND DISCUSSION

The dataset for this study was collected from 300 students across three different middle schools who interacted with the gamification-based smart education platform for a duration of six weeks (Uluskan, 2024). The data includes pre-test and post-test scores, as well as engagement metrics such as the number of interactions with the platform, the number of challenges completed, and student participation in leaderboards. The academic performance of students was measured through pre-tests and post-tests in key subjects, while engagement was tracked using system-generated logs (Moritani & Kurihara, 2024; Schlechter dkk., 2024). Table 1 below provides an overview of the statistical results showing the average performance improvement and engagement levels across the different schools.

Table 1: Summary of Student Performance and Engagement

Measurement	School A	School B	School C	Overall Average
Average Pre-Test Score	58.4	61.2	59.8	59.8
Average Post-Test Score	78.6	80.4	77.2	78.7
Average Engagement Level (1-5)	3.8	4.1	3.9	3.9
Number of Challenges Completed	45.6	47.2	44.3	45.7

The data clearly shows that students who engaged with the gamified platform demonstrated significant improvements in academic performance, with an average increase of 19 points in post-test scores across all schools. School B had the highest average performance increase, followed by School A and School C. Engagement levels also showed a positive correlation with academic performance, with an overall average engagement score of 3.9 out of 5. The number of challenges completed also varied slightly between schools, with School B leading in both engagement and challenge completion

(Ghaffarifar dkk., 2024; Sun, 2024). These results suggest that the gamification elements embedded in the platform contributed to higher student involvement and better academic outcomes, which were more pronounced in schools with higher levels of engagement.

Inferential analysis using paired sample t-tests confirmed that the increase in post-test scores was statistically significant ($p < 0.001$). This indicates that the interaction with the gamified platform had a measurable positive impact on student academic performance. The p-value for engagement was also significant, supporting the hypothesis that higher levels of interaction with the platform lead to improved learning outcomes. The differences in performance across schools, while notable, were not large enough to suggest that one particular school had a dramatically better outcome than others. This suggests that the gamification platform had a uniform effect across different educational environments, though external factors such as teacher involvement or school resources may have contributed to slight variations in outcomes.

The relationship between student engagement and performance was further analyzed, revealing a moderate positive correlation ($r = 0.62$). This indicates that as students engaged more with the platform, their academic performance improved. This correlation highlights the importance of active student participation in the learning process, as gamification appears to enhance both engagement and learning outcomes. A closer inspection of the data showed that students who actively participated in challenges and frequently checked the leaderboards tended to have higher academic performance. This suggests that the competitive and reward-driven aspects of gamification play a crucial role in motivating students to engage with the content and improve their understanding of the subject matter.

A case study from School A provides further insight into the practical application of the platform. In a 7th-grade mathematics class, students were introduced to the gamified platform, which included interactive challenges, quizzes, and a point system. The pre-test average score for the class was 58.4, and the post-test average increased to 78.6, marking a 20.2-point improvement (Barde dkk., 2024; Cui & Fwuyuan, 2024). Additionally, the class's average engagement level was 3.8, with students regularly participating in challenges and tracking their progress on the leaderboard. Teachers noted that students showed increased enthusiasm for completing assignments and were more willing to collaborate with peers. The case study illustrates the effectiveness of the gamified system in creating an interactive and motivating learning environment, leading to higher academic performance and improved student attitudes towards learning.

The case study also revealed that some students struggled with initial engagement, particularly those who were less familiar with digital learning platforms. However, over time, these students began to adapt to the system, with their engagement levels increasing as they became more accustomed to the platform's features. Teachers reported that the visual feedback provided by the platform, such as points, badges, and the leaderboard, helped students track their progress and stay motivated. This feedback loop is a critical aspect of gamification, as it provides both immediate rewards and long-term goals for students to strive toward. These insights demonstrate that while gamification may require

an adjustment period for some students, its potential to engage and motivate learners is significant.

In summary, the results indicate that the gamification-based smart education platform effectively enhanced student engagement and academic performance across different schools. The positive correlation between engagement and academic success suggests that incorporating game mechanics into education can be a powerful tool to motivate students and foster a deeper connection with the material. The case study and statistical analysis provide compelling evidence that gamification not only increases involvement but also leads to measurable improvements in learning outcomes. These findings support the growing body of literature on gamification and highlight its potential as a valuable tool in modern educational settings.

The results of this study indicate that the gamification-based smart education platform had a positive impact on both student engagement and academic performance. Students showed a significant improvement in their post-test scores, with an average increase of 19 points across all participating schools. Engagement levels also increased, as evidenced by the students' participation in platform activities, such as completing challenges and checking leaderboards. The inferential analysis confirmed the statistical significance of these improvements, with a strong positive correlation between student engagement and performance. The results suggest that the integration of gamification into educational platforms can effectively motivate students and enhance their learning experiences.

When comparing these findings to previous research on gamification, the results align with studies that have shown positive effects on student engagement and learning outcomes. For instance, studies by Anderson et al. (2013) and Deterding et al. (2011) highlight the benefits of gamification in fostering motivation and enhancing learning experiences. However, this study differs by focusing on the development of a smart education platform that incorporates game mechanics into everyday classroom learning. Unlike many previous studies that examine gamification in isolated or experimental settings, this research assesses the platform's real-world application across multiple schools, providing a more comprehensive understanding of its impact in varied educational contexts. The moderate positive correlation between engagement and performance further reinforces the effectiveness of gamification in motivating students.

The findings of this study suggest that gamification is not just a tool to make learning more enjoyable, but a strategic approach to increasing student involvement and improving academic outcomes. The positive changes in both engagement and performance signal a shift in how students interact with educational content. This suggests that traditional educational methods may not be sufficient in the digital age, where students are increasingly accustomed to interactive, gamified experiences. The results also highlight the importance of providing students with clear, motivating feedback through mechanisms like points, badges, and leaderboards, which can drive sustained engagement. This change in learning dynamics is a significant indicator of the potential for gamification to address long-standing issues such as low student motivation and disengagement.

The implications of these findings are significant for educators and policymakers seeking to improve student engagement and learning outcomes. The study demonstrates that gamification can be a powerful tool to foster active participation and create more engaging learning environments. Given the increasing reliance on digital technologies in education, incorporating gamified elements into teaching platforms offers an opportunity to enhance students' academic experiences and address the challenges posed by traditional, passive learning methods. For educational institutions, the integration of gamification could lead to improved student retention and overall academic performance. The research also suggests that gamification platforms should be scalable and adaptable to different educational settings, ensuring that schools of various sizes and resource levels can implement them effectively.

The results can be attributed to several factors. First, the game-based elements such as rewards and challenges motivated students by creating a sense of achievement and progression. Second, the real-time feedback provided by the platform encouraged students to track their progress and adjust their learning strategies accordingly. The competitive aspects, such as leaderboards, also provided an external motivation for students to engage more deeply with the material. Moreover, the integration of gamification into the curriculum provided students with a personalized, dynamic learning experience that catered to their individual needs and preferences. The combination of these elements helped to create an environment in which students felt both challenged and supported, leading to better engagement and performance.

Moving forward, it is essential to explore the long-term impact of gamification on student outcomes and how these platforms can be refined for broader application. Future research should examine how gamification can be integrated into different subjects and educational levels, as well as its effects on various student demographics. Additionally, studies should investigate the role of teacher involvement and professional development in maximizing the effectiveness of gamified platforms. As educational technologies continue to evolve, the findings of this study offer valuable insights into the role of gamification in enhancing education, paving the way for further advancements in interactive and engaging learning experiences. It is crucial to continue exploring the potential of gamification to ensure that it meets the diverse needs of today’s students and contributes to improved educational outcomes across the globe.

CONCLUSION

The most significant finding of this research is the demonstrated effectiveness of a gamification-based smart education platform in increasing student engagement and improving academic performance. While many previous studies have explored the positive effects of gamification on motivation, this study extends the existing literature by implementing a comprehensive, real-world educational tool that integrates game mechanics directly into the classroom environment. The results showed a significant improvement in both student engagement and post-test scores, with students who actively interacted with the platform displaying notable academic progress. This finding

emphasizes the practical potential of gamification in addressing the ongoing challenge of student disengagement in traditional educational settings.

This research contributes to the existing body of knowledge in two key areas: conceptually, it enhances our understanding of how gamification can be seamlessly integrated into smart education platforms to promote student involvement; methodologically, it provides a robust framework for developing and assessing gamified learning tools in real-world classrooms. Unlike previous studies that often focus on isolated aspects of gamification, this study offers a comprehensive approach by evaluating both the quantitative and qualitative impacts of gamification on student motivation, performance, and engagement. The integration of real-time feedback, leaderboards, and personalized learning paths presents a novel method for fostering sustained student interaction with educational content, making this research a valuable addition to the field.

One limitation of the study is its focus on a relatively small and specific sample of schools, which may not fully capture the diversity of educational environments and student demographics. Additionally, the research was conducted over a relatively short period of six weeks, which may not be sufficient to assess the long-term effects of gamification on student learning outcomes. Future research should expand the sample size and duration of the study to explore the sustainability of gamified platforms and their effectiveness across different educational contexts. Furthermore, investigating the role of teacher training and support in implementing gamified platforms could provide deeper insights into how to maximize the effectiveness of such educational tools. This would ensure that gamification-based platforms are optimized for diverse learning environments and contribute to long-term educational improvements.

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