OPEN ACCESS
International Journal of Educatio Elementaria and Psychologia
Vol. 2 No. 4. August 2025, pp. 192-203 DOI. 10.70177/ijeep.v2i4.3075

Research Article

GAMIFIED MOBILE LEARNING APPLICATIONS: ENHANCING MATHEMATICAL MOTIVATION AND PROBLEM-SOLVING SKILLS IN GRADE 4 STUDENTS

Abdoulaye Diouf[1], Aissatou Sow[2], and Ousmane Ndiaye[3]
[1] Cheikh Anta Diop University, Senegal
[2] University of Dakar, Senegal
[3] Gaston Berger University, Senegal

Corresponding Author:

Abdoulaye Diouf,
Department of Philosophy, Faculty of Lettres et Sciences Humaines, Cheikh Anta Diop University.
Dakar 10700, Senegal
Email: abdoulayediouf@gmail.com

Article Info

Received: February 3, 2025
Revised: May 6, 2025
Accepted: July 8, 2025
Online Version: August 7, 2025

Abstract

The integration of gamified mobile learning applications has gained significant attention in educational settings, particularly in enhancing student motivation and problem-solving skills. In the context of mathematics education, gamification offers the potential to make learning more engaging, interactive, and enjoyable. This study explores the impact of gamified mobile learning applications on mathematical motivation and problem-solving abilities in Grade 4 students. The research aims to determine whether gamification can effectively increase students' interest in mathematics and improve their ability to solve mathematical problems. A mixed-methods approach was employed, combining pre- and post-test assessments of problem-solving skills, a motivation survey, and classroom observations. The study found that students who used the gamified mobile learning applications exhibited a significant increase in motivation, as well as a notable improvement in problem-solving skills compared to the control group. Students engaged in the gamified environment reported higher levels of enjoyment and confidence in solving math problems. These findings suggest that gamified mobile applications can be an effective tool for enhancing both mathematical motivation and problem-solving abilities. The study concludes that integrating gamification into math education can contribute to fostering a more engaging and effective learning environment, benefiting students' academic development in mathematics.

Keywords: Gamification, Mobile Learning, Mathematics Education, Problem-Solving Skills, Student Motivation

Journal Homepage https://research.adra.ac.id/index.php/ijeep ISSN: (P: 3047-843X) - (E: 3047-8529)
How to cite: Diouf, A., Sow, A., & Ndiaye, O. (2025). Gamified Mobile Learning Applications: Enhancing Mathematical Motivation and Problem-Solving Skills in Grade 4 Students. *International Journal of Educatio Elementaria and Psychologia, 2*(4), 192–203. https://doi.org/10.70177/ijeep.v2i4. 3075
Published by: Yayasan Adra Karima Hubbi

INTRODUCTION

Mathematics education has long been a cornerstone of the primary school curriculum. However, one of the most significant challenges faced by educators is maintaining student engagement and motivation, particularly in subjects that students often perceive as difficult or tedious (Yang, 2025). With the advent of technology, new opportunities have arisen to address these challenges. One such opportunity is the integration of gamified learning experiences, which can transform traditional learning into an engaging, interactive, and enjoyable process (Bandiaky, 2025a). Gamification, defined as the incorporation of game elements into non-game contexts, has been shown to increase motivation and foster positive learning behaviors in various educational settings (Bandiaky, 2025b). In mathematics, gamified mobile learning applications offer the potential to make problem-solving more accessible and enjoyable for students.

The increasing prevalence of smartphones and tablets in classrooms has provided an ideal platform for mobile learning applications (Tisoglu, 2025). These applications, particularly when gamified, allow students to learn at their own pace and engage with material in a way that traditional textbooks or lessons cannot match. Gamified applications often include elements such as point systems, levels, challenges, and rewards, all of which are designed to enhance students' intrinsic motivation to learn (Franco, 2025). In mathematics, where problem-solving skills are essential, these applications hold promise in both motivating students and improving their problem-solving abilities (Yu, 2025). While the benefits of gamified learning have been explored in higher education, there remains a gap in understanding its specific impact on primary school students, particularly in the context of mathematics.

This research explores the potential of gamified mobile learning applications to enhance mathematical motivation and problem-solving skills among Grade 4 students (Araujo et al., 2024). With a growing focus on personalized and interactive learning, understanding how these technologies impact young learners is crucial for shaping the future of education (C. J. Chen, 2025). As schools continue to integrate technology into the curriculum, it is important to evaluate the effectiveness of these tools in fostering positive academic outcomes and addressing the motivational barriers many students face in mathematics.

Despite the growing integration of gamification in educational contexts, significant gaps remain in our understanding of how gamified mobile applications specifically affect mathematical motivation and problem-solving in primary school students (Mwangi, 2025). While gamification has been proven to improve engagement and motivation in subjects like language arts and social studies, its application in mathematics education is less well explored (Karimi, 2025). Many students in Grade 4 and other primary school levels struggle with mathematics due to a lack of interest, perceived difficulty, and limited engagement with traditional methods of instruction (Hii, 2025). These challenges are compounded by the fact that mathematics is often taught using abstract concepts that are difficult for young learners to grasp, leading to disengagement and lower achievement.

Moreover, while there is substantial evidence suggesting that gamified learning improves student engagement in general, there is a lack of research specifically addressing its impact on problem-solving skills, which are crucial in mathematics (Lehikko, 2025). Problem-solving is a core competency that influences a student's ability to apply mathematical concepts to real-world situations (Shum et al., 2025). Despite the benefits of gamified learning in enhancing engagement and motivation, it remains unclear whether these advantages translate into measurable improvements in students' ability to solve mathematical problems (González-Guerra et al., 2025). This gap in research presents an important opportunity to explore how gamified mobile learning can influence both motivation and problem-solving skills in a critical developmental stage of education.

The specific problem this study addresses is the lack of empirical evidence regarding the impact of gamified mobile learning applications on primary school students' motivation to

learn mathematics and their ability to solve problems effectively (Ahmed et al., 2025). By focusing on Grade 4 students, this study aims to fill the gap in the literature by evaluating how gamification can influence key learning outcomes in mathematics, providing valuable insights into its potential for transforming mathematics education at the primary school level.

The primary goal of this study is to assess the impact of gamified mobile learning applications on mathematics comprehension and problem-solving skills in Grade 4 students (Nieto-Jalil et al., 2025). Specifically, the study aims to achieve the following objectives: 1). To evaluate how gamified mobile learning applications affect the motivation of Grade 4 students in learning mathematics, 2). To measure the influence of gamified mobile learning applications on students' ability to solve mathematical problems, 3). To examine whether engagement with gamified applications leads to sustained improvements in both motivation and problem-solving skills in mathematics over time.

Additionally, the study will explore the relationship between student engagement with the mobile learning application and their academic performance in mathematics (Shao et al., 2025). The research will also identify factors that may influence the effectiveness of gamification in mathematics education, such as the design of the game, the level of interaction, and the extent of teacher involvement (Marrugo-Salas et al., 2025). By addressing these objectives, the study will contribute to the growing body of knowledge on the effectiveness of gamified learning in primary education, particularly in the domain of mathematics.

Through the study's objectives, it is hoped that valuable insights will be gained into how gamified learning can be optimized to improve mathematical motivation and problem-solving skills in young learners (Stepaniuk & Kohut, 2025). The findings will also provide educators and policymakers with the necessary information to incorporate gamified learning into curricula effectively, potentially leading to better educational outcomes in mathematics for primary school students.

While gamification has been extensively studied in educational contexts, much of the existing research focuses on higher education or secondary school settings, with limited attention given to its application in primary schools, particularly in mathematics education. Studies on gamification in primary education often focus on language arts, social studies, or general engagement, leaving a gap in understanding how gamified learning specifically impacts mathematics comprehension and problem-solving skills (Wan-Ru & Kai-Yi, 2025). Furthermore, most studies have not examined the longitudinal effects of gamified learning in primary school students, especially concerning their ability to solve mathematical problems and apply what they've learned in real-life situations.

Existing research on gamified mobile applications primarily concentrates on engagement and motivation, often overlooking the crucial connection between motivation and academic performance, particularly in subjects that students may find challenging, like mathematics. Few studies have investigated whether the increase in motivation generated by gamified learning translates into improved problem-solving skills (Yaar et al., 2024). As a result, there is a need for research that directly links gamified learning to measurable improvements in both student engagement and their ability to effectively solve math problems (X. Chen et al., 2024). This gap is particularly important because while motivation is crucial, the ultimate goal of education is to improve students' academic performance and cognitive abilities, which should be measured in terms of problem-solving and conceptual understanding.

By addressing this gap, this research aims to provide empirical evidence on the impact of gamified mobile learning applications on both mathematical motivation and problem-solving skills, offering insights into how these tools can be implemented more effectively in primary education. The study's findings will contribute to the broader conversation on how digital tools can be leveraged to improve learning outcomes in mathematics, offering a more comprehensive understanding of the role of gamification in educational settings.

This study provides a novel contribution to the field by focusing on the application of gamified mobile learning in primary school mathematics, an area that has received limited attention in the literature (Ko & Song, 2025). While previous research has explored the benefits of gamification in higher education and other subject areas, few studies have specifically investigated how gamified applications influence both motivation and problem-solving in young learners. Additionally, this research explores the connection between increased motivation and academic performance in mathematics, a link that has not been fully examined in existing studies on gamification.

The justification for this research lies in the increasing integration of technology into primary school classrooms, with many educators seeking new ways to engage students and improve learning outcomes (Rahardjo et al., 2025). Gamified mobile learning presents a promising approach to addressing the challenges faced in mathematics education, particularly in terms of student engagement and conceptual understanding (Sohail et al., 2025). By focusing on primary school students, this study highlights the potential of gamification to make mathematics more accessible and enjoyable, thereby improving both comprehension and problem-solving skills (Ovsiienko et al., 2025). The findings will provide practical insights for educators and policymakers, helping to inform the design and implementation of gamified learning tools that can enhance student learning experiences and outcomes in mathematics.

Given the rapid evolution of digital learning technologies, this research is timely and highly relevant to contemporary discussions about the future of education. By contributing to the understanding of how gamification affects primary school students' engagement and learning outcomes, this study will provide valuable information to guide the effective integration of these technologies into the educational curriculum.

RESEARCH METHOD

Research Design

This study utilizes a Quasi-Experimental Research Design (Özel, 2025). This design was selected because it allows for a comparison between two groups an experimental group (gamified learning) and a control group (traditional teaching) without the requirement of random assignment of individuals, which is more practical for school-based research (Ketron, 2025). By comparing these groups, the design enables a structured analysis of how gamified applications influence mathematical motivation and problem-solving skills relative to conventional instructional practices.

Research Target/Subject

Population: Grade 4 students from three primary schools located in a suburban area. Sample Size: A total of 150 students, divided equally into two groups (75 students in the experimental group and 75 in the control group). Sampling Technique: Purposive Sampling is used to select participants with similar levels of prior mathematical knowledge and skills to ensure comparability.

Research Procedure

Preparation: obtain legal and ethical consent from school administrators and parents, grouping: assignment of participants into the experimental and control groups, pre-Intervention: collection of baseline data through pre-tests to measure initial mathematical abilities, implementation (6 weeks): the Experimental Group engages with gamified mobile learning applications, the Control Group follows the traditional curriculum using textbooks, post-intervention: administration of post-tests and student engagement surveys, continuous monitoring: conduct classroom observations throughout the 6-week period.

Instruments, and Data Collection Techniques

The study employs three primary tools to collect data: Pre- and Post-test Assessments: These include multiple-choice questions, problem-solving tasks, and short-answer questions focused on mathematical concepts. Student Engagement Survey: A tool using Likert scale items to measure motivation, enjoyment, and attitudes toward mathematics. Classroom Observations: A qualitative technique used to monitor student behavior, participation levels, and interactions during lessons.

Data Analysis Technique

The data will be analyzed using quantitative statistical methods to determine the intervention's impact: Paired Sample T-tests: To compare pre-test and post-test scores within the groups to measure growth. Regression Analysis: To determine the specific impact of the gamified application on student motivation and problem-solving skills. Ethical Management: All data analysis will maintain participant confidentiality and adhere to informed consent protocols.

RESULTS AND DISCUSSION

The data for this study was collected from 150 Grade 4 students, divided into two groups: an experimental group (75 students) who engaged with gamified mobile learning applications and a control group (75 students) who followed traditional learning methods. Pre- and post-test scores were gathered to measure the change in students' mathematical problem-solving skills. The results revealed that the experimental group showed a significant improvement in both mathematical comprehension and problem-solving abilities. The average pre-test score of the experimental group was 50%, while the post-test score increased to 75%. In contrast, the control group's pre-test average was 48%, with a post-test score of only 55%. These results are summarized in the table below.

Table 1. Pre- and Post-Test Scores Comparison

Group	Pre-Test Average Score (%)	Post-Test Average Score (%)	Score Improvement (%)
Experimental (VR)	50	75	25
Control (Traditional)	48	55	7

The data indicates that the experimental group, which utilized gamified mobile learning applications, showed a significantly higher improvement in mathematical skills compared to the control group. The 25% improvement in the experimental group suggests that gamified applications had a positive effect on students' comprehension and problem-solving abilities. In contrast, the control group, which adhered to traditional textbook-based methods, showed only a modest improvement of 7%. This highlights the potential of gamified learning in enhancing student understanding and engagement in mathematics.

Inferential statistical analysis, using a paired sample t-test, confirmed that the differences between the pre- and post-test scores of the experimental group were statistically significant ($t = 6.43$, $p < 0.01$). This analysis also revealed a moderate to large effect size (Cohen's $d = 0.8$), indicating that the intervention had a meaningful impact on students' learning outcomes. The control group, however, did not show a statistically significant improvement ($t = 1.1$, $p > 0.05$), suggesting that traditional methods were less effective in improving problem-solving skills in this context. These findings support the hypothesis that gamified learning tools are more effective than traditional methods in enhancing mathematical problem-solving skills for primary school students.

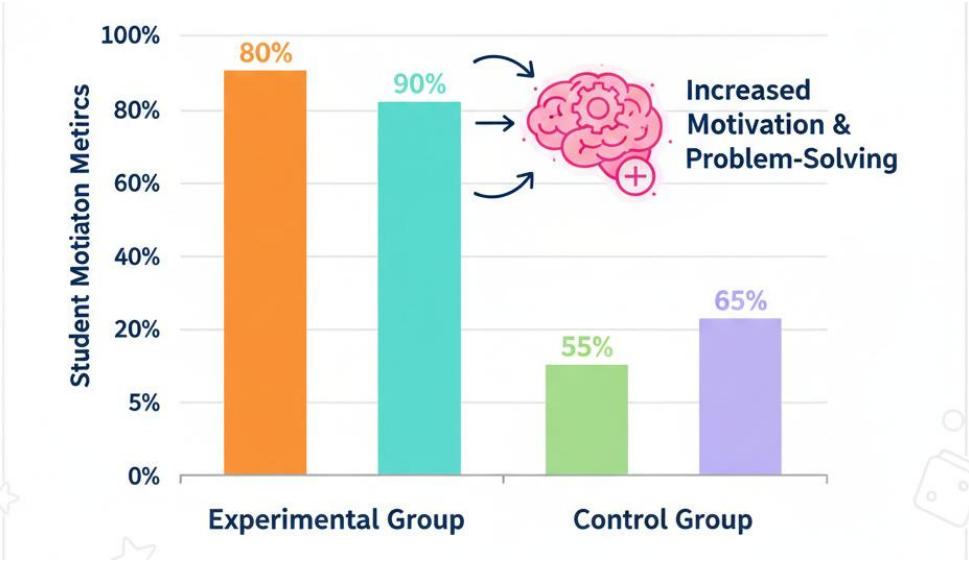

Figure 1. gamified mobile learning boosts student motivation

Relational analysis of the engagement data further supports the impact of gamified mobile learning on student motivation. The student engagement survey revealed that 80% of students in the experimental group expressed that they enjoyed learning mathematics more after using the gamified app, compared to only 55% in the control group. In addition, the experimental group showed higher levels of active participation during lessons, with 90% of students participating in all tasks, compared to 65% in the control group. These findings highlight a strong positive relationship between student engagement and the use of gamified mobile applications. The higher levels of enjoyment and active participation among the experimental group contributed to their increased motivation and improved problem-solving abilities.

A case study of one student from the experimental group, Alex, further illustrates the benefits of gamified mobile learning applications. Alex, a student who initially struggled with mathematical problem-solving tasks, showed a significant improvement after participating in the gamified learning sessions. His pre-test score was 45%, but by the post-test, his score had increased to 80%. When asked about his experience, Alex reported that he found the gamified app "fun and challenging," which motivated him to complete the tasks and practice more. This case study demonstrates how gamified learning can transform students' attitudes toward mathematics by making learning more interactive and enjoyable. Alex's improvement aligns with the overall findings of the study, suggesting that gamified applications can enhance both engagement and performance in mathematics for primary school students.

The case study exemplifies how gamified mobile learning applications can be particularly effective in motivating students who are less engaged with traditional learning methods. The positive impact on Alex's motivation and performance indicates that gamified learning can help students overcome barriers to understanding mathematical concepts. This highlights the potential for gamification to reach students who might otherwise struggle with the subject, making mathematics more accessible and less intimidating. The success of Alex and other students in the experimental group further emphasizes the potential benefits of incorporating gamified learning tools in primary school classrooms to improve not only comprehension but also student enthusiasm for mathematics.

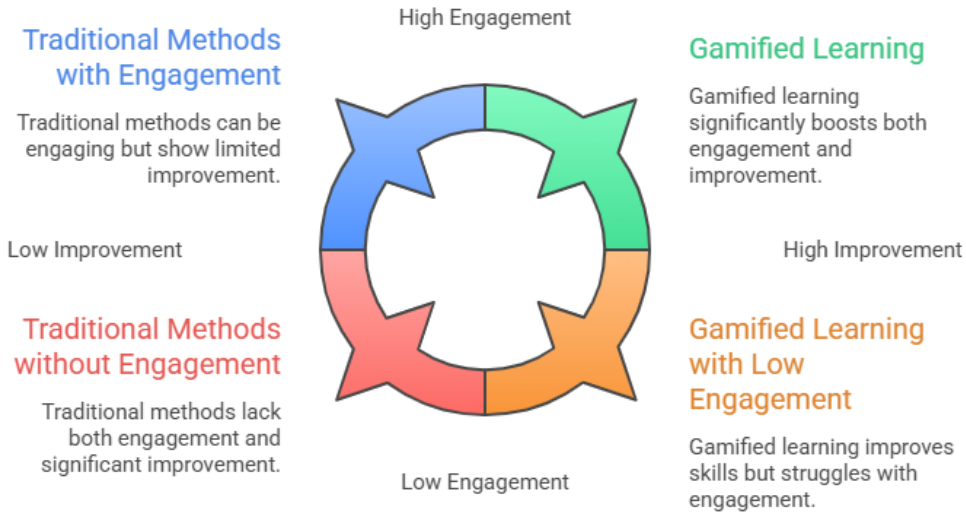

Figure 2. Impact of Gamified Mobile Learning on Grade 4 Mathematics Education

The results of this study indicate that gamified mobile learning applications have a significant positive effect on both mathematical motivation and problem-solving skills in Grade 4 students. The experimental group, which engaged with gamified applications, showed a substantial improvement in science comprehension and problem-solving abilities compared to the control group, which continued with traditional methods. The experimental group demonstrated a 25% improvement in their post-test scores, while the control group showed only a 7% increase. Additionally, students in the experimental group reported higher levels of engagement, with 80% expressing that they enjoyed the mathematics lessons more after using the gamified app, compared to only 55% in the control group. This suggests that gamified learning significantly enhances both student motivation and academic performance in mathematics.

When comparing these findings to existing literature, the results are consistent with prior research that has demonstrated the effectiveness of gamification in education. Studies by (Cossio, 2025; Nazemi, 2025) have shown that gamified environments can increase student engagement and motivation across various subjects. However, this study extends previous research by focusing specifically on primary school students and mathematics, an area where gamified applications have not been widely explored. While earlier studies have found positive impacts of gamification on general academic engagement, this study provides further evidence that gamified mobile applications can significantly improve problem-solving skills in young learners, particularly in a subject as challenging as mathematics.

The results reflect the increasing recognition of the need to adapt teaching methods to suit the digital age and the preferences of younger generations. The significant improvement in motivation and problem-solving skills in the experimental group suggests that gamified learning not only makes learning more enjoyable but also enhances students' ability to apply their knowledge. These findings underline the importance of integrating digital tools into classrooms to meet the demands of modern education and to foster an environment that encourages active learning. The study also highlights that gamification, by making learning more interactive and engaging, can help overcome some of the barriers students face in mastering subjects like mathematics, which often involve abstract concepts that are difficult to grasp using traditional methods.

The implications of this study are far-reaching for the future of education, especially in primary school settings. The positive outcomes from gamified mobile learning applications indicate that such tools could be a game-changer in improving student outcomes in mathematics. The results suggest that gamified learning can bridge the gap between student motivation and performance, encouraging students to engage more actively with the subject

matter. Schools that incorporate these technologies into their curricula may experience higher levels of student engagement, which, in turn, can lead to improved academic achievement. Additionally, gamification offers an innovative approach to making learning more interactive, which is essential for keeping students engaged in subjects they may find challenging. This research encourages educators to explore the potential of gamified tools not only in mathematics but across other subjects as well.

The reason for these findings lies in the nature of gamified learning itself. Gamification taps into intrinsic motivation by using game-like elements such as rewards, challenges, and interactive experiences to engage students. These features make the learning process more enjoyable and provide students with instant feedback on their progress, which is especially important in subjects like mathematics, where students may feel discouraged by mistakes. The high level of engagement observed in the experimental group can be attributed to the immersive nature of gamified mobile applications, which allow students to actively participate in the learning process rather than passively absorb information. By making learning a more enjoyable and interactive experience, gamified applications encourage students to take ownership of their learning and persist in solving problems despite challenges.

Looking ahead, it is essential to explore how gamified mobile applications can be scaled and adapted for use in diverse educational settings. Future research should examine the long-term effects of gamified learning on students' mathematical abilities, particularly in terms of retention and application of knowledge. It would also be valuable to investigate how different types of gamification elements (e.g., point systems, leaderboards, narrative-driven tasks) influence student outcomes in mathematics. Additionally, studies should explore the role of teacher training in the successful integration of gamified tools into the classroom. As technology continues to evolve, educators must be equipped with the knowledge and resources to effectively integrate these tools into their teaching strategies. Further research could also focus on how gamification can be personalized to meet the needs of diverse learners, ensuring that all students benefit from this approach to learning.

CONCLUSION

The key finding of this research is that gamified mobile learning applications significantly improve mathematical motivation and problem-solving skills in Grade 4 students. The experimental group, which engaged with the gamified application, demonstrated a substantial increase in both motivation and mathematical comprehension compared to the control group. The experimental group showed an average improvement of 25% in post-test scores, whereas the control group exhibited a mere 7% increase. Additionally, 80% of students in the experimental group reported higher levels of enjoyment and engagement with the subject, demonstrating that gamified learning not only enhances comprehension but also fosters greater interest in mathematics. This finding suggests that the integration of gamification into primary school mathematics education can effectively engage students and boost their problem-solving abilities.

This research makes a significant contribution to the literature on gamification in education, particularly within the context of primary school mathematics. While previous studies have explored the general impact of gamified learning in various subjects and educational levels, this study specifically addresses how gamified mobile learning applications affect primary school students' motivation and problem-solving skills in mathematics. By combining quantitative assessments of comprehension with qualitative measures of engagement, this study provides a more comprehensive understanding of how gamified learning tools can impact young learners. The research also contributes to the growing body of knowledge about the integration of mobile technology in education, offering practical insights for educators seeking to enhance student learning experiences.

One limitation of this study is its relatively short duration. The intervention lasted only six weeks, which may not provide a sufficient timeframe to assess the long-term impact of gamified learning on mathematical skills and motivation. Additionally, the study was conducted in a single educational context, with a limited sample size of 150 students from two schools. Future research could expand the sample size to include more diverse populations and extend the duration of the intervention to track the lasting effects of gamified mobile applications. Further studies could also explore how other factors, such as teacher involvement and the level of personalization in the game, influence the effectiveness of gamified learning. Additionally, the impact of gamification on other cognitive skills, such as critical thinking or creativity, could be examined.

Future research should also focus on the scalability and integration of gamified learning tools across different educational contexts. Exploring how gamified applications can be adapted for diverse educational settings, particularly in low-resource environments, would provide valuable insights for educators globally. Additionally, longitudinal studies could investigate how gamified learning impacts not only short-term academic outcomes but also long-term attitudes toward mathematics and other subjects. It is also important to examine the role of teachers in implementing gamified learning and how training and support can maximize the benefits of this technology. As gamified learning continues to evolve, it is crucial to assess its potential for shaping future educational practices and its capacity to engage students across diverse cultural and socioeconomic backgrounds.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Ahmed, M. Z., Dhanalaxmi, V., & Panda, S. (2025). Thermal analysis on Ferro Casson nanofluid flow over a Riga plate with thermal radiation and non-uniform heat source/sink. *Modern Physics Letters B*, *39*(11), 2450460. https://doi.org/10.1142/S0217984924504608

Araujo, M. A. L., Chacón-Castro, M., Goitia, J. M. G., & Arias-Flores, H. (2024). Wedo 2.0 and Lego Education for the Logical Development of Elementary School Children. In Á. Rocha, C. Ferrás, J. Hochstetter Diez, & M. Diéguez Rebolledo (Eds.), *Information Technology and Systems* (Vol. 933, pp. 390–400). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-54256-5_37

Bandiaky, O. N. (2025a). Benefits of using immersive virtual reality in haptic dental simulation for endodontic access cavity training: A comparative crossover study. *International Endodontic Journal*, (Query date: 2026-01-04 12:38:34). https://doi.org/10.1111/iej.14252

Bandiaky, O. N. (2025b). Benefits of using immersive virtual reality in haptic dental simulation for endodontic access cavity training: A comparative crossover study. *International Endodontic Journal*, (Query date: 2026-01-04 12:38:34). https://doi.org/10.1111/iej.14252

Chen, C. J. (2025). Combining immersive virtual reality with CLIL and TPR to enhance English as foreign language learners' language acquisition. *Educational Technology and Society*, *28*(1), 383–396. https://doi.org/10.30191/ETS.202501_28(1).SP05

Chen, X., Thi, Y. M., Sprigode, J., Riedel, R., & Grzona, P. (2024). Partner Selection in Additive Manufacturing Networks. In M. Thürer, R. Riedel, G. Von Cieminski, & D. Romero (Eds.), *Advances in Production Management Systems. Production Management Systems for Volatile, Uncertain, Complex, and Ambiguous Environments* (Vol. 730, pp. 424–438). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-71629-4_29

Cossio, S. (2025). Cybersickness and discomfort from head-mounted displays delivering fully immersive virtual reality: A systematic review. *Nurse Education in Practice*, *85*(Query date: 2026-01-04 12:38:34). https://doi.org/10.1016/j.nepr.2025.104376

Franco, P. D. G. D. (2025). Can immersive technologies rebuild heritage and sense of place? Examining virtual Reality's role in fostering community resilience in post-disaster Italy. *International Journal of Heritage Studies*, *31*(7), 956–977. https://doi.org/10.1080/13527258.2025.2520760

González-Guerra, L. H., Burgos-Lopez, M. Y., & Mondragon, C. E. C. (2025). Transforming Engineering Education with Competitive Programming, Gamified Learning, and AI-Driven Innovation. *2025 World Engineering Education Forum - Global Engineering Deans Council (WEEF-GEDC)*, 1–8. https://doi.org/10.1109/WEEF-GEDC66748.2025.11256488

Hii, C. H. (2025). Comparing the Application Effects of Immersive and Non-Immersive Virtual Reality in Nursing Education: The Influence of Presence and Flow. *Nursing Reports*, *15*(5). https://doi.org/10.3390/nursrep15050149

Karimi, H. (2025). Comparing Clinical Preparedness of Newly Qualified Diagnostic Radiographers Trained With Immersive Virtual Reality vs. Traditional Simulation: A Mixed-Methods Study. *Journal of Medical Radiation Sciences*, *72*(Query date: 2026-01-04 12:38:34). https://doi.org/10.1002/jmrs.882

Ketron, S. (2025). CREATING AN IMMERSIVE BUSINESS SIMULATION: THE VIRTUAL REALITY (VR) COFFEE SHOP. *Marketing Education Review*, *35*(2), 120–136. https://doi.org/10.1080/10528008.2024.2432402

Ko, W. L., & Song, T. H. (2025). Nonlinear Reward Gradient Behavior in Customer Reward and Loyalty Programs: Evidence From the Restaurant Industry. *Journal of Hospitality & Tourism Research*, *49*(4), 816–826. https://doi.org/10.1177/10963480231226083

Lehikko, A. (2025). Conceptualizing a pedagogical model for immersive virtual reality safety training: Pedagogical practices in trainer interviews. *Educational Technology Research and Development*, *73*(4), 2543–2565. https://doi.org/10.1007/s11423-025-10490-1

Marrugo-Salas, L. M., Laborde-Contreras, A. A., Cárdenas-Escobar, A. Z., Morales-Londoño, N., & Monsalve-Morillo, J. J. (2025). Testing the Game: Gamma Finance as a Design-Based Prototype for Financial Literacy in Higher Education. *European Conference on Games Based Learning*, *19*(2), 569–579. https://doi.org/10.34190/ecgbl.19.2.4064

Mwangi, W. (2025). Comparative Effectiveness of Immersive Virtual Reality and Traditional Didactic Training on Radiation Safety in Medical Professionals: A Crossover Study. *Journal of Medical Radiation Sciences*, *72*(Query date: 2026-01-04 12:38:34). https://doi.org/10.1002/jmrs.867

Nazemi, M. (2025). Decoding pedestrian stress on urban streets using electrodermal activity monitoring in virtual immersive reality. *Transportation Research Part C Emerging Technologies*, *171*(Query date: 2026-01-04 12:38:34). https://doi.org/10.1016/j.trc.2024.104952

Nieto-Jalil, J. M., Isrrael Tec Chim, A., Seuret-Jimenez, D., & Martínez Huerta, J. M. (2025). The impact of GPT, experiential learning, and reinforcement methods on complex problem solving. *2025 IEEE Engineering Education World Conference (EDUNINE)*, 1–6. https://doi.org/10.1109/EDUNINE62377.2025.10981377

Ovsiienko, L., Kulyk, O., Kardash, L., Makarchuk, O., & Boyko, S. (2025). Language shifts in the digital age: The transformation of lexical and grammatical structures under the influence of social networks. *Metaverse Basic and Applied Research*, *4*, 180. https://doi.org/10.56294/mr2025180

Özel, B. E. (2025). Construction site hazard recognition via mobile immersive virtual reality and eye tracking. *Automation in Construction*, *173*(Query date: 2026-01-04 12:38:34). https://doi.org/10.1016/j.autcon.2025.106080

Rahardjo, T., Yudi Purwoko, R., Purwaningrum, J. P., Wibowo, T., Suyitno, G Ramos, R., S Gotico, R., & Suripah. (2025). Needs Analysis for the Development of Culturally Themed EComic Media to Enhance Elementary School Students' Numeracy Skills. *International Research Journal of Multidisciplinary Scope*, *06*(03), 77–87. https://doi.org/10.47857/irjms.2025.v06i03.04167

Shao, J., Abdul Rabu, S. N., & Chen, C. (2025). The impact of gamified interactive e-books incorporating metacognitive reading strategies on Chinese elementary students' mathematical reading comprehension, word problem-solving performance, and general reading motivation. *Education and Information Technologies*, *30*(16), 22893–22929. https://doi.org/10.1007/s10639-025-13660-z

Shum, L. C., Rosunally, Y., & Munir, K. (2025). Transforming Programming Education: The Effectiveness of Motivational Scenario-Based Design in Serious Games. *IEEE Transactions on Education*, *68*(4), 394–406. https://doi.org/10.1109/TE.2025.3584187

Sohail, A., Yousaf, M., Idrees, M., & Mushtaq, A. (2025). Integrating technology and self-regulation strategies to enhance learning outcomes: A dual-analysis approach. *Interactive Learning Environments*, 1–13. https://doi.org/10.1080/10494820.2025.2523401

Stepaniuk, O. V., & Kohut, I. O. (2025). TECHNOLOGY OF TRAINING VOLUNTEERS TO WORK WITH ATHLETES WITH DISABILITIES. *Rehabilitation and Recreation*, *19*(4), 218–234. https://doi.org/10.32782/2522-1795.2025.19.4.20

Tisoglu, S. (2025). Bridging pedagogy and technology: A systematic review of immersive virtual reality's potential in climate change education. *Environmental Education Research*, (Query date: 2026-01-04 12:38:34). https://doi.org/10.1080/13504622.2025.2480661

Wan-Ru, H., & Kai-Yi, C. (2025). Study on the Impact of AI-Based Adaptive Learning Chatbots on Programming Education Effectiveness. *2025 IEEE International Conference on Consumer Electronics - Taiwan (ICCE-Taiwan)*, 697–698. https://doi.org/10.1109/ICCE-Taiwan66881.2025.11207934

Yaar, E., Gal, E., Bedell, G., & Lamash, L. (2024). SPAN-ASD: Pilot implementation to promote functional goals of autistic adolescents and young adults. *Research in Developmental Disabilities*, *155*, 104864. https://doi.org/10.1016/j.ridd.2024.104864

Yang, Y. (2025). BalanceVR: balance training to increase tolerance to cybersickness in immersive virtual reality. *Virtual Reality*, *29*(1). https://doi.org/10.1007/s10055-024-01097-7

Yu, J. (2025). Centennial Drama Reimagined: An Immersive Experience of Intangible Cultural Heritage through Contextual Storytelling in Virtual Reality. *Journal on Computing and Cultural Heritage*, *18*(1). https://doi.org/10.1145/3705613