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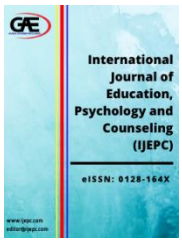

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LEARNING THROUGH PLAY: THE IMPACT OF MATHEMATICAL GAMES ON MOTIVATION IN PEDIATRIC CANCER EDUCATION

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Abstract:

Mathematical literacy represents a critical dimension of cognitive development; however, children undergoing cancer treatment often face significant educational challenges due to prolonged medical interventions, extended school absences, and psychosocial stressors. These circumstances contribute to diminished motivation, reduced self-confidence, and difficulties in comprehending mathematical concepts. This study employs a robust mixed-methods framework to examine the impact of a gamified mathematics intervention in addressing these learning disruptions. Quantitative assessments conducted before and after the intervention, alongside qualitative feedback from participants and their caregivers, provide a comprehensive evaluation of the program's effectiveness. The findings reveal statistically significant improvements in participants' motivation and self-confidence, accompanied by observable positive shifts in emotional and psychological well-being. Furthermore, the study offers compelling evidence in favour of integrating adaptive, game-based instructional strategies into specialized educational curricula. These results underscore the value of adopting more inclusive and flexible teaching models that are responsive to the complex educational needs of children facing serious health conditions.

Keywords:

Mathematical Games, Learning Motivation, Self-Confidence, Children with Cancer, Educational Intervention.

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Introduction

Mathematics is a foundational component in the cognitive development of children, fostering essential skills in logical reasoning, analytical thinking, and problem-solving that are integral to academic and everyday functioning. For children diagnosed with cancer, however, consistent engagement in mathematics learning is frequently disrupted due to the intensity and duration of medical treatments such as chemotherapy and radiotherapy. These treatments often necessitate extended periods of absence from school and reduce opportunities for interaction with teachers and peers. Additionally, psychosocial challenges, including emotional stress, physical fatigue, and fluctuating health conditions, further compromise their ability to participate fully in learning activities, often resulting in diminished motivation and confidence in subjects such as mathematics.

These continuous disruptions have broader implications beyond academic delay, often leading to increased anxiety and reduced persistence when engaging with mathematical tasks. The nature of mathematics, which relies heavily on the progressive accumulation and application of abstract concepts, makes it particularly vulnerable to interruption. In the absence of structured classroom interaction and immediate instructional support, children with cancer face significant obstacles in grasping new material and maintaining prior knowledge, highlighting the need for learning strategies that accommodate both their educational and emotional needs.

In response to these challenges, the use of mathematical games has been identified as an effective pedagogical method for improving student engagement, conceptual understanding, and self-efficacy in mathematics. By embedding learning within an interactive and enjoyable context, mathematical games offer a more approachable and less stressful alternative to traditional instructional methods. This approach not only fosters sustained interest but also encourages active participation and reinforces comprehension through repeated, play-based practice. For children coping with the demands of cancer treatment, such an approach can create a supportive learning environment that enhances both academic outcomes and emotional well-being.

This study examines the effectiveness of mathematical games in improving the motivation and confidence of children with cancer in learning mathematics. It also explores the underlying factors influencing the acceptance of this approach and evaluates its impact on academic performance. By emphasizing interactive learning tailored to the unique circumstances of these children, the study seeks to demonstrate that game-based methods can provide a more adaptable, engaging, and supportive educational experience.

Through its focus on an inclusive and responsive educational strategy, this study contributes to the broader discourse on special education for children with chronic health conditions. The findings aim to inform the development of more flexible and comprehensive curricular frameworks that support both academic achievement and psychosocial resilience among students facing prolonged health challenges.

Literature Review

Game-Based Learning (GBL) has emerged as a prominent educational paradigm across the globe and is increasingly being tailored to address specific learning needs, including in the context of education for children, those who are cancer survivors. Globally, GBL has proven effective in enhancing educational engagement and learning outcomes across diverse subject

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areas. Studies have demonstrated that the incorporation of game mechanics into educational frameworks can significantly improve student engagement and knowledge retention. For example, Lameras et al. (2016) discuss the essential features of serious game design in higher education, advocating for strong alignment between educational goals and game mechanics to facilitate effective learning experiences. Moreover, a comparative study by Gordillo et al. (2022) indicates that game-based learning has superior effectiveness compared to traditional video-based learning methods, underscoring the growing preference for interactive, game-centered educational approaches. Tlili et al. (2019) illustrate that personalized educational games lead to enhanced learner engagement and achievement. Such findings are instrumental in depicting the transformative potential of GBL in fostering autonomous learning styles and catering to diverse learner needs.

In the Malaysian context, GBL has garnered government support and is increasingly integrated into the educational framework. The Ministry of Education has endorsed innovative pedagogical strategies, as evidenced by studies that show improvements in learning outcomes when GBL is utilized. According to research conducted by Isa et al. (2022), game-based applications tailored for local contexts have shown considerable success in engaging students and enhancing their learning experiences. Furthermore, Gaalen et al. (2022) highlight that different player types can be identified and catered to within GBL contexts in Malaysia, paving the way for customized educational experiences. The unique cultural and social landscape of Malaysia requires game designs to resonate with local students. Evidence suggests that adaptive game-based learning approaches yield significant improvements in students' mathematics learning experiences, indicating a trend towards functional adaptability in GBL methodologies (Hui et al., 2024).

Nurjannah et al. (2023) show that school-aged kids with health problems can learn better when they play games that stimulate their minds. This is real-world evidence of the usefulness of GBL in specialized learning environments. This finding emphasizes the capability of game-based learning tools to create engaging educational environments that cater to sensitive situations, such as childhood illnesses. Furthermore, the flow experience in game-based learning facilitates deeper motivation and engagement in learners, which is particularly beneficial for critically ill children who may need tailored and enjoyable educational experiences. Hsiao et al. (2014) highlight how digital game-based learning environments can develop creativity and manual skills, contributing to positive learning attitudes among children, which is crucial for health-related education. Moreover, recent work by Dehghanzadeh et al. (2023) emphasizes the transformative potential of gamification in K-12 education by increasing motivation, engagement, and competitive spirit among students, ultimately proving beneficial in enhancing their overall cognitive and emotional learning outcome. This is completely in line with the basic ideas put forward by Hsiao et al. (2014), which shows how important game-based interactions are for supporting learning attitudes, especially when it comes to health-related educational goals.

Zhang (2024) explores the influence of gamification on learning outcomes in students. The research demonstrates that game elements increase engagement and positively affect students' motivation to learn, aligning with Self-Determination Theory and the principles of active learning. Additionally, Suryanto and Dewi's (2023) investigation into digital games in educational contexts reveals how interactive gaming experiences can effectively engage students at the elementary level. This study highlights the importance of developing enjoyable

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educational contexts that boost motivation and confidence in learners, providing a supportive environment that is crucial for children facing educational and health-related challenges.

Mathematical games have emerged as a prevalent instructional strategy within the context of enhancing both motivation and confidence, particularly in unique populations such as childhood cancer survivors. The application of game-based learning in mathematics has been shown to facilitate cognitive growth and improve emotional well-being, establishing a multifaceted approach that effectively addresses both educational and psychosocial outcomes. Khoirunnisya et al. (2024) talk about how game-based learning media can help students' cognitive development. They show how structured math games can help students get much better at understanding abstract ideas and solving problems. Similarly, Moyer-Packenham et al. (2019) demonstrate that digital math games can enhance children's awareness of mathematical concepts and processes, thereby promoting a more profound engagement with the material. This engagement is critical for children who have faced the adversities associated with cancer treatment, as it can bolster both their academic performance and their self-efficacy as learners.

Moreover, the role of persistence in game-based learning scenarios cannot be understated. Ke et al. (2023) argue that sustained interaction with mathematical tasks within these games enables students to build resilience and a stronger sense of competence, which is essential for overcoming educational barriers often faced by cancer survivors. This is particularly critical in the framework of motivational research, where overcoming struggle through engagement in game-based learning may reinforce a child's self-perception as a capable learner (Wahidah et al., 2020).

In addition to cognitive and emotional benefits, teachers' perceptions of mathematical games further support their integration into curricula, underlining their effectiveness. Russo et al. (2021) found that a significant majority of educators prioritize the use of games within their instructional practices because they foster richer mathematical discussions and deepen students' understanding. This aligns with a larger body of research in education that supports diverse learning techniques, like cooperative and game-based learning to promote positive attitudes toward mathematics (Trinter et al., 2015). The cumulative evidence suggests that mathematical games not only enrich academic learning but also empower children, particularly survivors of cancer, by enhancing their motivation and confidence through engaging, supportive learning environments.

Overall, previous literature indicates that GBL has the potential to enhance student motivation and understanding, but there is still a gap in research on students with special needs. This study provides more contextual empirical evidence regarding the effectiveness of GBL in supporting the learning of children with cancer. Therefore, the findings from this study can help in formulating more inclusive and responsive teaching strategies to meet the needs of students with health challenges.

Methodology

This study employed a quantitative pre-experimental design to assess the effectiveness of a mathematics-based intervention conducted through the "Kids Day Out: Math Fun Carnival" program. The program was designed to introduce mathematical concepts through interactive games, aiming to improve motivation and self-confidence in mathematics among children

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undergoing cancer treatment. The event took place in a community-based setting and involved collaboration between an academic institution and a paediatric cancer support organization. The participants were children diagnosed with cancer who voluntarily took part in the program. The sample included a range of age groups and educational backgrounds. Children aged between 5 and 7 years received assistance from their parents or guardians in completing the questionnaire due to developmental considerations. All participants were selected through purposive sampling based on their availability and willingness to participate in the activities and assessments provided during the program.

The study adopted a one-group pretest-posttest design. A structured questionnaire was used to measure participants' levels of motivation and confidence in mathematics before and after the intervention. The instrument consisted of eight items designed to assess four domains: understanding of mathematical content, attitudes toward learning mathematics through games, self-confidence in applying mathematical skills, and aspirations to continue learning mathematics. The questionnaire was administered immediately before and after the event to ensure consistency in the evaluation process.

Data Analysis

Quantitative data obtained from the questionnaires were analyzed using descriptive and inferential statistical methods. Descriptive statistics summarized overall participant responses, while a paired sample t-test was conducted to determine whether the differences in scores before and after the intervention were statistically significant. This analytical approach enabled a systematic evaluation of the effectiveness of the mathematical games in enhancing motivation and confidence among the participants.

This methodological framework allowed for a structured assessment of how an interactive, game-based approach to mathematics could support learning engagement among children with cancer within a single-session intervention setting.

Results and Discussion

Table 1 and Figure 1 present the gender distribution of the participants in the program. Out of a total of 42 children, 19 were male, accounting for 45.2%, while 23 were female, comprising 54.8%. The pie chart clearly illustrates this distribution, with a slightly higher proportion of female participants compared to male participants.

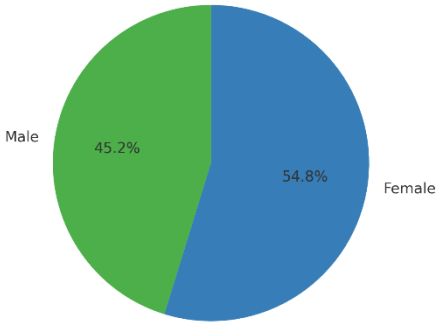

Figure 1: Gender of Respondents

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Table 1: Gender of Respondents

Gender	Frequency	Percentage (%)
Male	19	45.2
Female	23	54.8
Total	42	100.0

Figure 2 show the educational background of the participants. The majority, 22 children (52.4%), were enrolled in national primary schools. Additionally, 10 participants (23.8%) were from secondary schools, and another 10 participants (23.8%) fell under the "Others" category, which included preschool-aged children and those associated with public universities. The pie chart reflects this breakdown, with primary school students forming the largest group among the participants.

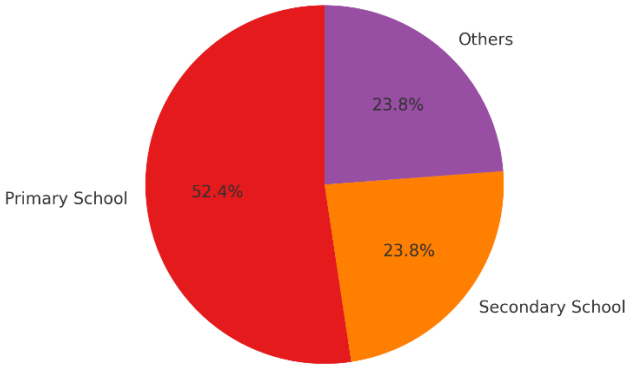

Figure 2: Educational Background of Respondents

Table 2 and Figure 3 present the age distribution statistics of the program participants. The average age was approximately 11 years, with both the median and mode recorded at 10 years. The youngest participant was 5 years old, while the oldest was 25 years old. The bar chart illustrates that the highest number of participants were aged 10, followed by those aged 12. Other age groups had smaller representations. Overall, the majority of participants were concentrated in the age range of 10 to 12 years.

Table 2: Age of Respondents

Age of Respondents	
Mean	11.05
Median	10.00
Mode	10
Standard deviation	4.531
Minimum	5
Maximum	25

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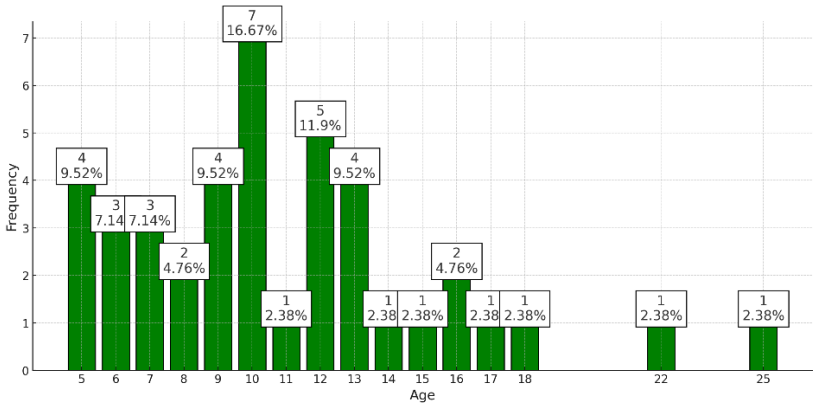

Figure 3: Age distribution of Respondents

Table 3: Mean Score of Participant Evaluation

	Before		After	
Participant Evaluation	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
I know how to use mathematics in this game.	2.33	0.477	4.24	0.726
I understand the mathematical concepts in this game.	2.12	0.504	4.14	0.751
I enjoy learning mathematics through games.	2.50	0.506	4.12	0.705
I am open to learning mathematics in new ways.	2.31	0.517	4.36	0.618
I can apply mathematical skills in this game.	2.17	0.853	4.43	0.59
I am confident in my mathematical abilities.	2.31	0.468	4.33	0.612
I want to use what I have learned in daily life.	2.26	0.885	4.48	0.505
I am motivated to continue learning mathematics.	1.86	0.783	4.14	0.647

The findings presented in Table 3 demonstrate clear improvements in participants' mathematical understanding, attitudes, confidence, and motivation following the game-based learning intervention. These outcomes are consistent with a growing body of literature supporting the effectiveness of game-based learning (GBL) in improving both cognitive and affective learning outcomes in mathematics education (Hui & Mahmud, 2023; Debrenti, 2024).

In the cognitive domain, participants showed notable gains in understanding mathematical concepts. The items "I know how to use mathematics in this game" and "I understand the mathematical concepts in this game" saw increases in mean scores from 2.33 and 2.12 before the intervention to 4.24 and 4.14 after the program, respectively. These results affirm prior studies which found that interactive digital environments and structured play can support deeper comprehension of abstract mathematical ideas (Lozano et al., 2023).

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In terms of attitudinal change, the items "I enjoy learning mathematics through games" and "I am open to learning mathematics in new ways" reflected positive shifts in perception, with participants expressing greater enjoyment and receptiveness to innovative pedagogical strategies. This aligns with findings by Attard (2013), who reported that playful and student-centered learning environments foster increased enthusiasm for mathematics. More recently, Abu-Hammad (2023) and Froehling (2023) highlighted the capacity of gamified activities to reduce mathematics anxiety and build a more positive learning climate.

Regarding self-confidence, the improvement in scores for "I can apply mathematical skills in this game" and "I am confident in my mathematical abilities" suggests that the intervention bolstered participants' perceived competence. This is supported by the work of Shin et al. (2012) and McLaren et al. (2023), who observed that learners exposed to structured GBL environments develop stronger self-efficacy and are more willing to take academic risks in mathematics learning.

In the motivational and aspirational domains, participants also reported increased willingness to apply what they learned and continue their engagement with mathematics. The items "I want to use what I have learned in daily life" and "I am motivated to continue learning mathematics" exhibited some of the highest post-intervention gains. These findings resonate with studies by Papastergiou (2009) and Henriksen et al. (2016), and are reinforced by more recent reports from Prodigy Education (2024) and Skill Prepare (2024), which demonstrate how educational games foster sustained learning interest and real-world application.

Taken together, the findings suggest that the "Kids Day Out: Math Fun Carnival" intervention not only supported immediate academic development but also cultivated longer-term learning attitudes among children with cancer. The overall consistency in post-program responses—evidenced by reduced variability—indicates that the intervention was broadly effective across the participant group. These results reinforce the utility of game-based learning as an inclusive, flexible strategy capable of supporting both academic and emotional needs in special education settings (Debrenti, 2024; Hui & Mahmud, 2023).

Table 4: Mean and Standard Deviation Score of Participant Evaluation

Participant	Mean	N	Standard Deviation
Before program	2.2321	42	0.43352
After program	4.2798	42	0.41394

Table 5: Paired Sample t -Test

Participant	Mean Difference	Standard Deviation Difference	t	p-value
Before – After	-2.04762	0.41683	-31.836	0.000

To further examine the significance of the observed improvements, a paired sample t-test was conducted, as shown in Table 5. The test yielded a mean difference of -2.05 with a t-value of -31.836 and a p-value of < .001, indicating a statistically significant difference between the pre- and post-program scores. This result confirms that the intervention had a meaningful and positive impact on the participants' attitudes and perceptions toward learning mathematics. These findings are in line with prior studies that have established the effectiveness of game-

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based learning (GBL) in enhancing students' learning motivation, mathematical confidence, and enjoyment (Barzilai & Blau, 2014; Attard, 2013). More recent literature further supports this trend. For instance, Hui and Mahmud (2023) concluded in their systematic review that GBL significantly improves both cognitive outcomes and affective attributes such as interest and engagement. Similarly, Debrenti (2024) and Jutin and Maat (2024) found that integrating games into mathematics education enhances conceptual understanding and reduces mathematics anxiety, particularly in primary education settings.

Moreover, the consistent responses among participants, as reflected by the small standard deviation, reinforce the inclusive and adaptable nature of game-based interventions for learners with varying needs. This is particularly relevant for children with chronic health conditions, such as cancer, where flexible and engaging pedagogical strategies are essential for sustaining academic engagement (Henriksen et al., 2016; Lozano et al., 2023). The statistically significant improvement also aligns with findings by McLaren et al. (2023) and Papastergiou (2009), who observed that structured digital game environments can meaningfully enhance students' understanding and willingness to apply mathematical concepts beyond classroom settings. Furthermore, platforms such as Skill Prepare (2024) and Prodigy Education (2024) emphasize the growing role of educational games in maintaining motivation and promoting self-directed learning.

Contribution of the Study

This study offers a significant contribution to the fields of special education and mathematics instruction, particularly in the context of learners facing health-related challenges such as children with cancer. The key implications of the study include the provision of empirical evidence on the effectiveness of mathematical games in enhancing student motivation and self-confidence. It also proposes an alternative learning approach that is more interactive and inclusive, tailored to the unique needs of children undergoing medical treatment.

Furthermore, the study underscores the importance of psychosocial support in mathematics learning, demonstrating that enjoyable and engaging teaching methods can alleviate academic stress and anxiety. The findings provide practical guidance for educators and policymakers in designing more effective and adaptable game-based learning modules that can be integrated into special education curricula.

Overall, the study supports the integration of game-based strategies within inclusive education frameworks and advocates for the broader implementation of such approaches within the education system. This can ensure that students experiencing health-related barriers have access to more positive, engaging, and meaningful learning experiences.

Conclusion

This study confirms the effectiveness of mathematical game-based approaches in enhancing the motivation and self-confidence of children with cancer in learning mathematics. Findings from the "Kids Day Out: Math Fun Carnival" program revealed significant improvements in participants' interest, self-belief, and social interaction following their engagement in more interactive and enjoyable learning activities. Quantitative analysis demonstrated a statistically significant difference in students' motivation and confidence scores before and after the intervention, validating the role of games in increasing students' willingness and engagement in mathematics. Complementing this, qualitative feedback from participants and parents

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indicated that mathematical games not only supported conceptual understanding but also contributed positively to students' emotional well-being.

The study holds important implications for the field of special education, particularly in designing learning strategies for students with health-related challenges. Several recommendations emerge from the findings, including the integration of mathematical games into special education settings to promote more engaging and effective learning experiences; the development of game modules that are both interactive and adaptable to students' needs; and further research to examine the long-term impact of such interventions on academic performance and cognitive development. Overall, this study contributes to the advancement of innovative, holistic, and responsive learning methods that support both the academic and psychosocial development of children undergoing medical treatment. It underscores the potential of game-based learning to serve as a viable and impactful strategy within inclusive and health-sensitive educational frameworks.

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References

Attard, C. (2013). "If I had to pick any subject, it wouldn't be maths": Foundations for engagement with mathematics during the middle years. Mathematics Education Research Journal, 25(4), 569–587. https://doi.org/10.1007/s13394-013-0081-8

Barzilai, S., & Blau, I. (2014). Scaffolding game-based learning: Impact on learning achievements, perceived learning, and game experiences. Computers & Education, 70, 65–79. https://doi.org/10.1016/j.compedu.2013.08.003

Debrenti, E. (2024). Game-based learning experiences in primary mathematics education. Frontiers in Education, 9, 1331312. https://doi.org/10.3389/feduc.2024.1331312

Dehghanzadeh, H., Farrokhnia, M., Taghipour, K., & Noroozi, O. (2023). Using gamification to support learning in K-12 education: A systematic literature review. British Journal of Educational Technology, 55(1), 34–70. https://doi.org/10.1111/bjet.13335

Froehling, A. (2023). A year in game-based learning: Educational trends and insights from 2023. Filament Games. https://www.filamentgames.com/blog/a-year-in-game-based-learning-educational-trends-and-insights-from-2023/

Gaalen, A., Schönrock-Adema, J., Renken, R., Jaarsma, D., & Georgiadis, J. (2022). Identifying player types to tailor game-based learning design to learners: Cross-sectional survey using Q methodology. JMIR Serious Games, 10(2), e30464. https://doi.org/10.2196/30464

Gordillo, A., López-Fernández, D., & Tovar, E. (2022). Comparing the effectiveness of video-based learning and game-based learning using teacher-authored video games for online

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 10 Issue 58 (June 2025) PP. 301-312
DOI 10.35631/IJEPC.1058021
software engineering education. IEEE Transactions on Education, 65(4), 524–532. https://doi.org/10.1109/TE.2022.3142688

Henriksen, D., Mishra, P., & Fisser, P. (2016). Infusing creativity and technology in 21st century education: A systemic view for change. Educational Technology & Society, 19(3), 27–37.

Hsiao, H., Chang, C., Lin, C., & Hu, P. (2014). Development of children's creativity and manual skills within digital game-based learning environment. Journal of Computer Assisted Learning, 30(4), 377–395. https://doi.org/10.1111/jcal.12057

Hui, H. B., & Mahmud, M. S. (2023). Influence of game-based learning in mathematics education on the students' cognitive and affective domain: A systematic review. Frontiers in Psychology, 14, 1105806. https://doi.org/10.3389/fpsyg.2023.1105806

Hui, S., Jawawi, D., & Jamal, N. (2024). Integration of adaptive game-based learning approach in learning mathematics subject for primary school. International Journal of Innovative Computing, 14(1), 43–47. https://doi.org/10.11113/ijic.v14n1.465

Isa, W., Suhaimi, A., Noordin, N., & Hassan, S. (2022). Mobile game-based learning application about Semai people. International Journal of Academic Research in Progressive Education and Development, 11(3). https://doi.org/10.6007/ijarped/v11-i3/14759

Jutin, N. T., & Maat, S. M. B. (2024). The effectiveness of gamification in teaching and learning mathematics: A systematic literature review. International Journal of Academic Research in Progressive Education and Development, 13(1), 1290–1309. https://doi.org/10.6007/IJARPED/v13-i1/20703Ke, F. (2008). A case study of computer gaming for math: Engaged learning from gameplay? Computers & Education, 51(4), 1609–1620. https://doi.org/10.1016/j.compedu.2008.03.003

Ke, F., Dai, C., West, L., Pan, Y., & Xu, J. (2023). Using mathematizing supports for applied problem solving in a game-based learning environment. Journal of Educational Computing Research, 62(2), 468–500. https://doi.org/10.1177/07356331231206990

Khoirunnisya, M., Anwar, L., & Kusumasari, V. (2024). The use of game-based learning media to support students' cognitive abilities in mathematics. Mathline Jurnal Matematika Dan Pendidikan Matematika, 9(2), 559–574. https://doi.org/10.31943/mathline.v9i2.654

Lameras, P., Arnab, S., Dunwell, I., Stewart, C., Clarke, S., & Petridis, P. (2016). Essential features of serious games design in higher education: Linking learning attributes to game mechanics. British Journal of Educational Technology, 48(4), 972–994. https://doi.org/10.1111/bjet.12467

Lozano, A. S., et al. (2023). A game-based learning application to help learners to practice mathematical patterns and structures. arXiv preprint arXiv:2306.13685. https://arxiv.org/abs/2306.13685

McLaren, B. M., et al. (2023). Decimal Point: A decade of learning science findings with a digital learning game. In Artificial Intelligence in Education (pp. 239–251). Springer.

Moyer-Packenham, P., et al. (2019). How design features in digital math games support learning and mathematics connections. Computers in Human Behavior, 91, 316–332. https://doi.org/10.1016/j.chb.2018.09.036

Nurjannah, N., Taamu, T., Dali, D., & Arum, D. (2023). Effect of cognitive stimulation based on puzzle games on learning achievement in school-aged stunted children. Asian Journal of Pharmaceutical Research and Development, 11(2), 20–24. https://doi.org/10.22270/ajprd.v11i2.1244

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DOI 10.35631/IJEPC.1058021

Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. Computers & Education, 52(1), 1–12. https://doi.org/10.1016/j.compedu.2008.06.004

Prodigy Education. (2024). 15 best math apps for kids [Updated for 2024]. https://www.prodigygame.com/main-en/blog/best-math-apps-for-kids/

Russo, J., Bragg, L., & Russo, T. (2021). How primary teachers use games to support their teaching of mathematics. International Electronic Journal of Elementary Education, 13(4), 407–419.

Shin, N., Sutherland, L. M., Shin, S. Q., & Conley, A. (2012). Engagement and learning: An exploratory investigation of a virtual reality game-based learning environment. Computers & Education, 59(1), 154–168. https://doi.org/10.1016/j.compedu.2011.11.001

Skill Prepare. (2024). 2024 educational games release updates. https://skillprepare.com/2024-educational-games-release-updates-for-skill-prepare/

Suryanto, S., & Dewi, A. (2023). Optimizing PPKn formative test in elementary school level with digital food education game. Journal of Intelligent Software Systems, 2(2), 7. https://doi.org/10.26798/jiss.v2i2.1140

Tlili, A., et al. (2019). Does providing a personalized educational game based on personality matter? A case study. IEEE Access, 7, 119566–119575. https://doi.org/10.1109/access.2019.2936384

Trinter, C., Brighton, C., & Moon, T. (2015). Designing differentiated mathematics games. Gifted Child Today, 38(2), 88–94. https://doi.org/10.1177/1076217514568560

Wahidah, N., Sari, W., Festiana, I., & Nasir, N. (2020). Game-based learning: Design a multimedia with DDD-E model for mathematics education. International Journal of Emerging Technologies in Learning (iJET), 15(21), 277. https://doi.org/10.3991/ijet.v15i21.16353

Zhang, F. (2024). Enhancing ESG learning outcomes through gamification: An experimental study. PLOS ONE, 19(5), e0303259. https://doi.org/10.1371/journal.pone.0303259