



Implementation of Gaming Strategy in Enhancing the Mathematics Performance of Learners

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Abstract

This study examined the implementation of gaming strategies and their relationship with the mathematics performance of learners at an elementary school during the School Year 2023–2024. Specifically, it assessed the extent of implementation of digital game-based learning, gamified classroom activities, and tabletop games and determined whether these strategies were significantly associated with learners' mathematics performance. A quantitative descriptive-correlational research design was employed involving 145 Grade 5 learners selected through stratified random sampling. Data were gathered using a validated researcher-developed questionnaire and the learners' mathematics grades obtained from official school records. Descriptive statistics, including weighted mean and standard deviation, were used to determine the extent of implementation, while Pearson Product-Moment Correlation was applied to examine the relationship between gaming strategies and mathematics performance at the 0.05 level of significance. The findings revealed that digital game-based learning and tabletop games were implemented to a very high extent, whereas gamified classroom activities were implemented to a high extent. The learners attained a very satisfactory level of mathematics performance. Moreover, all three gaming strategies demonstrated significant positive relationships with mathematics achievement, with digital game-based learning exhibiting the strongest association. The study concludes that integrating game-based instructional strategies can enhance learner engagement and contribute to improved mathematics performance. It recommends strengthening institutional support, expanding teacher training, and sustaining the integration of game-based learning approaches to improve mathematics instruction in elementary schools.

Keywords

game-based learning, gamification, mathematics performance, Grade 5 learners, elementary education

How to Cite

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Author Contributions

The author contributed to conceptualization, methodology, investigation, writing—original draft preparation, writing—review and editing, and supervision. The author approved the final manuscript.

Ethics Statement

This study was conducted in accordance with ethical standards.

INTRODUCTION

Mathematics plays a vital role in developing learners' logical reasoning, critical thinking, and problem-solving skills, making it one of the core subjects in basic education. Despite its importance, many elementary learners continue to face difficulties in understanding mathematical concepts and maintaining interest in the subject. Traditional teaching approaches often rely on repetitive drills and teacher-centered instruction, which may not fully address learners' diverse needs and learning preferences. As education continues to evolve, schools are increasingly exploring innovative teaching strategies that make learning more interactive and meaningful. Among these approaches, game-based learning and gamification have

gained considerable attention because they encourage active participation, sustain learners' motivation, and create enjoyable learning experiences. Recent studies have shown that integrating gaming strategies into mathematics instruction improves both learners' academic achievement and classroom engagement by providing opportunities for immediate feedback, collaboration, and problem-solving (Akman & Çakır, 2023; Hui & Mahmud, 2023; Li et al., 2023). The use of gaming strategies in elementary mathematics has expanded beyond simple educational games to include digital game-based learning, gamified classroom activities, and tabletop games. Digital learning platforms provide personalized learning experiences by adapting instructional activities to learners' individual needs, allowing students to progress at their own pace while receiving immediate feedback on their performance. Similarly, gamified classroom activities motivate learners through meaningful challenges, rewards, and collaborative tasks that encourage active participation. Tabletop games, on the other hand, promote mathematical reasoning and communication by allowing learners to manipulate mathematical ideas through hands-on activities. Collectively, these strategies help transform mathematics lessons into engaging learning experiences that support both conceptual understanding and learner motivation (Bang et al., 2023; Lin & Cheng, 2022; Jaramillo-Mediavilla et al., 2024).

In the Philippines, improving mathematics performance remains a major concern despite continuing efforts to enhance the quality of basic education. National and international assessments have consistently highlighted the need to strengthen learners' mathematical competencies and promote instructional practices that encourage deeper understanding of mathematical concepts. While many schools have begun incorporating technology and interactive learning activities into classroom instruction, the implementation of gaming strategies varies across schools because of differences in available resources, teacher preparedness, and access to educational technologies. These differences underscore the importance of examining how gaming strategies are implemented within specific educational contexts and how they contribute to learners' academic performance.

Although numerous international studies have established the educational benefits of game-based learning, there is still limited empirical evidence regarding its implementation in Philippine public elementary schools, particularly among Grade 5 learners. Existing research has largely focused on individual gaming interventions or technology-based applications, with fewer studies examining the combined use of digital game-based learning, gamified classroom activities, and tabletop games within a single instructional setting. Moreover, localized evidence explaining how these complementary strategies relate to learners' mathematics performance remains limited. Addressing this gap is important because educational practices are shaped by contextual factors such as school resources, classroom environments, and learner characteristics, which may influence the effectiveness of gaming strategies.

In response to this gap, this study investigates the implementation of gaming strategies and their relationship with the mathematics performance of Grade 5 learners at Margarita Roxas de Ayala Elementary School during the School Year 2023–2024. Specifically, it examines the extent to which digital game-based learning, gamified classroom activities, and tabletop games are implemented and determines whether these instructional approaches are significantly associated with learners' mathematics achievement. The findings are expected to provide practical insights for teachers, school administrators, and curriculum planners in designing more engaging mathematics instruction while contributing localized evidence to the growing body of research on game-based learning. Although the study is limited to one public elementary school, it offers valuable information that may guide future instructional innovations and support efforts to improve mathematics education in similar learning environments.

METHODOLOGY

Design

This study employed a quantitative descriptive-correlational research design to examine the implementation of gaming strategies and their relationship with the mathematics performance of Grade 5 learners. The descriptive component was used to determine the extent to which digital game-based learning, gamified classroom activities, and tabletop games were implemented in mathematics instruction. The correlational component determined whether a significant relationship existed between the implementation of these gaming strategies and learners' mathematics performance. This research design was appropriate because it allowed the researcher to describe existing conditions and examine the relationship between variables without manipulating the instructional environment.

The descriptive-correlational approach provided an objective means of collecting and analyzing quantitative data from the respondents. It enabled the researcher to measure the level of implementation of gaming strategies and determine how these instructional practices were associated with learners' academic performance in mathematics. The findings generated through this design provided empirical evidence that may serve as a basis for improving instructional practices and strengthening the integration of game-based learning in elementary mathematics education.

Locale

The study was conducted at Margarita Roxas de Ayala Elementary School, District V, Division of Manila, during the School Year 2023–2024. The school was selected because it provides a suitable learning environment for examining the implementation of gaming strategies in mathematics instruction among Grade 5 learners. The school also has an adequate population of learners and classroom settings that support the conduct of educational research. As one of the public elementary schools in the Division of Manila, Margarita Roxas de Ayala Elementary School implements instructional programs that aim to improve learners' academic performance through innovative teaching approaches. The research locale provided the necessary context for investigating how gaming strategies are integrated into mathematics instruction and how these practices relate to learners' academic achievement.

Participants and Sampling

The participants of the study consisted of 145 Grade 5 learners enrolled at Margarita Roxas de Ayala Elementary School during the School Year 2023–2024. The respondents were selected using stratified random sampling to ensure that all Grade 5 sections were proportionately represented in the study. The population was first divided into strata according to class sections, after which respondents were randomly selected from each group based on the required sample size. The use of stratified random sampling minimized sampling bias and increased the representativeness of the sample. This sampling technique ensured that every qualified learner had an equal opportunity to participate in the study while reflecting the characteristics of the Grade 5 population. Consequently, the data gathered from the selected respondents provided reliable information regarding the implementation of gaming strategies and learners' mathematics performance.

Instrument

Data were Data were collected using a researcher-developed questionnaire designed to measure the implementation of gaming strategies in mathematics instruction. The instrument consisted of three dimensions: digital game-based learning, gamified classroom activities, and tabletop games. Each indicator was measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with higher scores indicating a greater extent of implementation. Mathematics performance was measured using the learners' official mathematics grades obtained from school records with the approval of the school administration. Prior to its administration, the questionnaire underwent content validation by experts in educational research and mathematics education to ensure the clarity, relevance, and appropriateness of each item. Suggestions provided during the validation process were incorporated to improve the quality of the instrument before data collection. The finalized questionnaire was administered only after securing the necessary permissions and ensuring that it adequately reflected the objectives of the study.

Collection

Prior to data collection, the researcher secured permission from the school administration to conduct the study. After approval was granted, coordination was made with the Grade 5 teachers regarding the schedule and procedures for administering the research instrument. The respondents were informed about the purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses before the questionnaires were distributed. After the questionnaires had been completed, the researcher retrieved and checked them for completeness before encoding the responses for statistical analysis. The learners' mathematics grades were then obtained from the appropriate school records while observing all confidentiality requirements. The collected data were organized, tabulated, and prepared for statistical analysis based on the objectives of the study.

Analysis

The data gathered were analyzed using appropriate descriptive and inferential statistical techniques. Weighted mean and standard deviation were used to determine the extent of implementation of digital game-based learning, gamified classroom activities, and tabletop games. These statistical measures described the overall level of implementation of each gaming strategy and the mathematics performance of the learners. To determine the relationship between gaming strategy implementation and mathematics performance, the Pearson Product-Moment Correlation Coefficient was employed. The level of significance was set at 0.05 to determine whether the observed relationships between the variables were statistically significant. The selected statistical tools were appropriate because they enabled the researcher to answer the research questions objectively and accurately.

Ethical Considerations

Ethical principles were observed throughout the conduct of the study to protect the rights and welfare of the participants. Permission to conduct the research was obtained from the school administration before the collection of data. The respondents were informed of the objectives of the study, the procedures involved, and their right to participate voluntarily or withdraw from the study at any stage without any negative consequences. The confidentiality and anonymity of the participants were strictly maintained by ensuring that individual responses and academic records were used solely for research purposes. All collected information was securely stored and reported only in aggregate form to protect the identity of the respondents. These measures ensured that the study adhered to accepted ethical standards in educational research while safeguarding the privacy and dignity of all participants.

Limitations and Rigor

The study was limited to Grade 5 learners enrolled at Margarita Roxas de Ayala Elementary School during the School Year 2023–2024. Consequently, the findings reflect the instructional practices and learning environment of the selected school and may not be directly generalized to other educational settings. In addition, the assessment of gaming strategy implementation relied on questionnaire responses, which may be influenced by the respondents' perceptions and experiences. Despite these limitations, the study maintained methodological rigor through the use of a validated research instrument, an appropriate sampling technique, standardized data collection procedures, and suitable statistical analyses. These measures enhanced the reliability and credibility of the findings and ensured that the results provided meaningful evidence regarding the relationship between gaming strategies and mathematics performance.

RESULTS AND DISCUSSION

Table 1 shows that tabletop games obtained the highest mean score ($M = 4.331$, $SD = 0.898$), followed closely by digital game-based learning ($M = 4.317$, $SD = 0.880$), both interpreted as very highly implemented. Gamified classroom activities also received a high implementation rating ($M = 4.131$, $SD = 0.937$). These findings indicate that teachers frequently incorporate both digital and non-digital gaming strategies into mathematics instruction, creating learning experiences that encourage active participation and learner engagement.

The high level of implementation suggests that teachers recognize the value of interactive learning approaches in helping learners understand mathematical concepts more effectively. By incorporating educational games into classroom instruction, learners are provided with opportunities to explore mathematical ideas, receive immediate feedback, and participate in collaborative activities that make learning more meaningful. These classroom experiences promote sustained interest in mathematics and encourage learners to become active participants rather than passive recipients of information.

The findings are consistent with previous studies showing that game-based learning promotes learner engagement and improves mathematics learning. Akman and Çakır (2023) found that educational virtual reality games significantly enhanced learners' mathematics achievement and classroom engagement. Similarly, Bang et al. (2023) reported that adaptive digital mathematics applications improve learning by providing personalized instructional experiences. Lin and Cheng (2022) also demonstrated that technology-enhanced board games strengthen mathematical reasoning and conceptual understanding, while recent systematic reviews conclude that gamification consistently increases learner motivation and participation across educational settings (Jaramillo-Mediavilla et al., 2024; Li et al., 2023).

These findings imply that combining digital and non-digital gaming strategies creates a more engaging mathematics classroom where learners can actively construct knowledge through exploration, collaboration, and problem solving. The integration of these approaches provides teachers with flexible instructional strategies that accommodate different learning preferences while supporting the development of mathematical understanding.

Table 1
Extent of Implementation of Gaming Strategies among Grade 5 Learners

Indicators	N	Mean	SD	Interpretation
Digital Game-Based Learning	145	4.317	0.880	Very High
Gamified Classroom Activities	145	4.131	0.937	High
Tabletop Games	145	4.331	0.898	Very High

Table 2 indicates that the Grade 5 learners obtained a mean mathematics grade of 88.79 (SD = 4.815), which is interpreted as very satisfactory. This result suggests that the learners generally demonstrated strong mastery of the mathematics competencies expected for their grade level and were able to perform well in classroom assessments.

The learners' satisfactory performance may be attributed to instructional approaches that encourage active participation, continuous practice, and meaningful engagement during mathematics lessons. When learners are provided with opportunities to solve problems through interactive activities, they become more confident in applying mathematical concepts and are more willing to participate in classroom discussions. Such learning experiences help strengthen both conceptual understanding and higher-order thinking skills that are essential for mathematics achievement.

This finding is consistent with recent evidence showing that game-based learning positively influences both the cognitive and affective domains of mathematics education. Hui and Mahmud (2023) concluded that game-based learning improves learners' conceptual understanding, motivation, and classroom engagement, all of which contribute to higher academic performance. Likewise, Li et al. (2024) reported that gamification enhances learners' intrinsic motivation, autonomy, and relatedness, creating learning environments that support sustained academic achievement. Fisher et al. (2018) likewise emphasized that active engagement, timely feedback, and meaningful instructional experiences are among the most effective practices for improving mathematics learning.

The results indicate that creating engaging learning environments through well-planned instructional strategies can positively influence learners' mathematics performance. These findings highlight the importance of adopting learner-centered approaches that encourage participation, collaboration, and continuous interaction with mathematical concepts.

Table 2
Level of Mathematics Performance of Grade 5 Learners

Indicator	N	Mean	SD	Interpretation
Mathematics Performance	145	88.79	4.815	Very Satisfactory

Table 3 shows that all three gaming strategies were significantly and positively related to mathematics performance. Digital game-based learning exhibited the strongest relationship with mathematics performance ($r = .802, p = .000$), followed by tabletop games ($r = .641, p = .000$) and gamified classroom activities ($r = .581, p = .000$). Since all p-values were below the 0.05 level of significance, the null hypothesis was rejected. These findings indicate that greater implementation of gaming strategies is associated with better mathematics performance among Grade 5 learners.

The strong positive relationships observed in this study suggest that gaming strategies provide learning experiences that encourage learners to become more actively involved in mathematics lessons. Interactive activities, immediate feedback, collaborative problem solving, and opportunities for repeated practice help learners develop deeper conceptual understanding while maintaining interest in the subject. As learners become more engaged and motivated, they are more likely to participate confidently in classroom activities and demonstrate improved academic performance.

The findings support previous research demonstrating the educational benefits of game-based learning in mathematics. Akman and Çakır (2023) reported that learners exposed to educational game environments achieved significantly higher mathematics performance and engagement than those receiving conventional instruction. Bang et al. (2023) likewise found that adaptive game-based mathematics applications improved elementary learners' achievement through personalized

learning experiences. Meta-analyses conducted by Li et al. (2023) and Li et al. (2024) further concluded that gamification positively influences academic achievement by increasing learner motivation and engagement. In addition, recent reviews emphasize that well-designed game-based instructional approaches promote meaningful learning experiences that contribute to improved educational outcomes across different learning environments (Gini et al., 2025; Triantafyllou et al., 2025).

Overall, the findings demonstrate that gaming strategies are valuable instructional approaches that can enhance mathematics learning in elementary education. Integrating digital game-based learning, gamified classroom activities, and tabletop games into classroom instruction not only increases learner engagement but also contributes to stronger academic performance. These results highlight the importance of supporting teachers through adequate instructional resources, professional development, and school policies that encourage the effective use of game-based learning in mathematics classrooms.

Relationship between the Implementation of Gaming Strategies and Mathematics Performance

The third objective of the study was to determine whether a significant relationship exists between the implementation of gaming strategies and the mathematics performance of Grade 5 learners. The results are presented in Table 3.

Table 3
Relationship between the Implementation of Gaming Strategies and Mathematics Performance

Variables	Correlation Coefficient	p-value	Decision
Digital Game-Based Learning	.802**	.000	Reject Ho
Gamified Classroom Activities	.581**	.000	Reject Ho
Tabletop Games	.641**	.000	Reject Ho

Conclusion and Recommendations

This study examined the implementation of gaming strategies and their relationship with the mathematics performance of Grade 5 learners at Margarita Roxas de Ayala Elementary School during the School Year 2023–2024. The findings revealed that digital game-based learning and tabletop games were implemented to a very high extent, while gamified classroom activities were implemented to a high extent. The learners also achieved a very satisfactory level of mathematics performance. Furthermore, the results showed significant positive relationships between the implementation of digital game-based learning, gamified classroom activities, tabletop games, and learners' mathematics performance, indicating that greater implementation of these strategies is associated with higher academic achievement. Overall, the study demonstrates that gaming strategies can serve as effective instructional approaches in elementary mathematics education. The integration of interactive and engaging learning activities provides learners with meaningful opportunities to develop mathematical understanding, strengthen problem-solving skills, and participate more actively in the learning process. The findings also provide localized evidence supporting the use of game-based instructional practices in public elementary schools and underscore the importance of creating learner-centered classrooms that encourage motivation, collaboration, and academic success.

School administrators are encouraged to strengthen support for the integration of gaming strategies by providing teachers with adequate instructional resources, technological facilities, and professional development opportunities that enhance their ability to implement game-based learning effectively. Mathematics teachers should continue incorporating digital game-based learning, gamified classroom activities, and tabletop games into their lessons to create engaging learning experiences that promote active participation, collaboration, and deeper understanding of mathematical concepts. Regular monitoring and evaluation of these instructional strategies should also be conducted to ensure that they remain aligned with curriculum standards and learners' educational needs. Future researchers are encouraged to extend this study by involving larger samples from different schools and educational settings to improve the generalizability of the findings. Employing experimental or longitudinal research designs may provide stronger evidence regarding the long-term effects of gaming strategies on mathematics achievement and other learner outcomes. Further investigations may also explore additional variables, such as learner motivation, self-efficacy, mathematics anxiety, digital literacy, and teacher instructional competence, to gain a more comprehensive understanding of the factors that influence the successful implementation of game-based learning in elementary mathematics education.

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