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GAME-BASED LEARNING (GBL): ITS INFLUENCE ON THE MATHEMATICS PERFORMANCE OF GRADE 7 LEARNERS

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ABSTRACT

This study determined the effect of Game-Based Learning (GBL) on the mathematics performance of Grade 7 learners at Pavia National High School during School Year 2025–2026. Using a quasi-experimental pretest-posttest control group design, seventy learners were divided equally into experimental and control groups. A validated 40-item researcher-made test measured learners' mathematics performance. Statistical tools included mean, standard deviation, and t-tests. Findings revealed that both groups initially demonstrated low mathematics performance with no significant pretest difference. However, posttest results showed significant improvement, with the GBL group achieving higher mathematics performance than the traditional group. Results indicate that GBL is an effective instructional strategy for improving engagement and academic achievement in mathematics.

KEYWORDS: *Game-Based Learning, Mathematics Performance, Grade 7 Learners, Quasi-Experimental Design*

I. INTRODUCTION

Mathematics is essential in developing learners' critical thinking, logical reasoning, problem-solving, and decision-making skills, which are crucial for success in 21st-century education. However, Philippine learners continue to perform poorly in mathematics, as reflected in PISA 2022 results, where only 19.4% of Filipino students achieved the minimum proficiency level. This low performance is influenced by multiple factors, including negative attitudes toward mathematics, weak problem-solving abilities, ineffective teaching strategies, inadequate instructional materials, and learners' perception that mathematics is difficult and abstract.

Research suggests that students' mathematical achievement is shaped by both learner-related factors (such as cognitive development, prior knowledge, and attitudes) and school-related factors (such as teaching approaches, resources, and instructional strategies). Traditional teaching methods may limit conceptual understanding, while innovative approaches such as flipped classrooms and Game-Based Learning (GBL) offer more engaging alternatives. Problem-solving skills are particularly critical, as they directly predict learners' academic performance and conceptual mastery.

The researcher observed that many Grade 7 learners struggle with mathematics, demonstrate low engagement, and perform poorly in quizzes and examinations, often requiring remedial instruction. These challenges highlight the need for more effective teaching strategies and appropriate instructional materials. Studies emphasize that quality classroom resources and learner-centered approaches significantly improve learning outcomes.

Game-Based Learning (GBL) has emerged as a promising instructional strategy because it integrates educational content into interactive and structured games, making learning more engaging, motivating, and meaningful. GBL promotes active participation, immediate feedback, collaboration, and improved conceptual understanding, helping learners develop knowledge and skills while reducing anxiety toward mathematics. Therefore, this study seeks to examine the mathematics performance of Grade 7 learners and determine the effectiveness of GBL as an innovative strategy to improve mathematics learning, enhance engagement, and make mathematical concepts more accessible and effective.

II. RELATED STUDIES

The reviewed literature and studies establish Game-Based Learning (GBL) as an effective instructional strategy that significantly enhances mathematics performance, motivation, engagement, and confidence among learners. International studies consistently show that GBL improves conceptual understanding, critical thinking, and problem-solving skills by transforming traditional lessons into interactive and learner-centered experiences (Yulianto et al., 2025; Himmawan & Juandi, 2023). These studies emphasize that games are most effective when designed with clear objectives, structured rules, immediate feedback, and curriculum alignment, ensuring that educational goals remain central rather than entertainment alone.

In the Philippine context, local studies strongly support these findings. Research by Ibona-Mabini and Petancio (2024–2025), Ramirez and Mercado (2023), Mabuti (2023), and Galinzoga (2025) demonstrates that Filipino learners exposed to GBL strategies achieve significantly higher mathematics performance, improved participation, and stronger self-efficacy compared to those taught through traditional methods. These studies are particularly relevant for Grade 7 learners, who often face challenges transitioning from arithmetic to more abstract concepts such as algebra, geometry, and statistics. By making mathematical concepts concrete, enjoyable, and collaborative, GBL reduces anxiety and fosters sustained interest in mathematics.

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The literature also highlights the diverse forms of GBL, including digital applications, simulations, board games, math bingo, number puzzles, quiz competitions, role-playing, and collaborative problem-solving tasks. These forms allow educators to adapt GBL to cultural and classroom contexts while maintaining educational effectiveness. In the Philippine setting, localized strategies such as cabbage relay, board work games, and quiz bees are especially practical and culturally relevant for promoting academic achievement.

Furthermore, GBL supports both cognitive and affective outcomes. Cognitively, it strengthens mathematical reasoning, retention, and mastery through repeated practice and progressive challenges. Affectively, it enhances motivation, confidence, teamwork, and positive attitudes toward mathematics. This dual impact makes GBL particularly suitable for Grade 7 learners under the MATATAG Curriculum, where foundational mastery in numbers, algebra, geometry, and probability is essential.

Overall, the reviewed studies provide strong theoretical and empirical support for the present study by confirming that Game-Based Learning is a powerful, curriculum-aligned approach that can improve Grade 7 learners' mathematics performance. Both global and Philippine-based evidence justify its implementation at Pavia National High School as an innovative strategy to address low performance, increase engagement, and strengthen foundational mathematical understanding.

III. PURPOSE OF THE STUDY

This study aimed to determine the effect of Game-Based Learning (GBL) on the mathematics performance of Grade 7 learners at Pavia National High School during the School Year 2025–2026. Specifically, it sought to determine the pretest mathematics performance of Grade 7 learners with and without exposure to Game-Based Learning, identify whether there was a significant difference in the pretest mathematics performance of learners in both groups, determine the posttest mathematics performance of Grade 7 learners with and without exposure to Game-Based Learning, examine whether there was a significant difference in the posttest mathematics performance of learners in both groups, assess the pretest and posttest mathematics performance of Grade 7 learners with and without exposure to Game-Based Learning, and determine whether there was a significant difference between the pretest and posttest mathematics performance of learners with and without exposure to Game-Based Learning.

IV. THEORITICAL FRAMEWORK

This study was anchored in the Constructivist Learning Theory, which emphasizes that learners actively construct knowledge through engagement and meaningful experiences. Recent studies confirm that game-based learning supports this theory by allowing students to interact with mathematical content through hands-on and collaborative activities, enabling them to build understanding step by step (Cayang & Ursabia, 2024; Hidayat et al., 2024).

The study was also supported by Behaviorism Theory, particularly B.F. Skinner's concept of reinforcement. In game-based learning, immediate feedback, rewards, and recognition serve as positive reinforcements that strengthen desirable learning behaviors and motivate students to persist in solving mathematical problems. Current research highlights how reinforcement cycles in game-based learning encourage repeated practice, gradually improving learners' confidence and performance in mathematics (Cayang & Ursabia, 2024; Hii & Mahmud, 2023).

Additionally, Experiential Learning Theory highlights that knowledge is acquired through direct experience. Game-based learning provides real-time problem-solving opportunities where learners experiment, reflect, and apply concepts, thereby enhancing their comprehension of abstract mathematical ideas. Through the experiential learning cycle—concrete experience, reflective observation, abstract conceptualization, and active experimentation—students develop a deeper understanding and retain knowledge more effectively. Building on this, game-based learning also fosters collaboration and communication, as students often work in teams to solve challenges, mirroring real-world problem-solving contexts. It encourages creativity and adaptability, since learners must adjust strategies when faced with unexpected outcomes. Moreover, the immersive nature of games sustains motivation and engagement, making abstract mathematical concepts more accessible and less intimidating. Ultimately, this dynamic approach bridges theory and practice, ensuring that knowledge is not only understood but also meaningfully applied (Hui & Mahmud, 2023; Cayang & Ursabia, 2024).

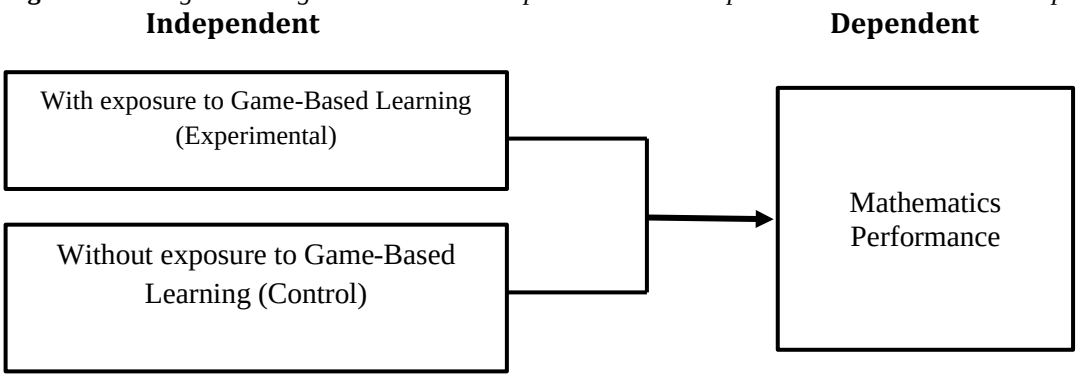
Together, these theories provide a strong foundation for the present study entitled "The Effect of Game-Based Learning on the Mathematics Performance of Grade 7 Learners." Constructivism explains how learners actively build mathematical knowledge through interactive games, Behaviorism accounts for the motivational impact of reinforcement and feedback, and Experiential Learning underscores the value of direct, hands-on experiences in deepening understanding. By integrating these perspectives, the study justifies the use of game-based learning as an effective instructional strategy to address the challenges faced by Grade 7 learners at Pavia National High School and to improve their mathematics performance.

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V. CONCEPTUAL FRAMEWORK

Figure 1 illustrates the paradigm of the study.

Figure 1 *Paradigm Showing the Interrelationship Between the Independent Variables and the Dependent Variable*



The paradigm illustrates the utilization of Game-Based Learning (GBL) in relation to the mathematics performance of learners. The independent variable is the instructional approach, specifically the exposure of Grade 7 learners to Game-Based Learning activities compared with those not exposed to Game-Based Learning. While the dependent variable is the mathematics performance of the learners.

VI. METHODOLOGY

This chapter presents the research design, the participants of the study, the data gathering instruments, experimental procedures, and data processing techniques that will be used in the study.

6.1. Research Design

A quasi-experimental pretest–posttest two-group design was used in this study. Quasi-experimental design is a type of research that seeks to evaluate causal relationships between variables but does not use random assignment of participants to groups. Instead, intact groups or naturally occurring classes are studied, which makes this design especially useful in educational settings where randomization is often impractical or unethical (Campbell & Stanley, 1963). In a quasi-experimental design, researchers introduce an intervention (Game-Based Learning) and compare the outcomes of an experimental group with those of a control group. To strengthen validity, pretests and posttests are often employed to measure changes in performance. While this design provides valuable evidence of causal effects, it is more vulnerable to threats such as selection bias compared to randomized controlled trials (Campbell & Stanley, 1963; Cook & Campbell, 1979; Creswell & Creswell, 2018).

6.2. Participants of the Study

The participants of the study were seventy (70) Grade 7 learners of Pavia National High School in Pavia, Iloilo, enrolled for the School Year 2025-2026. Thirty-five (35) learners were assigned to the control group and were taught using the traditional method of teaching, and thirty-five (35) learners were assigned to the experimental group and were taught using a Game-Based Learning strategy.

The distribution of the participants is shown in Table 1.

Table 1

Distribution of Participants

Category	N	%
Entire Group	**70**	100
With exposure to Game-Based Learning (Experimental)	35	50
Without exposure to Game-Based Learning (Control)	35	50

6.3. Data Gathering Instrument

The instrument used in the study was the researcher-made test, a 40-item test with a Table of Specification (TOS) with four options each (see Appendix A). A correct answer for each item is equivalent to one point. The lessons were based on the Grade 7 Most Essential Learning Competencies (MELCS) prescribed by the Department of Education. The problems were also based on the content area of the Matatag Curriculum in Mathematics. Before the conduct of the study, three mathematics experts were chosen based on their expertise to validate the 40-item mathematics problem-solving test. The instrument was then pilot tested with one section of Grade 9 learners at Pavia National High School. Grade 9 students were selected for the pilot testing of the researcher-made test because the Grade 8 learners, who were the intended participants, were not available during the time of the pilot testing. The selection of Grade 9 learners ensured that the instrument could still be evaluated for clarity, reliability, and appropriateness before its actual administration to the target group.

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The Cronbach's Alpha method was used to analyze the reliability of the test. The reliability coefficient of the test was 0.728, which indicates that the instrument is reliable. The participants' pretest and posttest mean scores were computed, and their levels of mathematics performance were described using the scale below.

Mean Score	*Interpretation*
32.01 – 40.01	Very High
24.01 – 32.00	High
16.01 – 24.00	Average
08.01 – 16.00	Low
0.00 –0 8.00	Very Low

6.4. Data Gathering Procedure

Before the conduct of the experiment, the researcher secured a permit to conduct the study from the Schools Division Superintendent of the Schools Division of Iloilo (see Appendix C). After approval, the principal and the head of the Mathematics Department of Pavia National High School, Pavia, Iloilo, were given copies of the approved letter (see Appendix D). After permission was granted, the researcher identified the learners as the participants of the study.

Seventy (70) Grade 7 learners were selected as the subjects of the study. The experimental and control groups are the two lower sections (slow learners). Thirty-five (35) students were assigned to the experimental group and the other thirty-five (35) to the control group. To control the teacher factor, the researcher taught both groups during the experimental period.

Before the start of the experiment, the learners were given the pretest using the researcher-made test instrument. Afterward, the researcher-teacher taught both groups the fourth-quarter lessons using the prepared instructional materials for the study, which lasted for six (6) weeks (within the months of February to March, S.Y. 2025-2026).

The study involved three stages: pre-experimental activities, experimental proper, and post-experimental activities. The first stage was the administration of the pretest on the fourth-quarter topics in Junior High School Mathematics. The second stage was the implementation of the teaching strategies (Game-Based Learning Strategy and traditional method of teaching) for the two groups of participants. This stage lasted for six (6) weeks, starting in the first week of February and ending in the second week of March 2026. The third stage of the study was the administration of the posttest after covering all the selected fourth-quarter topics.

For the experimental group, the Game-Based Learning strategy was used, while the control group was taught using the traditional method of teaching. The same competencies, topics, and reference books were used for both groups. The experimental group class took place in New Building 4 at 3:00-4:00 in the afternoon during class days, while the control group took place in their classroom in Coca-Cola Building 1 from 7:30-8:30 in the morning during class days.

6.5. Data Processing Techniques

To analyze the data in this study, both descriptive and inferential statistics were employed.

The mean and standard deviation were used for descriptive statistics to describe the learners' mathematics performance with and without exposure to Game-Based Learning.

The t-test for dependent (paired) sample test was applied to determine if there was a significant difference between the pretest and posttest scores of learners within each group (experimental group taught using Game-Based Learning and control group taught using the traditional method).

The t-test for independent samples was used to determine if there was a significant difference in the posttest scores between the experimental and control groups after the intervention.

All statistical computations were processed using the Statistical Package for the Social Sciences (SPSS) software at the 0.05 level of significance to ensure the accuracy and reliability of the results.

6.6. Ethical Consideration

About ethical issues, the researcher secured a permit to conduct the study from the Schools Division Superintendent of the Schools Division of Iloilo. After approval, the School Principal of Pavia National High School, Pavia, Iloilo, was given a copy of the approved letter. Parental consent was also secured from the participants to determine whether they would be allowed to participate in the study. All procedures ensured that the data gathered and results obtained did not adversely affect the participants' academic performance and were kept confidential.

VII. RESULTS AND DISCUSSION

This chapter presents the findings of the study. It includes descriptive and inferential data, along with their respective analyses and interpretations.

Pretest Mathematics Performance of Grade 7 Learners

Table 2 presents the pretest mathematics performance of grade 7 learners with exposure to Game-Based Learning (GBL) and without exposure to GBL (traditional teaching method).

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Table 2
Pretest Mathematics Performance of Grade 7 Learners with and without Exposure to Game-Based Learning

Categories	*N*	*Mean*		*Description*	*SD*
With Exposure to Game-Based Learning (Experimental)	35	14.34		Low	3.21
Without Exposure to Game-Based Learning (Control)	35	14.57		Low	3.29
Note: Interpretations are based on the following scale: Very High (32.01-40.01); High (24.01-32.00); Average (16.01-24.00); Low (8.01-16.00); Very Low (0.00-8.00)					

The results in Table 2 show that learners who were exposed to game-based learning also demonstrated a low level of performance (*M = 14.34, SD = 3.21*), while those taught through the traditional teaching method achieved a low level of mathematics performance (*M = 14.57, SD = 3.29*). This indicates that both groups had similar levels of mathematics performance before the intervention. This similarity may be attributed to the fact that most of the topics were new to the learners, and they had not yet been exposed to the competencies, resulting in limited prior knowledge. This result aligns with the idea that teachers should recognize early which learners are at risk of underperforming in mathematics. By identifying these learners during the initial stages of instruction, educators can provide targeted support and adopt appropriate teaching strategies to address their needs and improve their learning outcomes.

This finding is supported by Yumang (2024), who reported that Grade 7 learners in General Santos City had comparable pretest scores in mathematics before exposure to digital game-based learning, as the topics were new and unfamiliar to them. Similarly, Avila et al. (2023) found that learners initially performed at a low level in mathematics pretests because they had not yet encountered the competencies, confirming that both experimental and control groups started at the same baseline. Galinzoga et al. (2022) also emphasized that learners often exhibit low pretest performance when introduced to new mathematical concepts, highlighting the importance of scaffolding and targeted interventions to build foundational knowledge. Furthermore, Ke & Grabowski (2007) noted that learners' initial low performance is common in experimental studies, as pretests often measure unfamiliar content; however, subsequent exposure to innovative strategies such as game-based learning leads to significant improvement.

These studies reinforce the present findings by showing that low pretest performance is expected when learners are introduced to new mathematical competencies. Establishing this baseline comparability ensures that any observed improvement after instruction can be attributed to the teaching strategy rather than prior knowledge. It also underscores the role of teachers in identifying learners' initial difficulties and providing appropriate interventions to support their progress in mathematics.

Difference in the Pretest Mathematics Performance of Grade 7 Learners

Table 3 presents the difference in the pretest mathematics performance of Grade 7 learners with or without exposure to a Game-Based Learning strategy.

Table 3

Independent t-test Results on the Significant Difference of the Pretest Mathematics Performance of Grade 7 Learners with and without exposure to Game-based Learning Strategy.

Categories	*Mean*	*df*	*t-value*	*P*	*Interpretation*
Pretest with exposure to Game-based learning (Experimental)	14.34	68	0.294	0.77	Not Significant
Without exposure to Game-based learning (Control)	14.57				
Note: Interpretations are based on the following label: Significant (p<0.05) and Not Significant (p>0.05)					

As shown in Table 3, there was no significant difference in the pretest of the mathematics performance of Grade 7 learners with and without exposure to game-based learning *(t [68] = .294, p = 0.770).* These results indicate that learners' mathematics performance before the intervention was the same. This implies that both groups were comparable at the beginning of the study.

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This finding is consistent with several studies. Lagmay et al. (2024) reported that Grade 8 students exposed to game-based learning and those taught through traditional methods showed no significant difference in their pretest scores, confirming that both groups started at comparable levels. Similarly, Avila et al. (2023) found that Grade 7 learners in Monkayo, Philippines, demonstrated equal pretest performance before being introduced to game-based modules on Rational Expressions and the Rectangular Coordinate System. Galinzoga et al. (2022) also observed that Grade 6 pupils taught with interactive games and those taught conventionally had statistically similar pretest mathematics scores, reinforcing the fairness of the experimental design. These consistent findings across different grade levels and contexts highlight the reliability of game-based learning research designs in establishing fair comparisons between experimental and control groups. By ensuring that learners begin at similar levels of prior knowledge, these studies strengthen the validity of conclusions drawn about the effectiveness of GBL interventions. Collectively, they provide a strong foundation for attributing observed improvements in posttest performance to the instructional strategy rather than initial differences in ability.

These studies support the present findings, showing that learners typically begin at similar levels of mathematics performance, and that any differences observed after the intervention can be attributed to the instructional strategy rather than prior ability. Establishing this baseline comparability strengthens the validity of the study and allows the impact of game-based learning to be assessed more accurately. Moreover, it highlights the importance of controlling for prior knowledge when evaluating instructional innovations. By ensuring that learners start from comparable points, researchers can more confidently attribute improvements to the intervention itself. This methodological rigor enhances the credibility of the results and provides stronger evidence for the effectiveness of GBL strategies.

Posttest Mathematics Performance of Grade 7 Learners

Table 4 presents the posttest mathematics performance of Grade 7 learners with exposure to Game-Based Learning (GBL) and without exposure to GBL (traditional teaching method).

Table 4

Posttest Mathematics Performance of Grade 7 Learners with and without Exposure to Game-Based Learning

Categories	***N***	***Mean***	***Description***	***SD***
With Exposure to Game-based Learning (Experimental)	35	29.83	High	2.48
Without Exposure to Game-based Learning (Control)	35	19.31	Average	2.91
Note: Interpretations are based on the following scale: Very High (32.01-40.01); High (24.01-32.00); Average (16.01-24.00); Low (8.01-16.00); Very Low (0.00-8.00)				

The results in Table 4 show that learners who were exposed to game-based learning achieved a high level of performance (*M = 29.83, SD = 2.48*), while those taught through the traditional teaching method attained an average level of performance (*M = 19.31, SD = 2.91*). This indicates that both groups improved in their mathematics performance after instruction; however, learners exposed to game-based learning performed significantly better than those taught through traditional methods. The improvement suggests that game-based learning provided learners with more engaging opportunities to understand and apply mathematical concepts, thereby enhancing their performance.

These findings support the idea that innovative strategies such as game-based learning can foster deeper comprehension, problem-solving, and critical thinking skills. By making learning interactive and enjoyable, this approach helps learners retain knowledge more effectively compared to conventional teaching methods.

This result is supported by several studies. For instance, Ke & Grabowski (2007) found that students exposed to game-based learning environments demonstrated significantly higher achievement in mathematics compared to those taught through traditional instruction, attributing the improvement to the interactive and motivational nature of games. Similarly, Sung, Chang, & Lee (2017) reported that digital game-based learning enhanced learners' mathematical problem-solving skills and conceptual understanding, leading to better performance outcomes. In the Philippine context, Avila et al. (2023) observed that Grade 7 learners taught using game-based modules achieved higher posttest scores than those taught conventionally, highlighting the effectiveness of games in improving retention and mastery of mathematical concepts. Moreover, Galinzoga et al. (2022) emphasized that interactive games provided learners with opportunities to practice and apply mathematics in meaningful contexts, resulting in improved performance compared to traditional methods. These findings collectively underscore the growing body of evidence that game-based learning is not only engaging but also academically effective. By combining motivation with meaningful practice, GBL helps learners bridge the gap between abstract concepts and practical application. The consistent improvements reported across diverse contexts highlight its adaptability as a teaching strategy, making

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it a valuable tool for enhancing mathematics education in both local and global settings.

These studies reinforce the present findings by showing that game-based learning not only motivates learners but also enhances their ability to grasp abstract mathematical concepts, apply them in problem-solving situations, and retain knowledge more effectively. Thus, integrating game-based strategies into mathematics instruction can be considered a powerful tool for improving learners' academic performance.

Difference in the Posttest Mathematics Performance of Grade 7 Learners

Table 5 presents the difference in the posttest mathematics performance of grade 7 learners with or without exposure to a game-based learning strategy.

Table 5

Independent t-test Results on the Significant Difference in Posttest Mathematics Performance of Grade 7 Learners with and without exposure to game-based learning strategy.

Categories	*Mean*	*df*	*t-value*	*p*	*Interpretation*
With exposure to Game-based learning (Experimental)	29.83	68	-16.277	.000	Significant
Without exposure to Game-based learning (Control)	19.31				
Note: Interpretations are based on the following scale: Very High (32.01-40.01); High (24.01-32.00); Average (16.01-24.00); Low (8.01-16.00); Very Low (0.00-8.00)					

The data presented in Table 5 indicate a statistically significant difference in the posttest mathematics performance of Grade 7 learners based on their exposure to GBL *(t[68] = -16.277, p = .000).* The significant result indicates a high level of confidence that the performance gap is not due to random chance but is instead attributable to the intervention. This finding highlights the effectiveness of game-based learning as a pedagogical tool for Grade 7 mathematics.

Several studies corroborate this result. For instance, an action research study conducted at Cebu Normal University demonstrated that both digital and non-digital GBL strategies improved Grade 7 learners' mathematics outcomes under the MATATAG curriculum, with students reporting enhanced engagement and performance. These findings align with broader evidence that GBL fosters retention, problem-solving skills, and positive attitudes toward mathematics. In particular, the integration of games into lessons helped learners connect abstract concepts to practical applications. Moreover, the consistent improvements across diverse contexts suggest that GBL can be a scalable and adaptable approach to mathematics instruction.

However, cautionary perspectives exist. A systematic review of nine studies found that while GBL consistently enhances motivation and engagement, its impact on long-term achievement is mixed. Some studies reported improved attitudes but limited measurable gains in mathematics performance, suggesting that the effectiveness of GBL depends on its careful alignment with curriculum goals.

Additionally, research in primary mathematics education emphasized that poorly designed games may fail to reinforce mathematical concepts, limiting their impact despite high levels of engagement. This underscores the importance of designing games with clear instructional objectives rather than relying solely on entertainment value. Researchers also note that teacher facilitation plays a critical role in ensuring that gameplay translates into meaningful learning outcomes. Without proper guidance, learners may focus more on winning the game than mastering the underlying concepts. Thus, while GBL holds promise, its success depends on thoughtful integration into pedagogy and careful monitoring of its educational impact.

Difference in the Pretest and Posttest Mathematics Performance of Grade 7 Mathematics Learners with exposure to a game-based learning strategy.

Table 6 presents the difference in the pretest and posttest Mathematics Performance of Grade 7 Mathematics Learners with exposure to a game-based learning strategy.

Table 6

Paired t-test Results on the Significant Difference on the Pretest and Posttest Mathematics Performance of Grade 7 Learners with exposure to game-based learning strategy

Categories	*Mean*	*df*	*Mean Diff.*	*t-value*	*p*	*Interpretation*
With exposure to game-based learning						
Pretest	14.34	34	-15.49	-33.74	.000	Significant
Posttest	29.83					
Note: Interpretations are based on the following label: Significant (p<0.05) and Not Significant (p>0.05)						

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Table 6 illustrates the comparative analysis of the pretest and posttest mathematics performance of Grade 7 learners who were exposed to the Game-Based Learning (GBL) strategy *(t[34] = -15.49, p = .000).* This highly significant result confirms that GBL had a strong positive effect on learners' mathematics achievement, indicating that the intervention was effective in improving performance beyond random variation.

Supporting evidence from Philippine studies reinforces this conclusion. An action research study conducted at Cebu Normal University found that both digital and non-digital GBL strategies significantly improved Grade 7 mathematics outcomes under the MATATAG curriculum, while a quantitative study in General Santos City revealed that digital GBL interventions led to measurable gains in mathematics test scores, addressing persistent low performance in international assessments such as TIMSS. These Philippine-based studies further validate the global evidence that game-based learning is a powerful instructional approach in mathematics. By demonstrating consistent improvements across different regions and grade levels, they highlight the adaptability of GBL to diverse educational contexts. Importantly, they also show their potential to address systemic challenges, such as low performance in international assessments, positioning GBL as a promising strategy for curriculum innovation.

Together, these studies strengthen the case for integrating well-designed game-based modules into mainstream mathematics instruction under the MATATAG curriculum and beyond. Similarly, a study in North Cotabato reported a highly significant difference between pretest and posttest scores of pupils taught mathematics using GBL, and a quasi-experimental study in Surigao del Sur confirmed that interactive games aligned with curriculum competencies improved mathematics performance compared to traditional instruction. Collectively, these findings provide strong empirical support that GBL is an effective pedagogical tool for enhancing mathematics achievement among learners. Beyond test scores, these interventions also fostered greater learner confidence and motivation, which are critical for sustained success in mathematics. The evidence suggests that GBL not only improves immediate performance but also cultivates positive attitudes toward problem-solving and persistence. As such, incorporating GBL into classroom practice can contribute to both academic achievement and the holistic development of learners.

Difference in Pretest and Posttest Mathematics Performance of grade 7 learners without exposure to game-based learning Strategy

Table 7 presents the difference in the pretest and posttest Mathematics Performance of grade 7 learners without exposure to the game-based learning strategy.

Table 7

Paired t-test Results on the Significant Difference on the Pretest and Posttest Mathematics Performance of Grade 7 Learners without exposure to a game-based learning strategy.

Categories	***Mean***	***df***	***Mean Diff.***	***t-value***	***p***	***Interpretation***
A. Without exposure to game-based learning						
Pretest	14.57	34	-4.74	-13.89	.000	Significant
Posttest	19.31					
Note: Interpretations are based on the following label: Significant (p<0.05) and Not Significant (p>0.05)						

Table 7 presents the comparative results of the pretest and posttest mathematics performance for the Grade 7 learners who were not exposed to the Game-Based Learning (GBL) strategy *(t[34] = 13.89, p = .000),* indicating a significant improvement in student performance following the instructional intervention. The statistical significance of this improvement was evaluated using a paired t-test. Since the p-value is below the established level of significance (0.05), the null hypothesis, which suggests no difference between the scores, is rejected.

This result is consistent with studies showing that traditional instructional methods, when delivered effectively, can still lead to significant gains in mathematics achievement. For example, a study in North Cotabato reported that conventional teaching strategies produced measurable improvements in learners' mathematics performance, particularly when lessons were structured and aligned with curriculum standards. Similarly, international reviews have noted that while game-based learning enhances motivation, traditional approaches remain effective in improving test scores when teachers employ clear explanations, guided practice, and formative assessments.

However, cautionary perspectives emphasize that although traditional methods can yield significant short-term gains, they may not foster the same level of engagement and long-term retention as game-based learning, suggesting that a blended approach may maximize both achievement and motivation.

VIII. SUMMARY OF THE FINDINGS

The following were the findings of the study:

1. The pretest mathematics performance of Grade 7 learners with and without exposure to Game-Based Learning was both at a "low" level.

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2. There was no significant difference in the pretest mathematics performance of learners with and without exposure to Game-Based Learning.
3. The posttest mathematics performance of Grade 7 learners with exposure to Game-Based Learning was "high," while those without exposure obtained an "average" level of performance.
There was a significant difference in the posttest mathematics performance of learners with and without exposure to Game-Based Learning, with learners exposed to Game-Based Learning performing better.

The pretest and posttest mathematics performance of Grade 7 learners with exposure to Game-Based Learning improved from "low" to "high," while those without exposure improved from "low" to "average."

There was a significant difference between the pretest and posttest mathematics performance of learners with and without exposure to Game-Based Learning, indicating that both groups improved, with greater improvement observed among learners exposed to Game-Based Learning.

IX. CONCLUSION AND RECOMMENDATIONS

1. Grade 7 learners, regardless of exposure to game-based learning, initially demonstrated low mathematics performance, indicating a similar baseline level before the intervention. This suggests the need to strengthen foundational mathematics instruction across all learners to ensure readiness before introducing advanced strategies.

2. The two groups were comparable at the start, showing that Game-Based Learning had not yet influenced learners' mathematical ability before the intervention. This validates the fairness of the study design and implies that any improvements observed can be attributed to the instructional strategy rather than pre-existing differences.

3. Learners exposed to Game-Based Learning performed better in mathematics, implying that this strategy enhances engagement and improves academic performance. Thus, it should be integrated into teaching practices, and schools may consider adopting it as an instructional approach to foster motivation and achievement in mathematics.

4. The game-based learning strategy was more effective in improving mathematics performance than traditional methods, as evidenced by the significant difference in posttest results. This suggests that training teachers in GBL techniques may help maximize students' outcomes.

5. Both groups improved after instruction; however, the improvement was greater among learners exposed to Game-Based Learning, highlighting its stronger effect on performance. While traditional methods remain useful, integrating GBL can accelerate progress and help bridge learning gaps more effectively.

6. Instruction, whether game-based or not, contributed to improved mathematics performance. However, the magnitude of improvement was significantly higher among learners taught using Game-Based Learning. This suggests that combining approaches may be beneficial, with GBL as a primary strategy and traditional methods as reinforcement.

X. RECOMMENDATIONS

Based on the findings and conclusions, the following recommendations are proposed:

1. Strengthen foundational mathematics instruction for Grade 7 learners before introducing advanced strategies. Diagnostic assessments and remedial sessions should be conducted to address gaps early.

2. Ensure that learners are grouped fairly in experimental and control settings to maintain comparability and to confirm that observed improvements are due to the intervention rather than initial differences.

3. Integrate Game-Based Learning (GBL) strategies more widely into mathematics instruction, as these have been shown to enhance learner engagement and academic achievement compared to traditional methods.

4. School administrators and teachers may adopt Game-Based Learning as a instructional approach by providing adequate training, resources, and support to maximize its effectiveness in the classroom.

5. While traditional teaching methods contribute to improving performance, they may be complemented with Game-Based Learning strategies to achieve stronger learning outcomes.

6. Continuous assessment should be maintained to monitor learners' progress. Both instructional approaches can improve performance; however, Game-Based Learning may be prioritized, with traditional methods used as supplementary reinforcement.

XI. REFERENCES

1. *Arciosa, R. M. (2021). Game-Based Learning (GBL) in teaching primary mathematics. Asian Journal of Education and Social Studies, 25(3), 43–54. https://doi.org/10.9734/AJESS/2021/v25i330603*
2. *Cançado, L., Reisel, J., & Walker, C. (2018). International Journal of Mathematical Education in Science and Technology, 49(6). https://doi.org/10.1080/0020739X.2017.1423120*
3. *Cano, J. C., & Lomibao, L. S. (2023). A mixed methods study of the influence of phenomenon-based learning videos on students' mathematics self-efficacy, problem-solving and reasoning skills, and mathematics achievement. American Journal of Educational Research, 11(3), 97–115. https://doi.org/10.12691/education-11-3-2*
4. *Cayang, J. A. C., & Ursabia, E. M. E. (2024). Leveling up mathematical skills: The effectiveness of game-based learning. Journal of Interdisciplinary Perspectives, 2(7), 784–791. https://doi.org/10.69569/jip.2024.0087a*
5. *Galinzoga, J. A. (2025). Interactive game-based learning and mathematics performance of Grade 6 pupils in Tago District, Surigao del Sur, Philippines. Zenodo. https://doi.org/10.5281/zenodo.17482929*
6. *Grove, M. (2019). Specialist and more-able mathematics students: Understanding their engagement with mathematics support. International Journal of Mathematical Education in Science and Technology.*

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https://doi.org/10.1080/0020739X.2019.1603407

7. *Himmawan, D. F., & Juandi, D. (2023). Games-based learning in mathematics education: A systematic literature review. Union: Jurnal Ilmiah Pendidikan Matematika, 11(1), 41–50. https://doi.org/10.30738/union.v11i1.13982*
8. *Ibona-Mabini, L. M., & Petancio, J. M. (2025). Improving Grade 7 mathematics outcomes through game-based learning: An action research study. The Normal Lights, 19(1). https://doi.org/10.56278/tnl.v19i1.3131*
9. *Pacturan, D. B., Sabacajan, B. T., & Nahial, W. L. (2024). Integration of gamification in teaching and students' academic performance: Basis for action plan. International Journal of Multidisciplinary: Applied Business and Education Research, 5(3), 1013–1023. https://doi.org/10.11594/ijmaber.05.03.24*
10. *Ramirez, C. L., & Mercado, H. A. R. (2023). Mathematical achievements with or without games in Hinangutdan Public Secondary High School, Samar, Philippines. Jurnal Pendidikan Progresif, 13(2). https://doi.org/10.23960/JPP.V13.I2.202323*
11. *Reid, J., & Wilkes, J. (2020). Developing and applying quantitative skills maps for STEM curricula, with a focus on the use of technology and different modes of learning. International Journal of Mathematical Education in Science and Technology, 47(6), 837–852. https://doi.org/10.1080/0020739X.2016.1144814*
12. *Santiago, J. M., & David, E. S. (2019). The use of two media of instruction in biology: A quasi-experimental study. International Journal of Advanced Engineering, Management and Science, 5(2). https://doi.org/10.22161/ijaems.5.2.3*
13. *Yulianto, D., Situmeang, M. S., Anwar, S., & Puspitasari, N. (2025). Revisiting digital game-based mathematics learning: Global insights into thinking and attitudes from a PRISMA-guided review. Kalamatika: Jurnal Pendidikan Matematika, 10(2), 94–116. https://doi.org/10.22236/kalamatika.vol10no2.2025pp94-116*