



DIGITAL GAME-BASED LEARNING AND ITS EFFECT ON THE PERFORMANCE OF GRADE 4 LEARNERS IN MATH: BASIS FOR INSTRUCTIONAL SUPERVISION PLAN

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ABSTRACT

This study evaluates the effectiveness of digital game-based learning (DGBL) in improving the mathematics performance of Grade 4 learners at Puerto Bello Elementary School, Merida District, Leyte Division. The study utilized a quasi-experimental research design employing pre-test and post-test measures to determine the significant difference in learners' performance before and after the integration of DGBL. Thirty (30) Grade 4 learners participated in the study, using a researcher-made 30-item Mathematics test aligned with the first quarter's Most Essential Learning Competencies (MELCs). Digital game-based activities were incorporated into the lessons, allowing learners to engage with interactive and technology-supported mathematical tasks. The results revealed that learners' pre-test mean score of 11.80 (Fair) improved substantially to a post-test mean score of 27.53 (Excellent) after the intervention. The computed t-value of 41.26, which is greater than the critical t-value of 2.05, led to the rejection of the null hypothesis, confirming a significant difference between pre-test and post-test scores. These findings indicate that digital game-based learning significantly enhanced learners' mathematical comprehension, engagement, and achievement. Therefore, the study concludes that integrating digital game-based learning is an effective instructional approach to foster motivation, interactivity, and conceptual mastery in Mathematics. Based on these results, an instructional supervision plan was proposed to

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further guide and support teachers in effectively implementing digital game-based strategies in classroom instruction.

Keywords: *Digital Game-Based Learning, Performance, Grade 4 Learners, Math, Instructional Supervision Plan*

INTRODUCTION

Education is a field that is constantly changing and adapting to technology. With the changing landscape in education, student-centered methods are being favored over traditional or teacher-centered methods. With every level of cognitive development, students should be actively engaged in the learning process (Woolfolk, 2020). A method that is quickly rising in popularity that embodies this student-centered engagement is Digital game-based learning (DGBL).

Digital games and activities are a form of media that has captured the attention of children. The cultural acceptance of digital games as a leisure activity has led to an increase in digital game-based activities or educational video games in the classroom (Greipl et al., 2020). Because of their cultural relevance and the ability to consume hours of attention, video games are being looked at as an engaging learning experience (Tokac et al., 2019).

Mathematics remains one of the most challenging subjects for elementary learners, often resulting in low motivation and achievement. Traditional instructional methods may not always meet the learning needs and preferences of 21st-century learners who are growing up in a digitally immersive environment. DGBL addresses this gap by transforming mathematical concepts into interactive and stimulating learning experiences. According to Qian and Clark (2016), game-based learning improves students' problem-solving skills, motivation, and content mastery by providing instant feedback and adaptive learning paths.

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Recent studies, such as the one by Chu et al. (2023), indicate that the use of digital games in mathematics instruction significantly enhances students' conceptual understanding and computational skills. This is attributed to the game elements—such as levels, rewards, and challenges—that promote active participation and sustained attention. Moreover, Taher et al. (2022) found that learners who engaged in digital game-based learning environments outperformed their peers in both formative and summative assessments in math.

In the Philippine context, where educational innovations are actively being integrated through programs like the Department of Education's MATATAG curriculum and Digital Rise initiative, this study is timely and relevant. There is a pressing need to examine how DGBL can support the performance of learners, especially in Grade 4 mathematics—a critical stage where foundational numeracy and problem-solving skills are strengthened.

Math education has used traditional teaching techniques like lectures and textbooks for many years. However, it has been discovered that these methods fall short when it comes to motivating pupils and raising academic accomplishment (Chen et al., 2020). To improve students' academic performance and excitement for mathematics, educators have resorted to cutting-edge teaching strategies like game-based learning.

A teaching strategy known as "game-based learning" uses games to engage students and improve learning (Papastergiou, 2009). Because it allows students to study in a fun and engaging setting, game-based mathematics learning has been proven to be an effective technique for teaching mathematics (Egenfeldt-Nielsen et al., 2016). The development of students' problem-solving and critical-thinking abilities can also benefit from game-based mathematics instruction (Egenfeldt-Nielsen et al., 2016). According to Egenfeldt-Nielsen et al. (2016), game-based learning has become a successful teaching technique for improving students' mathematics performance and interest. According to Prensky (2013), game-based learning is a method of instruction that makes use of games to impart academic knowledge and abilities.

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As one of the primary trends in learning for the twenty-first century (Ahmad & Iksan, 2021), game-based learning (GBL) has recently attracted more scholarly attention (Zou, 2020). Using student-centered learning activities, GBL in mathematics education improves learning efficiency by striking a balance between in-class instruction and educational games (Lasut & Bawengan, 2020). Additionally, it is one of the more innovative and enjoyable techniques, and pupils will, inadvertently, pay attention to the teacher's lessons. This is because pupils naturally enjoy playing video games. In addition, educational games might help students develop a love of learning, the confidence to face a variety of challenges along the way, and the patience and focus to get through them (Liu et al., 2021).

Digital game-based learning being known as effective in learning Math, the researcher being a mathematics teacher is motivated to introduce this strategy to address the learning gaps that students have that. Hence, this study was formulated to evaluate the effectiveness of digital game-based learning in enhancing the performance of grade 4 learners in math. A proposed instructional supervision plan was formulated based on the findings of the study.

This study evaluates the effectiveness of digital game-based learning in improving the performance of grade 4 learners in math of Puerto Bello Elementary School, Merida District, Leyte Division. The findings of the study will be the basis for the proposed instructional supervision plan.

Further, it seeks to answer the following sub-problems:

1. What is the performance of the Grade 4 learners in Mathematics before the integration of digital game-based learning strategy?
2. What is the performance of the grade 4 learners in Mathematics after the integration of digital game-based learning strategy?
3. Is there a significant difference in the performances of the grade 4 learners in Mathematics before and after the integration of digital game-based learning strategy?

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4. What instructional supervision plan can be proposed based on the findings of this study?

METHODOLOGY

Design. This study employs the quasi-experimental research design utilizing the pre-test and post-test to evaluate the effectiveness of digital game-based learning in improving the performance of grade 4 learners in Mathematics of Puerto Bello Elementary School, Merida District, Leyte Division. The pre-test and post-test was conducted before and after the integration of digital game-based learning strategy in Math. This study was conducted in Puerto Bello Elementary School, one of the schools of Merida District, Schools Division of Leyte. The thirty (30) grade 4 learners enrolled in the said locale for School Year 2025-2026. were involved in the study. The study utilized the researcher-made Math test in the 1st quarter of the Most Essential Learning Competencies (MELCs). This is a 30-item Math test with problem solving. The test was conducted to the learners before and after the integration of digital game-based learning strategy in math. Moreover, the researcher formulated digital game-based activities that was used in teaching math. She also crafted lesson plans of which the digital game-based activities were utilized. The learners utilized gadgets available in the class. Digital activities were answered using the gadgets. The researcher-made tests and the lesson plans were submitted to the District Math Coordinator and School Head for validation before it was administered to the learners. A matrix of activities was provided by the researcher to keep track on the progress of the intervention provided.

Sampling. The thirty (30) grade 4 learners were involved in the study. Complete enumeration was employed in choosing the respondents of the study.

Research Procedure. Upon securing a research permit, data gathering was initiated. Application letters for study permits were personally submitted to concerned offices. A request

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letter was first submitted to the Schools Division Superintendent for approval to gather data from targeted respondents. After securing the approval of SDS, letters of permission were also submitted to the Public Schools District Supervisor and School Principals of the identified schools in the district. After getting the approvals, the researcher conducted data-gathering activities. An orientation was also held for the respondents and their parents, and their agreement through permits was to participate in the research. Then, pre-test was conducted. After giving the pre-test, intervention was provided within 4 weeks. The intervention focused on the integration of digital game-based learning strategy in Math. After the intervention, a post-test was administered. Answers were checked, collected, tabulated, and submitted for statistical treatment.

Ethical Issues. The researcher obtained the necessary written permission from the authorities to conduct the study. While developing and checking the tests used in the study, the use of offending, discriminatory, or other undesirable terminology was eschewed. The names of the respondents and other personal information were not included in this study to ensure confidentiality. The respondents were also voluntarily participating. Orientation was done for the respondents. During orientation, concerns and issues were clarified, and consent to be part of the study was signed. The researcher-maintained objectivity in discussing and analyzing the results. All authors whose works were cited in this study were correctly quoted and were acknowledged in the reference. Keeping of responses from the respondents were given to the researcher and kept under her care.

Treatment of Data. The quantitative responses underwent tallying and tabulation. Statistical treatment involved using specific tools: Simple Percentage and Weighted Mean assessed the performance of the grade 4 learners in Math before and after the integration of digital game-based learning strategy in Math. t-Test of Mean Difference was used to determine the significant difference in the performances of the grade 4 learners in Math before and after the integration of digital game-based learning strategy in Math.

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RESULTS AND DISCUSSION

Table 1

Pre-test Performance of Grade 4 Learners in Mathematics Before the Integration of Digital Game-Based Learning

Score Range	Description	Frequency	%
25–30	Excellent	0	0.00%
19–24	Very Good	0	0.00%
13–18	Good	13	43.33%
7–12	Fair	16	53.33%
1–6	Poor	1	3.34%
Total		30	100%
Weighted Mean		11.80	Fair

Table 1 presents the pre-test performance of Grade 4 learners in Mathematics before the integration of digital game-based learning. As shown, the majority of the learners, comprising 16 or 53.33%, obtained scores within the 7–12 range, which is described as Fair, while 13 learners (43.33%) achieved scores in the 13–18 range, corresponding to a Good performance. Only 1 learner (3.34%) fell within the 1–6 range, interpreted as Poor, and notably, no learners reached the Very Good (19–24) or Excellent (25–30) categories. The weighted mean score of 11.80, interpreted as Fair, indicates that the overall mathematical performance of the learners prior to the use of digital game-based learning was below satisfactory. This suggests that most learners demonstrated limited mastery of mathematical concepts and would likely benefit from more engaging and interactive instructional approaches to improve their understanding and performance.

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Table 2

Post-test Performance of Grade 4 Learners in Mathematics After the Integration of Digital Game-Based Learning

Score Range	Description	Frequency	%
25–30	Excellent	21	70.00%
19–24	Very Good	9	30.00%
13–18	Good	0	0.00%
7–12	Fair	0	0.00%
1–6	Poor	0	0.00%
Total		30	100%
Weighted Mean		27.53	Excellent

Table 2 presents the post-test performance of Grade 4 learners in Mathematics after the integration of digital game-based learning. The data reveal a remarkable improvement in learners' performance, with 21 learners (70.00%) achieving scores within the 25–30 range, described as Excellent, and the remaining 9 learners (30.00%) obtaining scores in the 19–24 range, interpreted as Very Good. Notably, no learners fell under the Good, Fair, or Poor categories, indicating that all participants performed above average. The weighted mean score of 27.53, interpreted as Excellent, suggests that the integration of digital game-based learning significantly enhanced learners' mathematical understanding and achievement. This demonstrates that interactive and technology-driven approaches can effectively engage learners, promote conceptual mastery, and improve overall academic performance in Mathematics.

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Table 3
Test of Difference Between the Pre-test and Post-test Scores
of Grade 4 Learners

Group	Test Scores (Mean)	Computed t	Critical t	Decision	Interpretation
Grade 4	Pre = 11.80 Post = 27.53	41.26	2.05	Reject Ho	Significant

Table 3 presents the test of difference between the pre-test and post-test scores of Grade 4 learners in Mathematics. The results show a pre-test mean score of 11.80 and a post-test mean score of 27.53, indicating a substantial improvement in learners' performance after the integration of digital game-based learning. The computed t-value of 41.26 exceeds the critical t-value of 2.05, leading to the rejection of the null hypothesis (H_0). This result signifies that there is a significant difference between the pre-test and post-test scores of the learners. The finding implies that the use of digital game-based learning had a positive and statistically significant effect on learners' mathematical achievement, demonstrating its effectiveness as an innovative instructional strategy to enhance student engagement and learning outcomes.

Conclusion

The findings of the study revealed a significant improvement in the mathematics performance of Grade 4 learners after the integration of digital game-based learning. The pre-test results showed that most learners performed at a fair level, with a weighted mean of 11.80, indicating limited mastery of mathematical concepts. However, after the implementation of digital game-based learning, the post-test results demonstrated a remarkable increase, with a weighted mean of 27.53 interpreted as excellent. Furthermore, statistical analysis using the t-test yielded a computed t-value of 41.26, which is greater than the critical t-value of 2.05, leading to the rejection of the null hypothesis. This confirms a

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significant difference between the pre-test and post-test scores, suggesting that digital game-based learning effectively enhanced learners' understanding and performance in Mathematics. Therefore, the study concludes that the integration of interactive and game-based digital tools serves as an effective pedagogical approach to improve student engagement, motivation, and achievement in Mathematics.

Recommendations

1. Teachers should continue to integrate digital game-based learning in Mathematics instruction to sustain learners' interest, engagement, and motivation toward mastering mathematical concepts.

2. Schools should provide access to digital tools and educational platforms that support interactive and game-based learning activities aligned with the curriculum.

3. Regular training and capacity-building programs should be conducted to equip teachers with the necessary skills to effectively design, implement, and assess digital game-based lessons.

4. School administrators should encourage innovation in teaching strategies, particularly the use of technology-driven approaches that make learning more meaningful and enjoyable for students.

5. The Department of Education (DepEd) and curriculum planners may consider integrating digital learning methodologies into the standard instructional framework to enhance student performance across different grade levels and subjects.

6. Teachers are encouraged to combine traditional and digital instructional approaches to address diverse learning needs and reinforce conceptual understanding.

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7. Provide technical support and infrastructure improvements such as reliable internet connection, gadgets, and software to ensure the effective implementation of digital learning.

8. Recognize and reward teachers who successfully utilize digital game-based strategies that lead to improved student outcomes to promote innovation and best practices in teaching.

9. Future researchers are encouraged to replicate and expand this study across different subjects, grade levels, and schools to validate the findings and explore the long-term effects of digital game-based learning on academic performance.

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AUTHOR'S PROFILE



MS. JENNY C. GETIZO

Jenny C. Getizo, born on June 25, 1990 in Macatol Puerto Bello Merida, Leyte, is a dedicated educator known for her commitment to nurturing continuous learning and empowerment among her students. Her journey in education began at Puerto Bello Elementary School, followed by her secondary education at Merida Vocational School Puerto Bello Annex.

Throughout her early years, Jenny was actively involved in different school activities like singing and dancing contest, which not only fostered her physical development but also helped her gain self-confidence. After graduating in high school, she works as a house helper in Tacloban City at the age of 16 since her parents cannot afford to send her to higher education. After 1 year, her aunt Marife Autida decided to take her and send to college. They provided her all the significant support in finishing her degree and molding her character.

Jenny continued her academic journey at Western Leyte College, where she earned her Bachelor of Elementary Education in 2011. That same year, she started to work in Sacred Heart Community Center. She passed the Licensure Examination for Teachers (LET) in 2016 and marking the official start of her teaching career in 2017.

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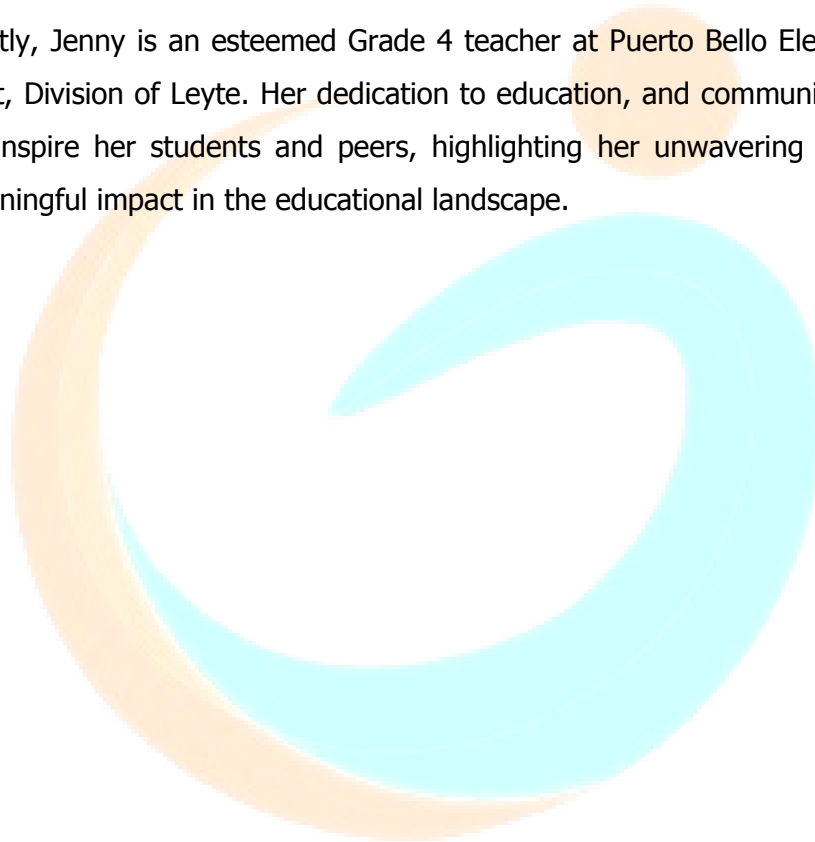
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Despite the demands of being a wife and mother to her son and daughter, Jenny has consistently pursued professional growth. Her commitment to lifelong learning led her to enroll in a Master of Arts in Education (MAEd) program, majoring in School Administration and Supervision. She successfully completed the academic requirements for her MAEd in December 2025, driven by her diverse experiences and the support of different groups she encountered through her sports and academic journey.

Currently, Jenny is an esteemed Grade 4 teacher at Puerto Bello Elementary School Merida District, Division of Leyte. Her dedication to education, and community involvement, continues to inspire her students and peers, highlighting her unwavering commitment to making a meaningful impact in the educational landscape.



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