
Effectiveness of Games and Graphic Organizers in Improving the Performance of Grade 4 Learners in Mathematics

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ABSTRACT

Effective teaching is crucial to learning because the products of teaching such as knowledge, skills and attitude acquisition are much dependent on the teacher's effective teaching. Effectiveness of a teacher and students' learning can be enhanced through the appropriate strategy adopted in a learning situation. The present study delves in using games and graphic organizers in teaching math with the goal of improving the performance of the grade 4 learners. A quasi-experimental research design employing pre-test and post-test assessments to evaluate the impact of games and graphic organizers on the academic performance of Grade 4 learners in mathematics with 28 grade 4 learners undergo series of activities which uses the innovation in teaching the subject. Simple percentage and t-test of mean difference were the statistical tools used to interpret the result of the study. After a series of interventions, the study revealed a significant difference in the performances of the grade 4 learners before and after the utilization of games and graphic organizers in teaching Math. These results highlight the importance of innovative instructional approaches in fostering academic progress and competence among students. Future educational strategies could benefit from further exploration and integration of similar effective teaching methodologies to sustain and amplify student achievement in mathematics. Further, with the integration of the innovative activities and materials, learners' attitude towards the subject has changed. They become more active and participative in all the activities provided to them and at the same time enjoy learning.

Keywords — Effectiveness, Games, Graphic Organizers, Performance, Grade 4 Learners, Mathematics

I. INTRODUCTION

The global pandemic poses an opportunity to change the way educators teach the learners in any subject using different modalities. It may be a dilemma to many but on the brighter side, it would be an avenue in upgrading one's skills and strategies when it comes to teaching and learning process. There are some teachers who formulated innovative teaching techniques and strategies to make learning happen even at home or in school. Educational transformation is evident in any facets of life.

Educational transformation is necessary because the success of said economic transformation is very much dependent on the successfulness of a futuristic education plan (Leal Filho et al., 2018). Globalization has formed a new path in worldwide education, and teachers play an active role in the teaching and learning process. In this regard, pedagogy is stressing more about the roles of the learners in the learning sessions, specifically how it is compatible with the 21st century learning methods (Amran et al., 2019). According to Kamarudin et al. (2019), the level of learners'

interest in teaching and learning is low when the conventional approach is employed. Consequently, teaching methods and techniques are essential for becoming a teacher who can impart knowledge to their learners using a variety of engaging approaches and strategies especially in teaching Mathematics subject. Teachers must employ the most effective method for imparting knowledge.

Subsequently, learning is intimately tied to the learning domains and has been introduced to education to encourage higher order thinking skills (Bitok, 2020) as what is expected from the learners of today. It encompasses the cognitive, affective, and psychomotor domains specifically. The cognitive domain is concerned with the intellectual growth of students, the affective domain involves the development of the students' attitudes, feelings, and values, while the psychomotor domain involves the physical development of the students. In this scenario, the cognitive and emotive domains of the pupils also influence the effectiveness of the game-based learning method. It was made mentioned by some of the researchers that learning is meaningful if learners are able to manipulate the materials they are using or when they participate in the activities.

Game-based learning in education is now one of the major learning trends of the 21st century (Ahmad and Iksan, 2021) and it has received an increasing amount of academic attention in recent years (Zou, 2020). Game-based learning is a mathematics teaching technique that creates a balance between classroom learning and educational games while enhancing the learning efficiency through student centered learning activities (Lasut and Bawengan, 2020). It is also one of the more creative and entertaining methods, and, indirectly, students will pay attention to the teacher's lessons. This is because playing games is innate to the students. Additionally, educational games may encourage the students to enjoy learning, to feel comfortable approaching a variety of difficulties along the way, and to overcome these challenges with focus, self-assurance, and patience, all of which are crucial for higher education in the development of lifelong learners (Liu et al., 2021).

Further, aside from the game-based learning, utilization of graphic organizer in teaching Math is also meaningful if applied. Using graphic organizer has been a proven effective problem-solving strategy for helping young learners think and process information more efficiently by allowing them to both visualize and organize the information they need to solve problems (Russell, 2019). Creativity and careful attention to detail can be greatly enhanced via the use of visual maps—which is exactly what a graphic organizer is. A graphic organizer aids in organizing thought processes as well as creating a framework to collect and compare the information that is being gathered. That is why, in addition to structuring information, organizers can be used to improve students' abilities to comprehend and process that information by seeing it separated into categories of what is more important and what less important (Russell, 2019). Hence, these two strategies if utilized will address the needs of the learners to attain positive learning outcomes in Mathematics.

As one of the interventions implemented in the school by the researcher for learning recovery among learners where learning losses is evident with the result of Mathematics assessment, the researcher is interested in evaluating the effectiveness of games and graphic organizers in improving the performance of the grade 4 learners in Mathematics. A proposed improvement plan was formulated based on the findings of the study.

It is in the rationale that the researcher who is currently a grade 4 teacher in the above mentioned local, would like to delve worthy research undertaking that will benefit herself, the school she is currently teaching and that of her Graduate Program she is enrolled at.

This study evaluates the effectiveness of games and graphic organizers in improving the performance of grade 4 learners in mathematics of San Roque Elementary School, Tanauan II District, Leyte Division for School Year 2023-2024. The findings of the study were the basis for the proposed improvement plan.

Specifically, this study sought to answer the following questions:

1. What is the performance of the grade 4 learners in Mathematics before the utilization of games and graphic organizers?
2. What is the performance of the grade 4 learners in Mathematics after the utilization of games and graphic organizers?
3. Is there a significant difference in the performance of the grade 4 learners in Mathematics before and after the utilization of games and graphic organizers?
4. What improvement plan can be proposed based on the findings of this study?

II. METHODOLOGY

Design. This study utilizes a quasi-experimental research design employing pre-test and post-test assessments to evaluate the impact of games and graphic organizers on the academic performance of Grade 4 learners in mathematics at San Roque Elementary School, Tanauan II District, Leyte Division. The locale, situated in Barangay San Roque, Tanauan, Leyte, encompasses a 0.5-hectare area near the shoreline, embodying a densely populated zone under a government-declared 50-meter "NO BUILD ZONE" limit. The school accommodates 604 learners across 22 classes overseen by 22 teachers and a principal, housed in seven concrete buildings prioritizing child-friendly and safe environments conducive to literacy and numeracy development. Two key projects, Project Pagbasa and Project Pag-ihap, aim to enhance reading and numeracy skills among learners. The study focuses on twenty-eight (28) Grade 4 learners enrolled for School Year 2023-2024, employing a researcher-made Math test aligned with the 4th quarter Most Essential Learning Competencies (MELCs). This 30-item multiple-choice test with problem-solving components serves as the primary assessment tool before and after the intervention using games and graphic organizers in mathematics instruction. Additionally, the researcher will design lesson plans integrating these tools, along with developing corresponding learning materials and activities tailored to the 4th quarter curriculum. All instructional materials will undergo validation by the District Math Coordinator and School Head before implementation, supported by a comprehensive matrix to monitor intervention progress and effectiveness.

Sampling. The respondents for this study were twenty-eight (28) Grade 4 learners enrolled in the mentioned locale for School Year 2023-2024. The study employed complete enumeration in selecting the respondents.

Research Procedure. After the research was approved, data gathering commenced. Letter requests to conduct the study were submitted to the relevant authorities for approval. Initially, a request letter was sent to the Schools Division Superintendent to obtain approval for proceeding with data collection among the identified respondents. Following approval from the SDS, permission letters were also submitted to the Public Schools District Supervisor and the School Principal. Once approval was granted, the researcher proceeded with data collection. An orientation session was conducted for the respondents, and parental consent was obtained to include their children in the study. The pre-test was administered face-to-face during the Math period. Following the pre-test, a four-week intervention was implemented, focusing on teaching Math using games and graphic organizers to develop lesson plans. Post-intervention, a post-test was administered, and responses were collected, tabulated, and submitted for statistical analysis. A Matrix of Activities was prepared by the researcher to monitor the progress of data collection.

Ethical Issues. The researcher properly secured the permission to conduct the study from the authorities through written communication. In the formulation of the intervention materials that was used in the study, the use of offensive, discriminatory, or other unacceptable language was avoided. The respondents' names and other personal data were not included in this study to protect their privacy. Participation of the respondents was also voluntary. Orientation was

conducted for the respondents with their parents. In the orientation, issues and concerns were addressed and consent to be included in the study were signed. The researcher-maintained objectivity in analyzing and discussing the results. All authors whose works were mentioned in this study were properly quoted and were acknowledged in the reference.

Treatment of Data. The quantitative responses underwent tallying and tabulation. Statistical treatment involved applying specific tools: Simple Percentage assessed the performance of Grade 4 learners in Math before and after integrating games and graphic organizers into teaching. Additionally, the t-Test of Mean Difference analyzed significant differences in Grade 4 learners' Math performance pre- and post-implementation of games and graphic organizers in teaching.

III. RESULTS AND DISCUSSION

TABLE 1

PRE-TEST PERFORMANCE OF GRADE 4 LEARNERS IN MATH

Score Range	Description	PRETEST	
		Frequency	%
25-30	Excellent	0	0
19-24	Very Good	0	0
13-18	Good	20	71
7-12	Fair	7	25
1-6	Poor	1	4
Total		28	100
Weighted Mean		13.43	Good

Table 1 presents the pre-test performance of Grade 4 learners in Math, categorizing scores into different ranges with corresponding frequencies and percentages. No learners scored in the "Excellent" or "Very Good" ranges (0% for both), while the majority fell into the "Good" category with 20 students, constituting 71% of the total. Seven students (25%) scored in the "Fair" range, and one student (4%) scored in the "Poor" range. The total number of respondents is 28, representing 100% of the sample. The weighted mean score, calculated as 13.43, falls within the "Good" category, indicating an overall satisfactory performance at the outset of the study. This distribution suggests a baseline level of mathematical competency among Grade 4 learners before the introduction of games and graphic organizers in teaching, which will be further evaluated in the post-test to assess improvement and effectiveness of the intervention. Math skills are important to develop early in life, as they are strong predictors of later academic success (VanDerHeyden & Burns, 2009). These skills, and differences in math achievement are also predictive of differences later in life (Lee, 2013; Parsons & Bynner, 2005). Thus, it is important for children as young as preschool age to begin developing strong math skills. It is also important for teachers and researchers to develop and examine different educational learning activities for students to practice and improve on these skills.

TABLE 2
POST-TEST PERFORMANCE OF GRADE 4 LEARNERS IN MATH

Score Range	Description	POST TEST	
		Frequency	%
25-30	Excellent	14	50
19-24	Very Good	10	36
13-18	Good	4	14
7-12	Fair	0	0
1-6	Poor	0	0
Total		28	100
Weighted Mean		24.29	Very Good

Table 2 illustrates the post-test performance of Grade 4 learners in Math, segmented into score ranges with corresponding frequencies and percentages. In the "Excellent" range (25-30), 14 students achieved this level, comprising 50% of the total. Ten students (36%) scored in the "Very Good" range (19-24), while four students (14%) attained a "Good" score range (13-18). No students scored in the "Fair" or "Poor" categories (7-12 and 1-6, respectively). The total number of respondents remains consistent at 28, representing 100% of the sample. The weighted mean score for the post-test is 24.29, indicating an overall performance categorized as "Very Good." This data suggests a notable improvement in mathematical proficiency among Grade 4 learners following the implementation of games and graphic organizers in teaching, highlighting the effectiveness of the intervention in enhancing their mathematical skills. Game-based learning in education is now one of the major learning trends of the 21st century (Ahmad and Iksan, 2021) and it has received an increasing amount of academic attention in recent years (Zou, 2020). GBL is a mathematics teaching technique that creates a balance between classroom learning and educational games while enhancing the learning efficiency through student-centered learning activities (Lasut and Bawengan, 2020). It is also one of the more creative and entertaining methods, and, indirectly, students will pay attention to the teacher's lessons. This is since playing games is innate to the students. Additionally, educational games may encourage the students to enjoy learning, to feel comfortable approaching a variety of difficulties along the way, and to overcome these challenges with focus, self-assurance, and patience, all of which are crucial for higher education in the development of lifelong learners (Liu et al., 2021).

TABLE 3
TEST OF DIFFERENCE BETWEEN THE SCORES IN THE PRE-TEST AND POST-TEST PERFORMANCES OF GRADE 4 LEARNERS IN MATH

Aspects	Test Scores		Computed T	Critical T	Decision	Interpretation
GRADE 4 Learners in Math	Pre	13.43	2.256	1.108	Reject H ₀	Significant
	Post	24.29				

Table 3 presents the results of the test of difference between the pre-test and post-test performances of Grade 4 learners in Math. It compares the mean scores before and after the intervention of games and graphic organizers in teaching. The pre-test mean score was 13.43, while the post-test mean score significantly increased to 24.29. The

computed t-value was 2.256, surpassing the critical t-value of 1.108 at a significance level of 0.05, leading to the rejection of the null hypothesis (H_0). This indicates a statistically significant improvement in the mathematical performance of Grade 4 learners following the intervention. The findings suggest that the use of games and graphic organizers effectively enhanced the learners' mathematical skills, moving their performance from a "Good" level pre-intervention to a "Very Good" level post-intervention. Games are an effective tool in education for quickening learning, teaching challenging material, and encouraging systemic thinking (Ding et al., 2018). Numbers, algebra, geometry, arithmetic, calculus, problem-solving, and mathematical topics in general are covered. Students, including those in early education, primary school, secondary school, and university, can gain mathematical knowledge and skills through game-based learning. One of the most effective learning strategies is active learning through gamification which allows the students to learn through playing games and using their classes more effectively. Training groups using video games have significantly increased their conceptual and rational amount of knowledge (Mohd et al., 2020).

IV. CONCLUSION

Based on the analysis of the pre-test and post-test performance of Grade 4 learners in Math, it is evident that the implementation of games and graphic organizers resulted in notable improvements. Initially, students demonstrated a "Good" level of performance during the pre-test, which significantly advanced to a "Very Good" level in the post-test phase. This improvement underscores the effectiveness of interactive teaching methods in enhancing students' mathematical skills and understanding. The statistical analysis confirmed these gains were statistically significant, affirming that the intervention positively impacted learning outcomes. These results highlight the importance of innovative instructional approaches in fostering academic progress and competence among students. Future educational strategies could benefit from further exploration and integration of similar effective teaching methodologies to sustain and amplify student achievement in mathematics. Further, with the integration of the innovative activities and materials, learners' attitude towards the subject has changed. They become more active and participative in all the activities provided to them and at the same time enjoy learning.

V. RECOMMENDATIONS

1. Utilize the proposed improvement plan formulated to help the teachers in teaching the subject with more excitement and learning will takes place due to the activities presented while integrating the learning innovation.
2. Teachers must integrate games and graphic organizers in all the activities provided by them to the learners to achieve the desired learning outcomes.
3. School Heads must formulate training design and conduct such to the teachers to acquire knowledge and competencies in teaching math utilizing the integration of games and graphic organizer in the activities presented in the lesson.
4. School Heads must assist and provide technical assistance to the teachers in the formulation of activities with the integration of games and graphic organizer used in the class.
5. School Heads must provide resources and other materials needed to produce learning resources and activities used in the teaching-learning process.
6. Teachers must create a classroom where learners have more activities and materials to work on during teaching-learning process.

7. Instructional supervision must be visible in all teaching and learning encounters and provide appropriate feedback, and
8. Future researchers should replicate this study to include different locales and include different variables aside from the mentioned in this study.

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