

# The Effect of Math Games on Learning Multiplication: Compare Traditional Teaching Vs. Game- Based Learning

<sup>1</sup>Alberto C. Sumaljag III, <sup>2</sup>Mary Jane M. Cabintoy, <sup>3</sup>Maricel L. Engracial, <sup>4</sup>Gervacio C. Veliganio, <sup>5</sup>Maricel B. Suma-Oy, <sup>6</sup>Marilyn M. Miranda

Cebu Technological University

<sup>1</sup>[alberto.sumaljag@deped.gov.ph](mailto:alberto.sumaljag@deped.gov.ph), <sup>2</sup>[maryjane.cabintoy@deped.gov.ph](mailto:maryjane.cabintoy@deped.gov.ph), <sup>3</sup>[maricel.engracial@deped.gov.ph](mailto:maricel.engracial@deped.gov.ph),

<sup>4</sup>[gervacio.veliganio001@deped.gov.ph](mailto:gervacio.veliganio001@deped.gov.ph), <sup>5</sup>[maricel.sumaoy@deped.gov.ph](mailto:maricel.sumaoy@deped.gov.ph), <sup>6</sup>[marilynmiranda1258@gmail.com](mailto:marilynmiranda1258@gmail.com)

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Corresponding Email:

[alberto.sumaljag@deped.gov.ph](mailto:alberto.sumaljag@deped.gov.ph)

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## Index Terms:

math games, multiplication learning, game-based learning, traditional teaching, elementary education, student engagement, Leyte, Philippines

**Abstract.** This study aimed to examine the effectiveness of math games in improving multiplication skills among elementary students compared to traditional teaching methods. Conducted at Albuera North Central School, Poblacion Albuera, Leyte, the research involved 40 Grade 4 students divided into two groups: a control group exposed to traditional instruction and an experimental group exposed to game-based learning. A quasi-experimental design using pre-test and post-test measures was employed over a four-week period. The intervention included structured math games such as flashcard races, multiplication bingo, peer competitions, and simple digital quiz games adapted to classroom conditions. Results indicated that both groups improved after the intervention; however, the experimental group demonstrated significantly higher gains in multiplication accuracy and speed. The mean score increase of the game-based group was 75.8%, compared to 49.6% in the traditional group. Additionally, observational data revealed higher engagement, participation, and motivation among students exposed to game-based strategies. Learners in the experimental group displayed improved confidence, faster recall, and greater willingness to participate in class activities. The findings suggest that integrating interactive and play-based strategies enhances conceptual understanding and retention of multiplication skills. The study concludes that game-based learning is a more effective and engaging approach than traditional teaching methods for elementary mathematics instruction.

## Introduction

Mathematics is a foundational subject that supports the development of logical reasoning, problem-solving skills, and analytical thinking among learners. At the elementary level, multiplication is a critical skill that serves as a building block for more advanced mathematical concepts such as division, fractions, and algebra. However, many students struggle to master multiplication due to its abstract nature and the reliance on memorization-based teaching approaches. Traditional teaching methods in mathematics often involve lectures, repetitive drills, and written exercises. While these approaches can be effective in reinforcing procedural knowledge, they may fail to sustain student interest and engagement. Learners who are not actively involved in the learning process may develop anxiety or negative attitudes toward mathematics, which can hinder their academic progress.

Recent educational trends emphasize the importance of student-centered learning strategies. Game-based learning, in particular, has emerged as a powerful approach for enhancing motivation and engagement. By incorporating elements such as competition, rewards, and immediate feedback, math games create an interactive learning environment that encourages participation and reinforces understanding. Learners are more likely to engage in tasks that are enjoyable and meaningful, leading to improved retention of concepts.

The theoretical foundation of this study is anchored in constructivist learning theory, which posits that learners construct knowledge through active engagement and interaction with their environment. When students participate in games, they are not merely passive recipients of information but active participants in the learning process.

This study aims to compare the effectiveness of traditional teaching methods and game-based learning in teaching multiplication to Grade 4 students at Albuera North Central School. Specifically, it seeks to determine whether math games significantly improve students' multiplication performance, speed, and engagement.

## Methodology

### Research Design

A quasi-experimental research design was utilized in this study. Two groups were formed: a control group exposed to traditional teaching methods and an experimental group exposed to game-based learning strategies.

### Participants

The participants consisted of 40 Grade 4 students enrolled at Albuera North Central School. The students were randomly assigned into two groups of 20 learners each to ensure fairness and minimize bias.

### Research Instrument

A researcher-made multiplication test consisting of 30 items was used as both the pre-test and post-test. The test measured students' accuracy and speed in solving multiplication problems. Additionally, an observation checklist was used to measure student engagement and participation during lessons.

### Procedure

The study was conducted over a four-week period. Both groups were administered a pre-test to determine their initial level of multiplication skills.

- Control Group: Taught using traditional methods such as lectures, drills, and worksheets.
- Experimental Group: Taught using math games including multiplication bingo, flashcard competitions, timed challenges, and group-based activities.

The experimental group participated in structured game sessions integrated into daily lessons. These activities were designed to reinforce multiplication concepts while maintaining student interest. At the end of the intervention, both groups were given a post-test to measure improvement.

### Data Analysis

Mean scores, percentage gains, and comparative analysis were used to evaluate the results. Descriptive statistics were employed to summarize the data, while comparative analysis was used to determine differences between the two groups.

## Results and Discussion

### Results

This section presents the findings of the study based on the analysis of pre-test and post-test multiplication scores, as well as observed student engagement during the four-week instructional intervention. Quantitative results are summarized in the succeeding tables to illustrate differences between traditional teaching and game-based learning approaches.

### Findings

Group	Pre-Test Mean (%)	Post-Test Mean (%)	Mean Difference	Gain %
Control (Traditional Teaching)	12.5	18.7	6.2	49.6%
Experimental (Game-Based Learning)	12.8	22.5	9.7	75.8%

*Legend: Scores are based on a 30-item multiplication test administered before and after the intervention (n = 40). Gain (%) represents percentage increase from pre-test to post-test.*

*Table 1. Pre-test and Post-test Scores of Students*

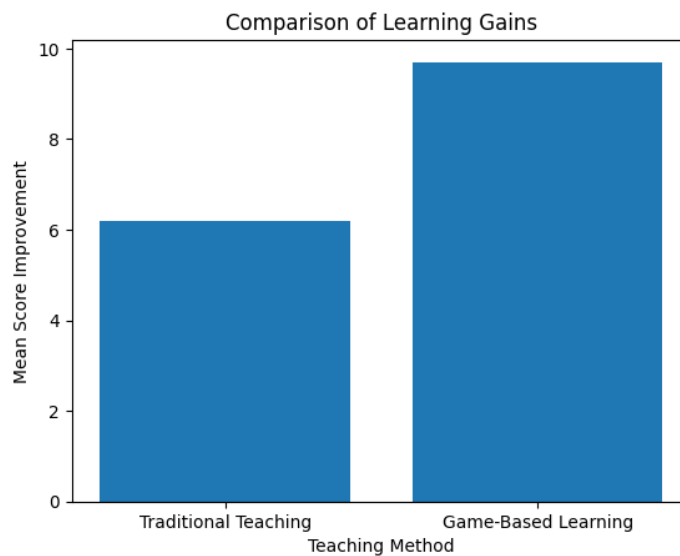
The data show that both groups improved after instruction; however, the experimental group demonstrated a significantly higher increase in scores compared to the control group. This suggests that game-based learning not only enhances accuracy but also accelerates mastery of multiplication concepts compared to traditional approaches.

Group	Engagement Level (Mean)	Participation Rate (%)
Control (Traditional)	3.1	65%
Experimental (Games)	4.6	90%

*Legend: Engagement was measured using a 5-point observation scale (1 = very low, 5 = very high). Participation Rate refers to percentage of students actively involved during sessions.*

*Table 2. Student Engagement and Participation Levels*

Students exposed to game-based learning showed higher engagement and participation during lessons. This indicates that interactive strategies create a more motivating learning environment, leading to sustained attention and active involvement in mathematical tasks.



*Legend: The bar graph represents the mean score improvement (post-test minus pre-test) of students in both groups. The experimental group shows a higher gain, indicating the effectiveness of math games in improving multiplication skills.*

*Figure 1. Comparison of Learning Gains Between Groups*

### Discussion

The findings of the study demonstrate that game-based learning significantly improves multiplication skills compared to traditional teaching methods. The higher gains observed in the experimental group can be attributed to increased student engagement, motivation, and active participation during learning activities.

Game-based learning encourages learners to practice multiplication in a meaningful and enjoyable way. The use of competition, rewards, and collaboration motivates students to participate actively and develop a positive attitude toward mathematics. This aligns with constructivist theory, which emphasizes active learning and knowledge construction.

In contrast, traditional teaching methods, while effective in reinforcing basic skills, may not sufficiently engage learners.

The repetitive nature of drills may lead to boredom and reduced motivation, which can affect learning outcomes.

The results also highlight the importance of incorporating varied teaching strategies to address different learning styles. Visual, auditory, and kinesthetic learners can all benefit from game-based approaches, making it a more inclusive method of instruction.

## Conclusion and Recommendations

The study concludes that math games are an effective tool for teaching multiplication among elementary learners. Game-based learning not only improves academic performance but also enhances student engagement, motivation, and confidence.

Educators are encouraged to integrate math games into their instructional practices to create a more dynamic and learner-centered environment. Future studies may explore the long-term effects of game-based learning on other mathematical concepts.

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## Competing Interests Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

## Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study; all data used were obtained from previously published sources as cited in the reference list.

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## Appendices

No appendices are attached to this study.