

Rolling the Dice on Learning: Utilizing the Bomber Board Game to Improve Mastery of Simple Interest Among HUMSS Grade 11 students at Luis Y. Ferrer Jr. Senior High School

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ABSTRACT

Gamification has emerged as a promising instructional approach for improving student engagement and conceptual understanding in mathematics. This action research examined whether the Bomber Board Game could improve Grade 11 Humanities and Social Sciences (HUMSS) students' mastery of simple interest at Luis Y. Ferrer Jr. Senior High School. Using a one-group pretest-posttest quasi-experimental design, the study involved 40 students from one Grade 11 HUMSS section selected through purposive sampling. A researcher-made 10-item multiple-choice test was used as both the pretest and posttest. The instrument was reviewed by three experts a Master Teacher in Mathematics, a Business Management Master Teacher, and a Research Master Teacher using a validation checklist. Pilot testing indicated that most items had moderate difficulty; one overly difficult item was revised before the actual implementation. The intervention was administered by the researcher once a week for one month, with each session lasting three hours. Descriptive statistics and a paired-samples t-test were used to analyze the data. Results showed that the mean pretest score was 4.00 (40%), while the mean posttest score increased to 7.25 (72.5%). The improvement was statistically significant, $t(39) = 12.27$, $p < .001$, with a very large effect size (Cohen's $d_z = 1.94$). These findings suggest that the Bomber Board Game may be an effective supplementary strategy for improving students' understanding of simple interest. However, the results should be interpreted with caution because the study used a single-group design and did not include a formal test of the normality assumption for the paired-samples t-test.

Keywords: Gamification, Mathematics Education, Bomber Board, Mathematical Concepts, Simple Interest

INTRODUCTION

Engaging and innovative teaching strategies are increasingly necessary in today's educational environment, particularly in subjects that students often perceive as difficult. Mathematics is one such subject, as many learners struggle not only with computation but also with the application of mathematical concepts to real-life contexts. One foundational concept that commonly challenges students is simple interest, which is essential to understanding borrowing, saving, and other everyday financial decisions.

The importance of teaching financial concepts meaningfully is underscored by prior research showing that many young people demonstrate low levels of financial literacy. Limited financial understanding may affect students' ability to make informed decisions in real-life situations. Because simple interest is a basic but practical concept in financial mathematics, improving mastery of this topic may contribute not only to mathematics achievement but also to functional financial literacy (Garg & Singh, 2018; Jayaraman & Jambunathan, 2018; Lalosa, 2020).

Within the Philippine context, financial literacy is also supported by national policy. Republic Act No. 10922, which declares Economic and Financial Literacy Week, and Republic Act No. 10679, which promotes entrepreneurship and financial education among Filipino youth, highlight the need to strengthen learners' financial awareness and practical decision-making skills through education. These policies support the integration of financial concepts into classroom instruction, including in mathematics classes.

At Luis Y. Ferrer Jr. Senior High School, some Grade 11 HUMSS students experience difficulty in mastering simple interest when conventional teaching approaches are used. This concern is consistent with the emphasis of DepEd Memorandum No. 160, s. 2012 on helping learners achieve mastery of essential competencies. When students do not fully grasp foundational concepts, they may struggle to connect mathematical procedures to meaningful and practical situations (Department of Education, 2012).

Game-based learning offers one possible response to this challenge. Prior studies indicate that gamification can increase motivation, engagement, interaction, and retention in educational settings. In mathematics education, classroom games may reduce anxiety, encourage participation, and provide repeated opportunities to apply concepts in a more enjoyable format. Guided by this perspective, the present study introduced the Bomber Board Game as an instructional intervention to help students practice and internalize the computation of simple interest (Bai et al., 2020; Putz et al., 2020; Zainuddin et al., 2020).

The study will be conducted to determine whether the integration of the bomber board game into the learning process can enhance students' comprehension and retention of simple interest concepts of HUMSS Grade 11 students at Luis Y. Ferrer Jr. Senior High School. Specifically, the research seeks to address the following question:

1. What is the pre-test result of the HUMSS 11 students in simple interest?
2. How do students perform in the post test after using bomber board game in teaching simple interest?
3. Is there a significant difference between pre-test and post-test?

THEORETICAL FRAMEWORK

This study is anchored in Jerome Bruner's theory of instruction, which emphasizes the role of active learning, social interaction, and guided discovery in the development of understanding. Bruner argued that learning becomes more meaningful when students are actively involved in constructing knowledge rather than passively receiving information. In the context of mathematics instruction, this perspective supports the use of interactive learning experiences that allow students to explore concepts, discuss strategies, and solve problems collaboratively (Bruner, 1966).

The study is also informed by perspectives on gamification in education. Gamification applies game elements such as challenge, feedback, competition, and rewards to non-game contexts in order to influence motivation and participation. In classroom settings, gamified activities may create a more engaging learning environment, sustain students' attention, and encourage repeated practice. These features are particularly relevant to mathematics learning, where mastery often requires sustained participation, immediate feedback, and multiple opportunities to apply concepts accurately (Bai et al., 2020; Locke & Latham, 2002; Zainuddin et al., 2020).

Taken together, Bruner's theory and the literature on gamification provide a foundation for the use of the Bomber Board Game in teaching simple interest. The intervention was expected to support learning by making the lesson more interactive, socially engaging, and cognitively meaningful for students (Aguilar-Castillo et al., 2021; Bai et al., 2020; Bruner, 1966).

METHODOLOGY

Study design

This study employed a quantitative approach using a one-group pretest-posttest quasi-experimental design. The design involved administering a pretest before the intervention and a posttest after the intervention to the same group of students. The difference between the two sets of scores was used to determine whether students' performance in simple interest improved after exposure to the Bomber Board Game.

Respondents of the Study

The participants of the study were 40 Grade 11 HUMSS students from the same section at Luis Y. Ferrer Jr. Senior High School in General Trias City. The respondents were selected through purposive sampling based on the researcher's identification of learners who needed support in understanding and mastering simple interest. No control group was included in the study.

Data Gathering Procedure

The respondents to the research were purposely chosen. As a purposive sampling, the researcher identified these students from the population of Academic Track HUMSS Grade 11 students enrolled in Luis Y. Ferrer Jr. Senior High School. The researcher developed a validated test by the experts used in the pre-test and post-test.

Research Instrument

The research instrument was a researcher-made 10-item multiple-choice test on simple interest, which served as both the pretest and the posttest. The items were aligned with the targeted learning competencies in General Mathematics. The test was reviewed by three experts: a Master Teacher in Mathematics, a Business Management Master teacher, and a Research Master Teacher. A validation checklist was used to assess the clarity, relevance, and alignment of the items to the lesson objectives.

A pilot test was conducted before the actual implementation of the study. The pilot testing results showed that most items had a moderate difficulty level, indicating that the test was appropriate for the learners. However, Item 8 was found to be too difficult because only one student answered it correctly. This item was therefore revised prior to the actual administration. The pilot test also suggested that the items were understandable and aligned with the intended learning competencies.

Intervention and Data Gathering Procedure

The study was conducted in three phases. In the first phase, the researcher administered the pretest to establish the students' baseline performance in simple interest. In the second phase, the Bomber Board Game was used as the instructional intervention. The intervention was administered by the researcher once a week for one month, with each session lasting three hours. During these sessions, students engaged in game-based activities designed to reinforce the concepts and procedures involved in solving simple-interest problems. In the third phase, the posttest was administered to determine changes in student performance after the intervention.

Statistical Treatment of the Study

Descriptive statistics, including mean scores and mean percentage scores, were used to summarize student performance in the pretest and posttest. To determine whether the difference between the two sets of scores was statistically significant, a paired-samples t-test was used at the .05 level of significance. The paired-samples t-test was selected because the same group of students took both the pretest and the posttest (Pallant, 2020).

Formula:

$$t = \frac{\bar{d}}{s_d/\sqrt{n}}$$

Where:

\bar{d} = Mean of the difference of pretest and post test

s_d = Standard deviation of the difference

n = number of samples

formal assumption test for the normality of the difference scores was not conducted prior to the analysis. Therefore, the results of the t-test should be interpreted with caution and understood within the methodological limits of the study.

Ethical Considerations

Ethical considerations were observed throughout the conduct of the study. Permission to conduct the research was secured from the school authorities. Participation was carried out with appropriate consent and assent procedures, and the identities of the student participants were kept confidential. The data gathered were used solely for academic and research purposes.

RESULTS AND DISCUSSION

What is the pre-test result of the HUMSS 11 students in simple interest?

Table 1 Student Respondents Mean Score in the Pretest Results.

Student Respondents	Pre-Test Average	Mean Percentage Score
HUMSS	4.00	40%

The Grade 11 HUMSS students obtained a mean pretest score of 4.00 out of 10, which corresponds to a mean percentage score of 40%. This result indicates that, prior to the intervention, students had limited mastery of simple interest. The low baseline performance suggests that the topic was indeed an area of difficulty for the participants and that an instructional intervention was warranted.

How do students perform in the post-test after using bomber board game in teaching simple interest?

Table 2 Student Respondents Mean Score in the Post test Results.

Student Respondents	Post Test Average	Mean Percentage Score
HUMSS	7.25	72.5%

After the implementation of the Bomber Board Game, the students obtained a mean posttest score of 7.25 out of 10, equivalent to a mean percentage score of 72.5%. Compared with the pretest result, this score reflects a notable increase in students' performance. The posttest result suggests that the intervention may have supported students in improving their understanding of simple interest and moving toward mastery of the topic.

Is there a significant difference between the pre-test and post-test?

Table 3 Paired Sample T-Test Results Comparing Pre-test and Post test Scores

Group	Mean	SD	t	df	p
Pre-test	4.00	1.32		39	
Post-test	7.25	1.10	12.27	39	< .001

The paired-samples t-test showed that the difference between the pretest and posttest scores was statistically significant, $t(39) = 12.27$, $p < .001$. The mean score increased by 3.25 points from pretest to posttest, indicating substantial improvement after the intervention. Based on the reported test statistic and sample size, the effect size was very large (Cohen's $d_z = 1.94$), which suggests that the magnitude of the observed change was not only statistically significant but also educationally meaningful.

DISCUSSION

The findings indicate that the use of the Bomber Board Game was associated with improved student performance in simple interest. The increase from a mean score of 4.00 in the pretest to 7.25 in the posttest suggests that students developed a stronger grasp of the concept after participating in the game-based intervention. While the numerical improvement is important, the value of the intervention may be better understood by considering the learning processes that the board game likely supported (Aguiar-Castillo et al., 2021; Putz et al., 2020).

First, the Bomber Board Game may have increased students' engagement and sustained attention during instruction. Unlike conventional lecture-based methods, board games can provide a structured but enjoyable environment in which students repeatedly encounter the target concept. This repeated exposure may have strengthened students' procedural understanding of how to compute simple interest. In addition, the game format may have helped reduce boredom and encouraged active participation, which are both important for learning in mathematics (Bai et al., 2020; Zainuddin et al., 2020).

Second, the intervention may have supported learning through interaction and immediate feedback. As students played the game, they likely discussed strategies, checked answers, and corrected mistakes in real time. These processes are consistent with Bruner's view that learning is enhanced through active discovery and social interaction. The Bomber Board Game may therefore have functioned not only as a motivational tool but also as a scaffold for understanding, allowing students to connect formulas and computations to classroom tasks in a more concrete and memorable way (Bai et al., 2020; Bruner, 1966).

Third, the game-based approach may have enhanced retention by embedding practice in a meaningful and enjoyable activity. An anecdotal classroom remark from one student "enjoyable at mas mabilis natandaan ang pagkuha ng simple interest" suggests that the intervention may have made the topic easier to remember. Although this statement was not gathered through a formal qualitative procedure and should therefore be interpreted cautiously, it provides a useful classroom-based insight into how students may have experienced the activity. This interpretation is also broadly consistent with studies linking well-designed gamified learning to stronger knowledge retention and more positive learning experiences (Aguiar-Castillo et al., 2021; Putz et al., 2020).

The findings also align with the broader idea that innovative instructional strategies can support students' movement toward mastery of essential competencies. The posttest mean percentage score of 72.5% shows clear progress relative to the baseline score of 40%, even though mastery was not yet complete. This implies that the Bomber Board Game may be a helpful supplementary instructional tool for teaching simple interest, particularly for learners who need additional motivation and practice (Department of Education, 2012).

However, the results should not be interpreted as definitive proof that the intervention alone caused the observed improvement. Because the study used a one-group pretest-posttest design without a control group, other factors such as repeated exposure to the topic, teacher support, or test familiarity may also have contributed to the gain in scores. Even so, the magnitude and direction of the results suggest that the Bomber Board Game has potential as a classroom strategy worthy of further investigation.

CONCLUSION

The study found that Grade 11 HUMSS students performed better in the posttest than in the pretest after the use of the Bomber Board Game in teaching simple interest. The difference between the two sets of scores was statistically significant, and the effect size indicated a strong improvement in performance. These findings suggest that the Bomber Board Game may be an effective supplementary instructional strategy for improving students' understanding of simple interest.

Nevertheless, the conclusions of the study should be interpreted cautiously. Because the research employed a one-group pretest-posttest design, did not include a control group, and did not formally test the normality assumption for the paired-samples t-test, causal claims should be avoided. The results are best understood as evidence that the intervention was associated with improved performance in this particular group of learners.

RECOMMENDATION

Teachers may consider using game-based instructional materials such as the Bomber Board Game when teaching mathematics topics that students often find challenging, especially when the goal is to increase engagement and repeated practice.

Curriculum developers and school-based learning action cells may provide training on the design, adaptation, and classroom use of gamified learning materials in mathematics and related subjects.

School administrators may support the development and use of contextualized game-based resources as part of instructional improvement efforts.

Future researchers are encouraged to replicate the study using larger samples, longer intervention periods, and a control or comparison group in order to strengthen the evidence for effectiveness. Future studies may also include delayed posttests to examine retention over time and formal qualitative data to better understand learners' experiences.

LIMITATIONS OF THE STUDY

Several limitations should be acknowledged in interpreting the findings of this study. First, the research employed a one-group pretest-posttest design without a control group; therefore, the observed improvement in students' performance cannot be attributed solely to the intervention with complete certainty. In addition, the participants were selected through purposive sampling and were drawn from only one Grade 11 HUMSS section in a single school, which limits the generalizability of the findings to other contexts, grade levels, or student populations. The relatively small sample size ($n = 40$) and the short intervention period of one month also restrict the extent to which the results may reflect the sustained effectiveness of the Bomber Board Game.

Another limitation is that the study did not include a delayed posttest; thus, it was not possible to determine whether the gains in performance were retained over time. Furthermore, the instrument used in the study was researcher-made. Although it was reviewed by experts and pilot-tested, additional psychometric evidence, such as reliability coefficients, was not reported. Finally, the normality of the difference scores was not formally tested prior to the use of the paired-samples t-test, and this should be considered when interpreting the statistical results.

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