Enhancing Numeracy Level of Grade 8 Students Using Trading Board: An Experimental Study

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Abstract

The study investigated the effectiveness of trading board utilization in enhancing the numeracy levels of Grade 8 students at Southern Samar National Comprehensive High School. It employed a quasi-experimental research design involving two groups of participants: a control group and an experimental group, with 32 students assigned to each group. The experimental group was exposed to the use of a trading board as an instructional material during mathematics class discussions for approximately three months. Meanwhile, the control group was taught using the traditional lecture-based method commonly practiced in the classroom. To measure the numeracy level of the participants, the researcher administered a standardized test questionnaire as both the pre-test and post-test. The data collected were analyzed using frequency, percentage, mean scores and t-tests for both independent and dependent samples at a 0.05 level of significance. The pre-test results revealed no significant difference between the numeracy levels of the control and experimental groups, indicating that the two groups were comparable before the intervention. After the three-month implementation period, the post-test results showed a significant difference between the two groups. The experimental group achieved a higher mean score compared to the control group. These findings indicate that the use of trading boards as instructional material in teaching Mathematics 8 is effective in enhancing students' numeracy levels compared to the traditional lecture method. Therefore, the study recommends the integration of trading boards in mathematics instruction to improve learners' numeracy development.

Keywords: Numeracy level; Trading board; Grade 8 students; Quasi-experimental study

1. Introduction

Mathematics education has long been recognized as an important element in shaping an individual's intellectual development (Yuanita et al., 2018; Rahmawati, 2017). It provides an effective way of building individual's reasoning, abstract, analytical, logical, and critical thinking skills, and problem-solving ability. At the secondary level, mathematics plays a crucial role in strengthening students' reasoning and proof skills, which are fundamental components of the discipline (Otten et al., 2021). Moreover, proficiency in mathematics has been identified as a strong indicator of students' overall academic achievement (Pellissier, 2018).

However, despite the recognized importance and wide application of mathematics in everyday life, many secondary school students struggle to appreciate its relevance and usefulness for their future studies and careers. This issue has become a persistent concern in mathematics education (Fitzmaurice et al., 2021). In fact, the study conducted by Mujtaba et al. (2014) revealed that secondary school students tend to view mathematics less favorably compared to other academic subjects. Students often perceive mathematics as

dull, boring, and lacking relevance to real-life situations, preventing them from achieving their full potential in mathematics. Furthermore, Layug et al. (2021) emphasized that many students find mathematics extremely difficult to learn and understand due to factors such as ineffective teaching strategies, lack of interest, and limited opportunities to apply mathematical concepts in meaningful contexts.

The 2018 Programme for International Student Assessment (PISA) indicated that the Philippines ranked second from the lowest out of 79 participating nations worldwide. This merely implies that the students' mathematics abilities are poor in the Philippines (Layug et al., 2021) and the number of non-numerates are increasing (Gigante, 2020). The Trends in International Mathematics and Science Study (TIMSS) in 2019 also reported that only 19% of grade learners in the Philippines met the minimum benchmark level required in Math (Department of Education, 2022). Meanwhile, the World Bank report released in 2021 pointed out that Filipino students ranked low in the multilateral lender's learning assessment in math, science, and reading (Yang, 2022).

Moreover, the result of the Regional Unified Numeracy Test in the Region VIII intended for Grades 3 to 10 learners which aimed to measure the learners' competencies on the four fundamental operations in Mathematics (Addition, Subtraction, Multiplication, and Division) revealed a bigger percentage of learners with moderate numeracy level to non-numerates which suggest of providing enrichment and intervention from the teachers. Thus, numeracy level among learners is one of prime concerned issues right now in the Philippines' educational arena.

To address the persistent poor performance of learners in mathematics, the Department of Education (DepEd) has implemented several academic interventions aimed at improving the mathematical literacy of Filipino students who experience difficulties in learning mathematical concepts. One of these initiatives is outlined in DepEd Memorandum No. 39, s. 2012, which encourages secondary schools to design and implement programs and interventions that address learning deficiencies among students (Briones et al., 2021).

In the Schools Division of Eastern Samar, one of the recent interventions introduced to enhance students' numeracy skills is the use of a trading board in teaching mathematics. Selected mathematics teachers were trained on the proper utilization of the trading board and were encouraged to integrate this instructional material into their classroom instruction. The implementation of this intervention aims to support learners in developing stronger numeracy skills and improving their overall performance in mathematics. As emphasized by Machera (2017), effective interventions not only enhance students' academic development but also help strengthen students' confidence and motivation. This underscores the importance of selecting effective and appropriate mathematical interventions.

Several studies have examined the effectiveness of instructional interventions in improving learners' mathematical literacy (Briones et al., 2021; Ramadhani & Fitri, 2021; Layug et al., 2021). However, limited research has been conducted on the effectiveness of the trading board intervention in developing learners' numeracy levels. Therefore, investigating this intervention is significant for the DepEd, particularly in the Division of Eastern Samar, as the findings may inform instructional practices and guide the development of policies aimed at improving students' numeracy skills.

Therefore, the study aimed to examine the effectiveness of trading board in the development of numeracy level of Grade 8 students. Specifically, this study sought to answer the following questions: (1) What is the numeracy level of control and experimental groups before and after the experiment?; (2) Is there a significant difference between the pre-test scores of the control group and experimental group?; (3) Is there a significant difference between the pre-test and post-test scores of the control group?; (4) Is there a significant difference between the pre-test and post-test scores of the experimental group?; and (5) Is there a significant difference between the post-test scores of the control group and experimental group?

2. Methodology

The study employed a quasi-experimental design using a before–after two-group approach, with two pre-existing sections of students assigned as the control and experimental groups. The control group was taught using the traditional lecture method without the use of a trading board, while the experimental group received instruction through the lecture method integrated with the trading board. Both groups were given the same pre-test to assess their initial numeracy levels, followed by the same post-test after the intervention to measure any changes in performance. A standardized numeracy test questionnaire, adopted from the Department of Education (DepEd), was used for both assessments.

The study was conducted for approximately three months at Southern National Comprehensive High School (SSNCHS), a public secondary school located in the Municipality of Balangiga, Eastern Samar, Philippines. The participants in the study were the Grade 8 students of SSNCHS. Both the control and experimental groups consisted of not less than 30 samples (Fraenkle & Wallen, 1993). The collected data were analyzed using descriptive statistics such as frequency, percentage, mean scores, as well as inferential statistics, particularly t-tests for independent and dependent samples, with a significance level of 0.05 to determine the effectiveness of the intervention.

3. Results and Discussion

3.1 Numeracy Level of Control and Experimental Groups Before the Experiment

Table 1
Numeracy Level of Control and Experimental Groups Before the Experiment

Numeracy Level	Frequency	Percentage
Control Group		
Moderately Numerate	4	12.50
Non-Numerate	28	87.50
Total	32	100.00
Experimental Group		
Moderately Numerate	6	18.75
Non-Numerate	26	81.25
Total	32	100.00

Table 1 presents the numeracy level of control and experimental groups before the experiment. In the control group, out of 32 participants, 28 or 87.50% were classified as non-numerate, while only 4 or 12.50% were moderately numerate. Similarly, in the experimental group, 26 or 81.25% were non-numerate, with 6 or 18.75% falling under the moderately numerate category. These results highlight the prevalence of students with low numeracy skills who struggled with one or more of the four fundamental mathematical operations

prior to the experiment. Furthermore, the prevalence of low numeracy skills underscores the significant need for instructional support in foundational mathematics, emphasizing the importance of implementing interactive and hands-on approaches, such as the trading board, to enhance students' understanding.

3.2 Numeracy Level of Control and Experimental Groups After the Experiment

Table 2
Numeracy Level of Control and Experimental Groups After the Experiment

Numeracy Level	Frequency	Percentage
Control Group		
Highly Numerate	21	65.63
Moderately Numerate	11	34.37
Total	32	100.00
Experimental Group		
Highly Numerate	25	78.13
Moderately Numerate	7	21.87
Total	32	100.00

Table 2 presents the numeracy levels of the control and experimental groups after the intervention. In the control group, 21 or 65.63% of the participants were classified as highly numerate, while 11 or 34.37% were categorized as moderately numerate. On the other hand, the experimental group demonstrated a higher proportion of highly numerate students, with 25 or 78.13% of the participants reaching this level, and only 7 or 21.87% categorized as moderately numerate. These results indicate that both groups experienced improvements in numeracy levels after the study period. However, it can be noted that the experimental group, which received instruction with the integration of the trading board, showed a greater increase in the number of highly numerate students compared to the control group.

3.3 Pre-Test Mean Scores of Control and Experimental Groups

A pre-test was given to both the experimental and control groups during the first week of class using the test questionnaire adopted from DepEd. The pre-test was given to determine or measure the initial numeracy level of the participants. The pre-test contains questions on addition, subtraction, multiplication, and division, which were answered by the participants within 12 minutes. The result of the pre-test is presented in Table 3.

Table 3
Difference Between the Pre-Test Mean Scores of the Control and Experimental Groups

Group	Mean Score	t - value	p-value	Interpretation
Control	5.08	0.072	0.943	Not Significant
Experimental	5.03			

As reflected in Table 3, the control group obtained a slightly higher mean score of 5.08 on the pre-test, compared to the experimental group, which had a mean score of 5.03. However, a more detailed analysis using a t-test for independent samples, the study revealed no significant difference in the mean scores between the two groups, with a t-value of 0.072 and a p-value of 0.943. This result implied that both groups were comparable in their numeracy level. The similarity in their pre-test results suggested that the two groups possessed almost the same level of skills in performing the four fundamental operations of mathematics. Thus, both groups started on an equal footing.

According to Creswell and Creswell (2023), the assumption that the groups are equivalent at baseline is essential in experimental research designs to ensure valid comparison. In addition, establishing group equivalence before treatment helps control for confounding variables, thereby improving the internal validity of the study (Fraenkel et al., 2021) and ensuring that observed learning gains reflect the true effect of the intervention (Gay et al., 2022).

3.4 Pre-Test and Post-Test Mean Scores of Control Group

Table 4 shows the comparison between the pre-test and post-test mean scores of the control group, which received instruction through the traditional teaching method without trading board.

Table 4
Difference Between the Pre-Test and Post-Test Mean Scores of the Control Group

Scores	Mean Score	t - value	p-value	Interpretation
Pre-Test	5.08	7.933	<0.001	Significant
Post-Test	7.50			

The reflected data revealed that the group's mean score increased from 5.08 in the pre-test to 7.50 in the post-test. The computed t-value of 7.933 with a p-value < 0.001 indicated that this difference was statistically significant at the 0.05 level of significance. This result suggested that the control group demonstrated a significant improvement in performance after the instructional period. Even though the traditional teaching approach was applied, it still led to meaningful learning gains. Students were able to acquire skills in performing the four fundamental operations which enhances their numeracy level through consistent practice, reinforcement, and teacher-led explanations.

The Innova Design Group (2023) argued that despite the existence of several modern teaching methods in teaching, the traditional style method is still productive, effective, and useful in today's education. Slavin (2021) highlighted that learning occurs regardless of instructional approach, if lessons are systematically delivered and students are actively engaged in the process. In support, Ormrod and Jones (2022) emphasized that traditional instruction, when effectively implemented, can still yield positive learning outcomes by promoting familiarity with concepts and step-by-step problem solving.

3.5 Pre-Test and Post-Test Mean Scores of Experimental Group

Table 5 presents the comparison between the pre-test and post-test mean scores of the experimental group, which received instruction through the lecture method integrated with the trading board

Table 5
Difference Between the Pre-Test and Post-Test Mean Scores of the Experimental Group

Scores	Mean Score	t - value	p-value	Interpretation
Pre-Test	5.03	10.156	<0.001	Significant
Post-Test	8.42			

As reflected in the table, the mean score increased remarkably from pre-test mean scores of 5.03 to post-test mean scores of 8.42, demonstrating a solid improvement in the experimental group's performance.

Testing further the result of the study using t-test for dependent samples, the study revealed that the difference between the pre-test and post-test mean scores was statistically significant with a t-value of 10.156 and p-value of <0.001. This means that the improvement in the scores was not due to chance but rather to the effectiveness of the intervention used in teaching the experimental group. Thus, the use of trading boards enhances numeracy level.

The results of the study are supported by Hidayah et al. (2021), who emphasized that when teachers use manipulatives in the classroom to introduce, practice, or remediate mathematical concepts, these materials provide a strong foundation that promotes critical thinking and encourages students to take ownership of their learning. Furthermore, Pouw et al. (2014) explained that when students interact with manipulatives, their reasoning processes become focused on the objects they are handling. Through this interaction, students can explore ideas, construct meaning, and develop a deeper understanding of mathematical concepts. Thus, the use of manipulatives plays an important role in facilitating student learning, as the opportunity to physically manipulate instructional materials can significantly enhance learners' comprehension and engagement in mathematics.

3.6 Post-Test Mean Scores of Control and Experimental Groups

After 3 months of teaching the control group and experimental group, the researchers conducted post-tests. Both groups were tested using the same instrument utilized in the pre-test.

Table 6
Difference Between the Post-Test Mean Scores of the Control and Experimental Groups

Group	Mean Score	t - value	p-value	Interpretation
Control	7.50	1.436	0.047	Significant
Experimental	8.42			

It can be noted from Table 6 that control group obtained a mean score of 7.50, while the experimental group achieved a substantially higher mean score of 8.42. The computed t-value of 1.436 and p-value of 0.047, which is below the 0.05 level of significance, indicated that the difference between the two groups' post-test scores was statistically significant. This implied that the learners who were exposed to the trading board performed significantly better than those who received traditional instruction without trading board. Furthermore, the marked improvement of the experimental group suggested that the instructional strategy applied was more effective in enhancing numeracy level compared to conventional lecture-based teaching. The significant gap between the two groups further supports the conclusion that the intervention contributed meaningfully to improving students' mathematical achievement and numeracy level.

The findings of the study are corroborated by Blanco et al. (2026) and Abarquez (2020), who reported that students instructed with manipulatives achieved significantly higher post-test scores than those in the control group who received traditional instruction, highlighting the effectiveness of hands-on materials in enhancing conceptual understanding. In support, Carbonneau et al. (2013) emphasized that instructional strategies that use manipulatives (like trading boards) can be effective because of physical enactment. The use of manipulatives in teaching mathematics may increase students' retention because the encoding and subsequent retrieval of target information may occur via nonverbal coding or a motoric channel, as concretized in the same study.

4. Conclusions and Recommendations

Based on the findings of the study, the researchers conclude that utilization of trading boards enhances numeracy level of Grade 8 students. The experimental group outperformed the control group, indicating higher numeracy level among learners exposed to trading board. The results conform the effectiveness of manipulatives in enhancing mathematical conceptual understanding. Thus, the researchers strongly recommend the use of trading boards in teaching Mathematics 8 as instructional material to improve mathematics achievement and student engagement.

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