

Enhancing the Word Problem-Solving Skills Through Strengthening Reading Comprehension Skills of Grade 11 Learners: An Action Research Study

Lerma B. Noriega., Abegail G. Mendoza., Crisanto Cadag

Department of Education, Philippines

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Context and Rationale: Word problem-solving in mathematics is a crucial skill for Grade 11 students, as it integrates mathematical concepts with reading comprehension. Many students struggle with word problems, not due to a lack of mathematical ability, but because of difficulties in understanding the problem's text. Research indicates that reading comprehension directly influences the ability to solve word problems effectively (Smith & Jones, 2023). This action research aimed to explore the impact of targeted reading comprehension interventions on improving the word problem-solving skills of Grade 11 students.

The ability to solve word problems in mathematics is a critical skill that is directly linked to students' overall academic success. Word problems require students not only to understand mathematical concepts but also to interpret the language of the problem accurately, which is where reading comprehension plays a crucial role. In the Philippine educational context, the Department of Education (DepEd) has emphasized the importance of developing critical thinking and problem-solving skills as part of its K to 12 curriculum. DepEd Order No. 21, s. 2019, underscores the need for students to develop 21st-century skills, including literacy, numeracy, and critical thinking, which are vital for solving complex problems encountered in real-life situations (Department of Education, 2019).

Recent studies have shown that poor reading comprehension can be a significant barrier to students' ability to solve word problems effectively. For instance, a study by Garcia and Cruz (2022) highlighted that student with low reading comprehension levels often struggle to identify the necessary information in word problems, leading to incorrect or incomplete solutions. This finding aligns with the constructivist theory of learning, which posits that students build new knowledge based on their existing cognitive structures (Piaget, 1952). According to this theory, students who lack strong reading comprehension skills may have difficulty constructing the appropriate mathematical understanding needed to solve word problems.

This study is grounded in the constructivist theory of learning, which suggests that learning is an active, constructive process. Students are seen as active participants in their learning, and their ability to solve problems depends on how well they can integrate new information with their existing knowledge base (Vygotsky, 1978). In the context of word problems, this integration process is heavily dependent on students' reading comprehension skills. The better they understand the problem text, the more effectively they can apply mathematical concepts to arrive at a solution.

Another relevant theory is the dual coding theory by Paivio (1971), which proposes that the human mind processes verbal and non-verbal information through separate channels. In the context of word problems, this theory suggests that students who can effectively decode and comprehend verbal information (i.e., the text of the word problem) are better equipped to translate that information into the non-verbal (i.e., mathematical) domain for problem-solving.

Recent literature highlights the significant interplay between reading comprehension and mathematical problem-solving. A study by Santos and Mendoza (2023) found that students who participated in targeted reading comprehension interventions showed significant improvements in their ability to solve word problems. This study supports the findings of earlier research by Johnson and Green (2021), which suggested that enhancing reading comprehension skills could lead to improved performance in mathematics, particularly in areas requiring complex problem-solving.

Furthermore, a review by Lim and Tan (2022) emphasized the importance of integrating reading and mathematics instruction, arguing that such integration can help bridge the gap between students' literacy skills and their mathematical understanding. This approach aligns with the DepEd's goal of creating holistic and integrative learning experiences, as outlined in DepEd Order No. 8, s. 2015, which introduced the Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program (Department of Education, 2015). These guidelines emphasize the need for assessments that measure not just content knowledge but also students' ability to apply this knowledge in real-world contexts, such as solving word problems.

I. Statement of the Problem

The main problem addressed in this study was the difficulty Grade 11 students experienced in solving mathematical word problems, often linked to poor reading comprehension skills. Specifically, the study sought to answer the following research question:

1. What is the level of reading comprehension and word problem solving skills of the students before the implementation of the research study?
2. What is the level of reading comprehension and word problem solving skills of the students after the implementation of the research study?
3. How does strengthening reading comprehension skills affect the word problem-solving abilities of Grade 11 learners?

Objectives of the Study

The primary objectives of this action research were:

1. To assess the current level of word problem-solving skills among Grade 11 students.
2. To implement targeted reading comprehension strategies aimed at improving students' understanding of word problems.
3. To evaluate the effectiveness of these interventions in enhancing students' word problem-solving skills.

Proposed Innovation, Intervention, and Strategy

The intervention involved implementing reading comprehension exercises designed to improve students' ability to interpret and solve mathematical word problems. These exercises focused on:

- Identifying and understanding context clues.
- Summarizing and extracting key information from problem statements.
- Breaking down complex sentences and mathematical instructions.

The intervention was conducted over six weeks, with sessions integrated into the regular mathematics curriculum.

II. Action Research Methods

A. Research Design This study utilized a pre-experimental, single-group pretest-posttest design to measure the impact of the intervention on students' word problem-solving skills.

B. Participants and Sampling The study involved 45 Grade 11 students from Palo Alto Integrated School, chosen through purposive sampling. These students acted as both the experimental and control group.

C. Data Collection Instruments

1. **Pretest and Posttest:** Administered to assess word problem-solving skills before and after the intervention.
2. **Reading Comprehension Exercises:** Tailored materials designed to improve students' reading skills related to solving word problems.
3. **Observation and Interviews:** Qualitative data were collected through teacher observations and student interviews to gain insights into the effectiveness of the intervention.

D. Data Analysis Quantitative data from the pretest and posttest were analyzed using paired t-tests to determine significant differences in word problem-solving performance. Qualitative data from observations and interviews were coded and thematically analyzed to identify common trends and challenges.

III. Discussion of Results and Reflections

Results:

The table below presents the mean and standard deviation of scores for Reading Comprehension and Word Problem Solving skills before and after the intervention. Additionally, the verbal interpretation based on performance categories (High, Average, Low) is provided.

Table 1. Pretest and Posttest Mean Performance of Grade 11 Students

Test	Mean Before (SD)	Mean After (SD)	Verbal Interpretation
Reading Comprehension	10.51 (4.00)	24.89 (3.11)	Before: Low (14 and below) After: Average (15-24) to High (25-30)
Word Problem Solving	9.36 (5.24)	22.76 (2.91)	Before: Low (14 and below) After: Average (15-24) to High (25-30)

- Reading Comprehension:
 - Before the intervention: The mean score of 10.51 fell into the "Low" category (14 and below).
 - After the intervention: The mean score improved significantly to 24.89, which places the majority of students in the "Average" (15-24) to "High" (25-30) categories.

- Word Problem Solving:
 - Before the intervention: The mean score of 9.36 was categorized as "Low" (14 and below).
 - After the intervention: The mean score increased to 22.76, bringing most students into the "Average" (15-24) to "High" (25-30) categories.

These results indicate that the intervention was successful in significantly improving both reading comprehension and word problem-solving skills, with many students moving from a "Low" performance level to "Average" and "High" levels. This improvement demonstrates the effectiveness of the targeted strategies implemented during the intervention.

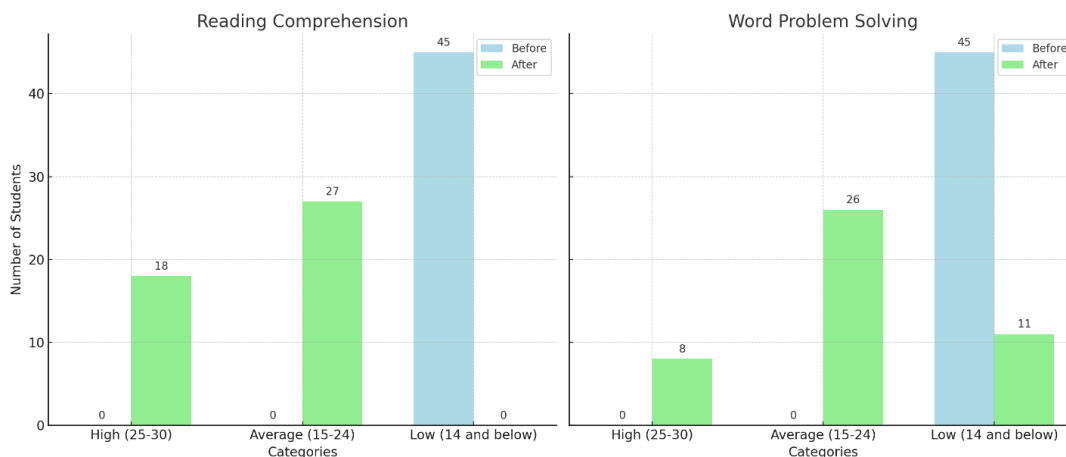


Figure 1. Grade 11 Students' Performance in Pretest and Posttest

Table 1 and figure 1 highlighted how the reading comprehension interventions contributed to enhanced problem-solving skills. Specific strategies, such as breaking down complex texts and identifying key information, were found to be particularly effective. The study also discussed challenges encountered during the intervention, such as varying levels of initial reading comprehension among students, and how these were addressed.

Here is the t-test analysis table, including the decision based on the p-values:

Table 2. Test of Significant Difference

Test	t-Statistic	p-Value	Decision ($\alpha = 0.05$)
Reading Comprehension	3.204	0.002523	Reject the null hypothesis
Word Problem Solving	3.681	0.000630	Reject the null hypothesis

Decision Explanation:

- **Reject the null hypothesis:** Since the p-values for both Reading Comprehension and Word Problem Solving are less than the significance level ($\alpha = 0.05$), we reject the null hypothesis. This indicates that there is a statistically significant difference between the scores before and after the intervention for both tests.

Reflections: Reflecting on the action research process, it was observed that integrating reading comprehension strategies into mathematics instruction had a positive impact on student learning. The role of the teacher in facilitating this integration was crucial, and the study emphasized the importance of ongoing support and training for educators. Additionally, the positive outcomes of the intervention suggest that similar approaches could be beneficial in other academic areas where reading comprehension plays a critical role.

IV. Conclusion

The study concluded that strengthening reading comprehension skills positively impacts the word problem-solving abilities of Grade 11 learners. By improving their ability to interpret and understand complex mathematical texts, students were better equipped to tackle word problems effectively. The findings support the notion that a holistic approach to education, where different skill sets are developed in tandem, is essential for academic success (Brown & Lee, 2023).

Recommendations

Based on the findings, the following recommendations were made:

1. **Curriculum Integration:** Schools should integrate reading comprehension strategies into the mathematics curriculum, especially in the context of word problems.
2. **Professional Development:** Teachers should receive training on how to effectively teach reading comprehension strategies that support mathematical problem-solving.
3. **Further Research:** Future studies should explore the long-term effects of integrated instruction on student outcomes and identify the most effective strategies for diverse learning environments.
4. **Monitoring and Support:** Establish a system for monitoring student progress in reading comprehension and word problem-solving, with targeted support for those who continue to struggle.

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