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Enhancing Grade 7 Learners' Problem-Solving Skills Through Literacy-Integrated Explicit Teaching in Mathematics

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ABSTRACT

This research aimed to assess the impact of demonstration-based explicit teaching on improving the word problem-solving abilities of Grade 7 students at Cataingan National High School. The issue addressed was students' ongoing struggle with solving mathematical word problems, often linked to poor reading comprehension and a limited ability to interpret problem frameworks. The initiative sought to incorporate literacy techniques into math instruction to enhance students' understanding and analytical skills . A one-group pretest-posttest design that was pre-experimental was utilized. The research included 28 Grade 7-Kunzite students, each of whom took a pretest to evaluate their fundamental word problem-solving abilities. The intervention employed a novel, demonstration-focused teaching approach that emphasized organized, straightforward instruction using the "I Do, We Do, You Do" technique. Lessons were designed to integrate reading comprehension strategies and engaging activities to aid in problem interpretation and metacognitive insight. After the intervention, a posttest was administered . Data were analyzed using Jamovi, and the Shapiro-Wilk test confirmed that the pretest and posttest scores followed a normal distribution. The paired sample t-test revealed a statistically significant improvement in students' scores (t = 4.25; p < .001), indicating that the intervention positively impacted their performance in solving word problems. The results showed that incorporating literacy through direct instruction not only improved understanding but also helped students in grasping and addressing complex word problems. The findings affirmed that organized, student- centered teaching methods could effectively connect literacy and mathematics education. This research concluded that the demonstration-based explicit teaching method offered a promising strategy for enhancing the problem-solving skills of struggling learners and should be considered in similar educational contexts .

Keywords: Integrating literacy, Word problem solving, Problem-solving skills, Explicit teaching approach, and Comprehension.

1.Introduction

The integration of literacy into Mathematics instruction had become increasingly recognized as a method to improved students' comprehension and problem-solving. According to Verschaffel, Greer, and De Corte (2000), many students encounter difficulties in solved mathematical word problems not because of a lack of mathematical skill, but due to poor understood of the language and structure of the problems. Word problems require both linguistic and analytical skills, and students who was unable to decode the narrative or interpret key information was at a disadvantage. Students at Cataingan National High School struggled significantly with problem-solving in mathematics, looking for more student-centered approach teaching. Students who exhibit strong reading comprehension skills often outperform their peers in solving contextual mathematical problems, as Pape (2004).

To address this challenge, the researchers developed innovative and interactive demo explicit teaching as a strategy for improving word problem solving skills. The demo explicit teaching is not only enhanced students' problem solving skills but also integrated literacy into word problem solving, helping students better understand concepts by learning how to translate verbal phrases into algebraic expressions. Through explicit instruction, enhances students' metacognitive awareness, enabling them to monitor their problem-solving steps and improve overall performance (Hudson and Miller 2006). To sustain interest and accommodate learning styles, the instruction used in this study were tailored developmental level of the learners, and engaging activities and interactive games. Santos (2020) employed the "I Do, We Do, You Do" instructional approach to develop problem-solving skills, gradually transferring responsibility from teacher – led to independent student practice.

This study examined the effectiveness of the innovative demo explicit teaching of Grade 7 students. To provide an effective solution for teachers in similar educational contexts who had difficulty using traditional demo teaching instructions it aimed to be an effective strategy. The study was significant because it developed a deeper comprehension o comprehension of mathematical concepts and the language used in contexts by providing an organized

framework for resolving difficult problems into understandable steps. This research contributed to efforts to enhance word problem solving skills by integrating literacy and interactive strategies.

1.1 Statement of the Problem

This action research examined the effectiveness of demo explicit teaching in enhancing the word problem-solving skills of Grade 7 students as Cataingan National High School. Through the use of these innovative instructions, clearly stated steps of word problem-solving were identified as most improving. Further, it examined how demo explicit teaching supported word problem-solving skills development by providing clear explanations, demonstrations, and structured guidance to learners' progress. Specifically, the study examined the level of problem-solving skills significantly improved after implementing this intervention.

2. Methods

2.1 Research Design

In this study, a pre-experimental one-group pre-test and post-test framework, this action research used a quantitative research design. The nature and goal of the study – to assess the effectiveness of an explicit teaching strategy that incorporated literacy methods into mathematics instruction – made this design particularly appropriate. To determine whether the integrative method improved the students' problem-solving abilities, the researcher used this design to compare students' performance before and after the intervention. This aligned with the objective of action research, which is to implement a practical intervention and evaluate its effects in an actual classroom environment. The sections that follow provide comprehensive details about the research participants, data sources, and specific techniques used for data collection and analysis.

2.2 Data Sources

The primary sources of data for this study were 28 Grade 7-Kunzite students from last section of Cataingan National High School, located in Cataingan, North District, School Division of Masbate, Philippines. There were 14 males and 14 females among the participants. The students took both pretest and posttest assessment to measure their word problem-solving skills before and after utilizing innovative demo explicit teaching as an Instructional Intervention. The secondary data consisted of the students' Mean Percentage Scores (MPS), which served as a benchmark performance. The participants were part of a heterogeneous group classified under the regular or lower section. This group was specially selected to determine whether the integration of literacy skills into mathematics problem-solving instruction could support students across varying skill levels.

2.3 Research Procedure

This study employed a quantitative research design. The quantitative phase aimed to determine whether the integrative approach – specifically through the use of reading comprehension strategies in teaching, effectively enhanced problem-solving skills in mathematics among Grade 7-Kunzite students. The primary data collection method was a researcher-developed multiple-choice test, which was administered as both a pre-test and a post-test to the experimental group. To ensure content validity, mathematics teachers from the education field were invited to review and validate the instrument. The pre-test was conducted on the first day of implementation. Students in the experimental group were informed about the purpose of the assessment and were given one hour to complete the test. The researchers then checked and recorded their responses.

After the pre-test, the integrative approach was applied to 44 students in the experimental group. The researchers conducted the lessons with creative lesson plans that integrated reading strategies of the math content. These are the lessons on comprehension of words and comprehension of English statement to solve word problems. The students finished the worksheet material within an hour after each lesson. Researchers then verified and reviewed the students' answers. This process was repeated throughout the intervention and the final post-test, from which any increases in the problem-solving ability of the students were analyzed.

3. Results and Discussion

3.1 Normality Test of Data in Mathematics

The pre-test and post-test were administered to 28 participants experiencing the Explicit Approach , to reveal the impact of the intervention on word problem-solving for Grade 7-Kunzite. The pre-test was undertaken prior to the intervention in order to establish baseline levels of ability with word problems for the students. After completion of the intervention, the post-test was conducted to measure any alterations in the participants' word problem-solving skills. Following the intervention, the post-test was given to determine the effect on their word problem-solving abilities. The output of the Shapiro- Wilk normality test in Table 1 indicated that the pre-test and post-test data were normally distributed. The W statistic and the P-value for pre-test data are 0.950 and 0.197, while for post-test data, they are 0.937 and 0.091, respectively. The P-value for both tests was greater than 0.05, confirming that the data were normally distributed. Consequently , it was considered appropriate to analyze the paired data with Jamovi, since the statistical test for which this set of paired tests is averaged assumed normality. This enabled a legitimate comparison of the pre-test and post-test scores to evaluate how the

Explicit Approach affected the respondents' problem-solving performance. word The pre-test and post-test data were collected from 28 respondents who had engaged in the Explicit Approach to assess the effectiveness of the intervention in enhancing the word problem-solving skills of Grade 7-Kunzite students. The pre-test, conducted before the intervention, served as a baseline measure of the students' initial word problem skills. Following the intervention, the post-test was administered to evaluate changes in their word problem-solving skills. The result of the Shapiro- Wilk normality test in Table 1 showed that both pre-test and post-test data were normally distributed. Specifically, the pre-test data had a W statistic of 0.950 and a P-value of 0.197, while the post-test data recorded a W statistic of 0.937 and a P-value of 0.091. Since the P-value for both tests exceeded 0.05, the data followed a normal distribution. Consequently, the use of Jamovi was deemed appropriate for analyzing the paired data, as this statistical test assumed normality. This allowed for a valid comparison of the pre-test and post-test results to assess the impact of the Explicit Approach the respondents' problem-solving skills on word Since Jamovi was specifically developed to assist in advanced statistical analysis and enable users without much programming knowledge to work with it, it was the most suitable tool for calculating the findings of this study. In Jamovi, statistical tests -such as the Shapiro-Wilk test-were integrated directly into its analytical modules. This way, researchers were able in this study to determine whether or not the data met the normality assumption required for parametric tests, such as the paired sample t-test, making it a very useful methodology for evaluating the effectiveness of the intervention, particularly in fostering improvements in students' problem-solving performance before and after implementing the literacy-integrated strategy (Ahmed and Muhammed, 2021).

Table 1

Shapiro-Wilk Normality Test Results for Pretest and Posttest of Grade 7-Kunzite Students

Variables	S-W	P-value	Interpretation	
Pretest	0.950	0.197	Normally distributed	
Posttest	0.937	0.091	Normally distributed	

3.2 Level of word problem-solving skills of Grade 7-Kunzite after the Implementation of the Explicit Approach

The analysis of the pre-and post-tests word problem-solving skills of Grade 7-Kunzite students, before and after the implementation of Explicit Approach, showed a significant gain in skills at a statistically level. The results from Jamovi (Table 2) showed that the difference between the pre- and post-test was significant (t=4.25; p <0.001). This helped conclude that the intervention had positively and measurably affected the enhancement of the students' Word Problem Solving Skills. The low p-level indicated that the success of the students in terms of commonly accepted word problem-solving skills would not have happened if experimental conditions had not been placed in the Explicit Approach here. This pair of findings supports past research that stated that such targeted interventions are instrumental in improving word problem-solving skills, especially with students who had weak comprehension skills. Emanuel et al. (2021) noted the importance of identifying and addressing the difficulties that students face in solving mathematical word problems. The authors mentioned the importance of explicit instruction in helping students understand and work through word problems effectively. Thus the data pointed out that the structured intent such as those put into practice in the Explicit Approach significantly impacted enhancing the word problem-solving skills of students. As the fact that all 28 students improved from pre- to post-test also exemplifies the inclusivity and adaptiveness of the intervention in accommodating a variety of learning needs, Powell and Fuchs (2010) emphasize that integrating literacy and math through Explicit Instruction combines literacy strategies with math instruction through Explicit teaching, which has been shown to improve student problem-solving outcomes.

The importance of constant diagnostic testing and remediation programs formed on scientific evidence, in the process of teaching and learning, was accentuated. These tools made it possible for teachers to accurately gauge their students' progress and render timely, targeted support. By incorporating aspects of both summative and formative assessment, teachers isolated the areas that their students found to be challenging and modified their instruction in the affected areas. This provided students with their much-needed support when they needed it instead of solely on standardized end-of-term evaluations. Considerable gains in solving word problems provide evidence of how the problems and the evidence-based interventions, like Explicit Approach, have really changed teaching practices to favor structured, intentional, and reflective instruction. The teachers were encouraged to use methodologies such as interactive games, peer teamwork, individual tasks, discussions, and oral repetition that demanded active engagement and participation from the students. These methodologies not only improved their word problem-solving skills but also enhanced comprehension. Further backing explicit instruction in promoting problem-solving and creative thinking for elementary students is offered by Magbuana (2018).

Additionally, the outcomes also highlighted the necessity of teaching word problem-solving explicitly. Identifying the standing of students with regard to word problem-solving skills enabled instructors to plan inclusive and responsive learning experiences. Darch, Carnine and Gersten (1984) claimed that explicit instruction, as a structured, teacher-led approach, would improve student's effectiveness in turning word problems into equations. In their results, low-performing students benefitted more from systematic teaching than from traditional methods. The results further indicated that such success would be most considerable if the teaching is intentional, informed by data, and tailored to each individual's needs and contexts. Reflections of the effectiveness of the direct approach made clear how the intervention closed the literacy gaps of the students concerning word problem-solving skills. Thus, there was not only validation of those positive results but further justification for continued sustained, evidence-based, and student-centered interventions. Educators were challenged to continue experimentation with and application of such strategies, especially in poor-resource settings. Ultimately, the intervention not only improved test scores but also prepared learners with skills and confidence for future academic achievement and lifelong literacy.

The application of the Explicit Approach in instructing Grade 7-Kunzite students in solving word problems led to notable enhancements in their mathematical abilities. This result aligns with Abana's (2005) research, which showed that students who received explicit problem-solving education exhibited significant improvements in both their problem-solving skills and conceptual understanding compared to those taught through conventional methods. The systematic nature of explicit instruction, characterized by distinct modeling and focused practice, likely contributed to these advancements . These methods have been recognized for their effectiveness in improving students' grasp and application of mathematical concepts.

Furthermore, the success of the intervention underscores the importance of incorporating clear teaching strategies in math education, especially for learners struggling with word problems. As emphasized by Powell et al. (2021), direct instruction-featuring aspects such as demonstration, guided practice, and feedback-has been essential in enhancing mathematical outcomes for middle-school students facing difficulties. The promising results from the Grade 7-Kunzite group underscore the significance of these strategies in bolstering students' problem-solving skills and their overall proficiency in mathematics.

Table 2

Level of Word Problem-Solving Skills of Grade 7-Kunzite After the Implementation of the Explicit Approach

Variables	Ν	T-value	P-value	Interpretation
Pretest-posttest	28	4.25	<.001	Statistically significant

4. Conclusion

The findings of the significant difference in the problem-solving skills of Grade 7-Kunzite students after the implementation of Integrating Literacy in Word Problem-Solving Skills of Struggling Grade 7-Kunzite Through Explicit Approach shows clear and measurable improvement. Based on the results of the Jamovi, a T-value of 4.25 and a P-value <0.001 were obtained, indicating that the difference in scores had been statistically significant. This finding established that the problem-solving performance of learners following the intervention had been significantly higher compared to their performance prior to the intervention. As a result, the research hypothesis stating that a significant difference in problem-solving performance existed after the implementation of the intervention was accepted, while the null hypothesis – claiming that no significant difference occurred – was rejected. This outcome validated the effectiveness of the intervention program in enhancing at learners' mathematical solving abilities.

The data suggested that the structured activities and literacy-integrated strategies implemented through the explicit approach played a critical role in bridging comprehension gaps and improving students' abilities to solve mathematical word problems. The significant improvement implied that the targeted and well-designed interventions connecting literacy with mathematical instruction yielded positive academic outcomes, especially among struggling learners. This finding emphasized the importance of incorporating research-based and sustained instructional approaches in mathematics education to support diverse learners and fostered their academic success.

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