



EXPLORING THE LINK BETWEEN MATHEMATICAL VOCABULARY MASTERY AND PROBLEM-SOLVING COMPETENCE AMONG GRADE 7 STUDENTS IN THE PHILIPPINE CONTEXT

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Abstract:

Mathematical vocabulary plays a vital role in students' ability to comprehend problem statements and apply appropriate strategies to solve mathematical tasks. This study investigated the relationship between mathematical vocabulary mastery and problem-solving competence among Grade 7 students in a private higher education institution. Employing a descriptive-correlational research design, the study involved 65 students who were assessed using validated questionnaires measuring both mathematical vocabulary proficiency and problem-solving skills. Descriptive and inferential statistics were used to treat the gathered data. The results revealed that the majority of the students performed at the Approaching Proficiency level for both mathematical vocabulary mastery and problem-solving competence. Moreover, there is a strong, significant positive correlation between mathematical vocabulary mastery and problem-solving competence. These findings highlight the critical need for integrating explicit mathematical vocabulary instruction into classroom teaching and strengthening students' understanding of mathematical language to improve students' problem comprehension, promote higher-order thinking, and overall mathematical achievement. The study further recommends the development of instructional interventions that

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combine vocabulary development with problem-based learning to bridge performance gaps and foster mathematical confidence among learners.

Keywords: mathematical vocabulary; problem-solving skills, grade 7 students

1. Introduction

Mathematical vocabulary consists of the specialized language, including terms, symbols, and notations, that is essential for understanding and effectively communicating mathematical concepts. This vocabulary is fundamental in developing critical skills, particularly problem-solving, as it enables students to interpret problems accurately and apply appropriate strategies. Mastering mathematical vocabulary is vital for students to succeed in mathematics and enhance their problem-solving abilities (Joseph, 2020).

Problem-solving involves identifying issues, developing solutions, and evaluating their effectiveness. Vocabulary plays a key role in this process by providing the precise language needed to understand and communicate mathematical ideas. Terms related to size, shape, and position, such as 'length,' 'width,' 'triangle,' and 'circle,' are often more significant than basic operation terms because they help explain the connections between math problems and everyday language. Research has consistently shown the importance of vocabulary in mathematics. Alghazo and Al-Wadi (2019) examined how vocabulary knowledge affects the math performance of English language learners in elementary schools, highlighting its key role in academic success. Lin, Zhao, and Jiang (2021) studied the enhancement of mathematical vocabulary knowledge and its impact on problem-solving skills among middle school students. Marzano and Simms (2019) emphasized the necessity of targeted vocabulary instruction in their work on the New Science Standards, while Nunes and Bryant (2019) discussed how mathematical vocabulary aids in developing a better understanding of math, reinforcing the link between language and learning. Lastly, Morrow and Gambrell (2021) conducted a systematic review of the literature on vocabulary instruction in mathematics, emphasizing the importance of effective teaching strategies.

Mathematical vocabulary instruction is a crucial element in enhancing students' understanding and performance in mathematics. Ramos and Pineda (2021) explored this relationship, highlighting its impact on student achievement in elementary mathematics. Similarly, Natividad (2020) examined the role of vocabulary in the mathematical comprehension of Filipino students, underscoring its significance in learning. Galang and De Guzman (2019) focused on collaborative learning strategies to enhance mathematical vocabulary among high school students, demonstrating the benefits of group interactions in vocabulary acquisition. Dela Cruz and Reyes (2020) conducted a study on vocabulary development in mathematics, investigating its influence on the problem-solving skills of students in Manila. Furthermore, Santos (2021) discussed the integration of mathematical vocabulary instruction within the curriculum, providing insights from teachers in Cebu.

Together, these studies emphasize the importance of mathematical vocabulary as a foundation for students' success in mathematics.

Mathematics teachers in DLSASMC who are handling seventh graders observed a low proficiency in problem solving and can hardly translate mathematical sentences into mathematical expressions. This is strongly proven in their Performance Assessment of Standards and Skills (PASS). With this, the teachers take the initiative to study if there is a relationship between mathematical vocabulary and problem-solving skills.

Through this initiative, the researchers aspire to empower students with the necessary tools to succeed in mathematics, transforming their perceptions of the subject and enhancing their overall educational experience. Addressing the gap in vocabulary knowledge is vital for improving students' attitudes toward mathematics and fostering a more positive learning environment. By implementing targeted vocabulary instruction, grade 7 teachers can help students overcome difficulties, build their mathematical understanding, and ultimately succeed in this vital subject area.

Thus, this study aims to explore the link between mathematical vocabulary mastery and problem-solving competence among grade 7 students, providing valuable insights into how this mastery supports both problem-solving skills and overall success in mathematics.

2. Materials and Methods

2.1. Research Design

This study employed a descriptive-correlational research design to delve into the intricate relationship between mathematical vocabulary proficiency and problem-solving skills in seventh-grade students. By meticulously examining the interplay between these two critical cognitive abilities, researchers aim to uncover profound insights into the factors that influence mathematical success. This innovative approach will provide a solid foundation for developing targeted interventions to enhance student learning and achievement.

2.2. Research Environment

The study was conducted at De La Salle Andres Soriano Memorial College (DLSASMC), a renowned institution deeply rooted in the Lasallian core values of faith, service, and community. De La Salle Andres Soriano Memorial College's unwavering commitment to quality education makes it the ideal setting for this research, ensuring a rich and meaningful exploration of the topic.

2.3. Research Respondents

The study comprehensively examined the knowledge and skills of 65 seventh-grade students at DLSASMC. By focusing on this pivotal grade level, where foundational competencies are deeply ingrained, researchers aim to gain invaluable insights into the educational landscape and identify areas for improvement.

2.4. Research Instruments

This study employed specially designed questionnaires to comprehensively assess the mathematical vocabulary proficiency and problem-solving skills of the participants. By focusing on rates and percentages, these questionnaires provided a precise and detailed measurement of the participants' knowledge and abilities in these crucial areas. This innovative approach enabled researchers to gain a nuanced understanding of the participants' strengths and weaknesses, paving the way for targeted interventions to enhance their mathematical performance. The researchers conducted a pilot test in order to test the validity and reliability of the instruments. Three experts will validate the questionnaires through item analysis.

2.5. Data Gathering Procedure

The researchers asked permission to conduct a survey from the office of the President and Chancellor. During the data gathering stage, the researchers will create and validate the questionnaires, and distributed the questionnaires after approval. After the data was gathered, the researchers tabulated, organized, interpreted and analyzed the results. The results were interpreted using descriptive statistics and correlational statistics in accordance with stringent integrity and confidentiality rules, yielding significant results and well-informed recommendations.

2.6. Data Analysis

This study applied both descriptive and inferential statistical techniques to analyze the data. Descriptive statistics include frequency and percentage to illustrate the distribution of learners' scores across different proficiency levels. The mean was used to determine the learners' average performance, while the standard deviation measured the variability or consistency of their scores.

For inferential statistics, Pearson's r correlation was employed to assess the strength and direction of the relationship between mathematical vocabulary proficiency and problem-solving skills. Pearson's r values range from -1 (perfect negative correlation) to +1 (perfect positive correlation), with 0 indicating no linear relationship. This analysis helped to determine whether improvements in mathematical vocabulary proficiency are associated with better problem-solving skills among Grade 7 learners.

2.7. Ethical Considerations

This research adhered to ethical standards, prioritizing the protection of human rights throughout the study. The researchers followed the three core ethical principles of beneficence, respect for persons, and fairness. Respect for persons ensured that each participant is treated as an autonomous, capable individual, with their privacy safeguarded. Beneficence guaranteed that participants are not harmed, allowing them to avoid sensitive questions. Justice ensured the fair selection of participants based on the study's requirements, with confidentiality measures in place to protect their information, used solely for research purposes.

3. Results and Discussion

This section presents the findings on Grade 7 students' mathematical vocabulary mastery and problem-solving competence and examines the relationship between the two. The discussion interprets the results in light of the study's objectives and relevant literature.

Table 1: Frequency Distribution of Students' Mathematical Vocabulary Proficiency Levels

Proficiency Level	Range of Scores	f	%
Advanced	0 - 4	1	1.54
Proficient	5 - 8	17	26.15
Approaching Proficiency	9 - 12	30	46.15
Developing	13 - 16	15	23.08
Beginning	17 - 20	2	3.08
Total		65	100.00
Mean			10.262
Standard Deviation			3.129

The findings reveal that most students fall within the Approaching Proficiency (46.15%) and Proficient (26.15%) levels of mathematical vocabulary mastery, with only a small fraction achieving Advanced (1.54%) proficiency. This clustering around moderate proficiency levels suggests that while students possess foundational mathematical vocabulary, they may lack the depth necessary for optimal problem-solving performance. The mean score of 10.26 and standard deviation of 3.13 reinforce this, indicating moderate central performance with considerable variability across the group.

These results align with contemporary research emphasizing that mathematical vocabulary mastery directly influences problem-solving competence. Recent studies (e.g., Scammacca *et al.*, 2025; Fuchs *et al.*, 2023) show that targeted mathematical vocabulary interventions enhance both word-problem comprehension and broader mathematical reasoning skills. When students grasp precise mathematical terms, they are better equipped to interpret problems accurately, select appropriate operations, and execute solutions effectively (Peltier & Vannest, 2024).

Furthermore, the moderate spread in proficiency levels implies that a differentiated instructional approach is essential. Students at the Approaching and Developing levels likely require explicit instruction in vocabulary meaning-making and contextual application, while advanced learners may benefit from enrichment activities fostering deeper conceptual understanding.

Overall, the synthesis of the present findings and recent literature underscores a reciprocal relationship: mathematical vocabulary mastery is both a foundation and a catalyst for problem-solving competence. Strengthening students' vocabulary knowledge can thus close comprehension gaps, enhance critical thinking, and improve success in complex mathematical tasks.

Table 2: Frequency Distribution of Students' Problem-Solving Proficiency Levels

Proficiency Level	Range of Scores	f	%
Advanced	0 - 5	4	6.15
Proficient	6- 11	16	24.62
Approaching Proficiency	12 - 16	29	44.62
Developing	17 - 21	16	24.62
Beginning	22 - 26	0	0.00
Total		65	100.00
Mean		13.246	
Standard Deviation		4.448	

The distribution of students' problem-solving proficiency levels reveals that the majority fall under Approaching Proficiency (44.62%), followed equally by Proficient and Developing (each 24.62%), with only a small fraction in the Advanced category (6.15%) and none in the Beginning level. The mean score of 13.25 and standard deviation of 4.45 suggest moderate overall performance with noticeable variation among learners.

These findings indicate that while most students have foundational problem-solving skills, they may struggle with more complex or non-routine tasks. The large proportion in Approaching Proficiency suggests a transitional stage—students understand basic procedures but lack the consistency and flexibility required for advanced problem solving. The minimal representation in the Advanced category underscores the need for targeted interventions to elevate higher-order thinking and multi-step reasoning abilities.

Recent studies (e.g., Scammacca *et al.*, 2025; Peltier & Vannest, 2024) emphasize that problem-solving proficiency improves significantly when instruction integrates explicit strategy training, opportunities for collaborative reasoning, and contextualized mathematical tasks. Furthermore, research highlights the critical role of mathematical language comprehension in problem-solving success (Fuchs *et al.*, 2023), suggesting that deficits in mathematical vocabulary may partially explain why many students remain at mid-level proficiency.

Overall, the results suggest that strengthening both conceptual understanding and mathematical language skills through differentiated, problem-based, and language-integrated instruction can bridge the gap from Approaching and Developing levels toward Proficient and Advanced problem-solving competence.

Table 3 indicates that the respondents' proficiency in mathematical vocabulary is at the *approaching proficiency* level, suggesting a partial understanding of terms and a frequent need for guidance in interpreting mathematical statements accurately. Similarly, their proficiency in problem-solving falls within the same category, indicating that while they demonstrate basic skills, they still require support when faced with more complex tasks.

These findings highlight the need for targeted instructional strategies to strengthen both mathematical vocabulary and problem-solving skills, ultimately enhancing students' overall mathematical competence

Table 3: Correlation between Proficiency in Mathematical Vocabulary and Proficiency in Problem Solving

Paired Variables	r-value	Strength of Correlation	p-value	Decision	Interpretation
Proficiency in Mathematical Vocabulary	0.661*	Strong Positive Correlation	0.000	Reject the H_0	Significant
Proficiency in Problem Solving					
*Significant at $p < 0.001$ (two-tailed)					

Recent studies have demonstrated a significant positive correlation between proficiency in mathematical vocabulary and the ability to solve word problems. The present study found a strong positive correlation ($r = 0.661$) between these two variables, indicating that proficiency in mathematical vocabulary significantly influences problem-solving skills. Given the p-value of 0.000, the null hypothesis (H_0) was rejected, confirming that the relationship between these two proficiencies is statistically significant. These findings align with prior research showing that enhancing mathematical vocabulary improves students' ability to solve word problems (Adom *et al.*, 2023; Zhang & Lin, 2020). The results underscore the critical role of language proficiency in mathematical problem-solving, reinforcing the idea that a strong mathematical vocabulary foundation leads to better comprehension and execution of word problems.

4. Conclusion

The results of this study provide clear evidence that mastery of mathematical vocabulary plays a crucial role in enhancing students' problem-solving competence. Students with a stronger understanding of mathematical terms are better able to interpret problem statements accurately, identify the necessary operations, and apply appropriate strategies to arrive at correct solutions. This connection shows that mathematical vocabulary serves as the foundation for understanding the language of mathematics, allowing students to focus more on reasoning and analysis rather than struggling with unfamiliar terms.

Answering the general research question, the study confirms that students' problem-solving skills significantly improve when they have a solid grasp of mathematical vocabulary. Without this mastery, even simple problems can become challenging because students may misinterpret the requirements or fail to connect the concepts involved. On the other hand, a strong vocabulary enables them to approach problems with confidence, apply logical thinking, and use mathematical concepts effectively.

These findings highlight the need for teachers to integrate vocabulary development into mathematics instruction. When students learn mathematical terms in meaningful and practical ways, they not only enhance their comprehension but also become more capable and independent problem-solvers. Strengthening this area can

therefore lead to better overall performance in mathematics and help students develop essential skills for higher-level learning.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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Kim Tasic currently serves as a Senior High School STEM educator in the Philippines, focusing on mathematics and quantitative research instruction. He holds academic qualifications in education with specialization in STEM teaching and research methodologies. His academic interests include quantitative research processes, STEM curriculum development, student scientific literacy, and performance-based learning strategies. He has participated in various school-based research initiatives, academic training programs, and student research mentoring activities.

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Tiny Gerli R. Villarino holds a Bachelor of Secondary Education major in Mathematics, graduating Magna Cum Laude, and is currently pursuing her postgraduate studies at Cebu Technological University with a specialization in Teaching Mathematics. She has three years of teaching experience at the grade school, junior high school, and college levels at De La Salle Andres Soriano Memorial College. Her professional background combines strong academic preparation in mathematics with classroom experience, providing a solid foundation for her interests in mathematics instruction, learner-centered teaching strategies, and enhancing students' mathematical understanding and achievement across basic and secondary education.

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Jeanlaily Oberes Barcuma graduated as a Cum Laude of the Bachelor of Secondary Education major in Mathematics and a Lasallian Mission In-Charge. She leads Social Action Programs in the school and partner community that help learners improve their problem-solving skills and understanding of mathematics, especially those who need the most support. Guided by the Lasallian mission, she helps students overcome learning gaps, build confidence, and use mathematics in real-life situations—teaching minds, touching hearts, and transforming lives.

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