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Original Article

Linking Barrett's Taxonomy to Reading Comprehension and Problem-Solving: Implications for Math Performance in Primary Education

Marlon Jr. P. Ersando*, Joe Marie Ferolino, Charlene Guiral, Mary Ann Jose, Raquel Jabal, Lumelle Villarta, Joseph Rex Jabal, and Jenelyn Longos

Elementary Department,
University of San Jose-Recoletos,
Cebu City, Philippines

Correspondence:
marlon.ersando@usjr.edu.ph

Abstract

Background: *This action research investigates the relationship between reading comprehension and mathematical word problem-solving performance among Grade 6 students aged 11 to 12, acknowledging the interdependence of literacy and numeracy skills.*

Methods: *Using Barrett's Taxonomy as a framework, the study employed a quantitative design with two teacher-made, expert-validated assessment tools aligned with five comprehension levels: literal, reorganization, inferential, evaluation, and appreciation. The assessments were administered through the school's Learning Management System and analyzed using correlational statistics.*

Results: *The study involved 153 learners, categorized into two groups: top-performing and average. Among top performers, comprehension of reorganization showed a significant positive correlation with math performance, while inferential comprehension had a significant negative correlation. For average learners, literal comprehension demonstrated a significant positive relationship with problem-solving ability.*

Conclusion: *The findings suggest that differentiated instruction, integrating targeted reading strategies, can enhance mathematical reasoning, particularly by strengthening literal and inferential comprehension for average learners and refining inferencing skills among high performers.*

Keywords

comprehension, problem-solving, performance, differentiated instruction, quality education, Barrett's taxonomy, elementary education, cognitive processes, instructional strategies, literacy and numeracy integration

INTRODUCTION

Elementary education is crucial in developing foundational academic skills essential for lifelong learning, particularly reading comprehension and mathematical problem-solving (National Research Council, 2001). Globally, educators and policymakers emphasize the importance of developing these skills early to prepare learners for the complex, real-world challenges they will face (Organization for Economic Cooperation and Development [OECD], 2019). When taught beyond rote computation, mathematics nurtures critical thinking, logical reasoning, and structured decision-making (Boaler, 2016). Similarly, reading comprehension enables

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learners to interpret, analyze, and respond meaningfully to various academic tasks (Snow, 2002). As Panjiyeva and Elmurodova (2023) emphasize, subject integration in the early grades enhances learner engagement and deepens conceptual understanding across disciplines, ultimately supporting holistic development and academic success.

Despite curriculum reforms and targeted instructional strategies, the Philippines continues to face significant challenges in student performance, particularly in mathematics. The 2018 Programme for International Student Assessment (PISA) revealed that Filipino learners ranked among the lowest globally in mathematics, with an average score of 353, which is significantly below the OECD average of 489 (OECD, 2019). This gap reflects a broader systemic issue not solely about numerical fluency but also about learners' ability to make sense of mathematical texts, such as word problems. The Department of Education has since recognized the urgency of addressing content delivery and the reading demands embedded within math instruction. As mathematics word problems become more complex, students are expected to decode language, analyze context, and determine operations—all of which require strong comprehension skills.

In many Philippine classrooms, particularly at the elementary level, teachers report that learners struggle with mathematical word problems not because they lack computational ability but because they have difficulty understanding what the problem is asking. This observation supports findings from both local and international studies that underscore the role of reading comprehension as a mediator in mathematical reasoning. Peng et al. (2020) found that reading and mathematics share a moderate correlation, particularly when problem-solving tasks involve linguistic complexity. Their meta-analysis emphasized that reading comprehension is critical in mathematical word problems, as students must process textual information and numerical relationships. Thus, when learners face difficulties in decoding or understanding problem texts, their mathematical performance suffers—even when their arithmetic skills are adequate. This highlights the importance of strengthening reading strategies to support success in math problem-solving tasks. Locally, Patac and Patac (2015) identified comprehension-related errors as a primary obstacle in solving word problems using Newman's Error Analysis. Rivera (2021) also noted that conceptual and procedural understanding—rooted in comprehension—are essential for accurate performance in algebraic expressions. Collectively, these studies reinforce the importance of integrated literacy and numeracy instruction.

Understanding the specific types of comprehension contributing to mathematical performance is crucial for developing targeted interventions to enhance mathematical performance. The present study uses Barrett's Taxonomy of Reading Comprehension to structure this analysis, categorizing comprehension into five levels: literal, reorganization, inferential, evaluation, and appreciation (Barrett, 1976). Although initially designed for reading instruction, scholars such as Boonen et al. (2016) argue that reading comprehension skills, especially the ability to make inferences, reorganize information, and evaluate content, are fundamental to solving mathematical word problems, reinforcing the interdisciplinary relevance of comprehension frameworks like Barrett's taxonomy. Likewise, Panjiyeva and Elmurodova (2023) highlight that strong reading comprehension skills, particularly in reorganization and inferential thinking, support learners in navigating complex multi-step mathematical problems by enabling them to interpret, sequence, and make sense of textual information within word problems. This interdisciplinary perspective offers a theoretical and practical foundation for examining how pupils' reading comprehension levels impact their ability to solve math problems.

Given this context, the present study examines the relationship between the reading comprehension levels of Grade 6 pupils aged 11-12 years and their performance in solving mathematical word problems. It examines how each comprehension domain—literal, reorganization, inferential, evaluation, and appreciation—impacts learners' ability to analyze and solve math tasks. Anchored in Barrett's Taxonomy, the study provides a framework for understanding how comprehension strategies can support mathematical thinking across varying levels of cognitive demand. By exploring this relationship, the research seeks to generate evidence-based insights to guide teachers in tailoring instruction to match students' comprehension strengths and needs. Ultimately, the goal is to inform classroom practices that promote integrated learning, where reading and mathematical reasoning are developed to enhance academic outcomes in elementary education.

Barrett's Comprehension Level	Theoretical Basis	Cognitive Focus	Implications in Math
Literal Comprehension	Behaviorist theory (focus on recall and recognition of facts)	Recalling directly stated facts	Students identify known quantities and given values directly from the problem.
Reorganization	Cognitive theory (structuring and summarizing information)	Categorizing, ordering, and summarizing	Students interpret data from multiple parts of a problem and organize it in a logical manner.
Inferential Comprehension	Constructivist theory (inferring meaning from context)	Reading between the lines, predicting outcomes	Students deduce missing steps or values not directly stated in the problem.
Evaluation	Critical thinking (judging accuracy and relevance)	Making judgments based on criteria	Students assess solution strategies or the reasonableness of answers.
Appreciation	Affective theory (emotional or aesthetic response)	Demonstrating personal and emotional engagement	Students develop an interest in real-life applications and appreciate the practical value of math.

METHODS

Study Design, Population, and Setting

This study employed a quantitative correlational design to investigate the relationship between reading comprehension and mathematical word problem-solving performance among sixth-grade pupils. The theoretical foundation for the study was Barrett's Taxonomy of Reading Comprehension, which categorizes comprehension into five levels: literal, reorganization, inferential, evaluation, and appreciation (Barrett, 1976). These levels served as the basis for developing and aligning the reading comprehension and math problem-solving instruments.

The study was conducted in one of the private elementary schools in Cebu City, Philippines, during the second grading period of the present academic year. The target population consisted of all Grade 6 students aged 11 to 12. To facilitate comparison, students were divided into two groups, top performers and average performers, based on their cumulative academic performance. However, the classification was not disclosed to avoid influencing pupil behavior.

Study Variables, Instrument, and Data Collection

Two teacher-made, expert-validated assessments were utilized to assess comprehension and mathematical problem-solving. The first instrument was a 15-item multiple-choice reading comprehension test, with three items aligned to each of the five levels of Barrett's taxonomy. This tool was constructed with reading and mathematics faculty to ensure alignment with cognitive domains and current grade-level competencies.

The second instrument was a 15-item math problem-solving test that mirrored the reading test in structure and design. Each item was crafted to reflect one of Barrett's comprehension levels and applied to math problems involving the four fundamental operations with decimals. For example, literal-level math items required pupils to extract explicitly stated quantities, while inferential-level items involved predicting missing information or deducing operations based on context. This alignment enabled a consistent analytical framework across both literacy and numeracy assessments.

Both instruments underwent validation by the school's Math Area Chair and Principal. They were further reviewed by the Center for Policy, Research, and Development Studies (CPRDS) to ensure content validity, clarity, and appropriateness. Item analysis was conducted to establish each item's reliability and difficulty index before administering the entire test. All assessments were administered through the school's Learning Management System (GENYO) to ensure accessibility, standardization, and ease of data collection during regular instructional periods.

Data Analysis

The data collected from the comprehension and math tests were analyzed using correlational statistical methods to determine the strength and direction of the relationship between each comprehension level and problem-solving performance. Since the data did not meet the assumptions of normality, Spearman's rank-order correlation was used. This non-parametric test was chosen to analyze ordinal data and identify monotonic relationships.

The analyses were conducted using Microsoft Excel and JASP (Version 0.18.2), with statistical significance set at $p < .05$. Separate correlation analyses were performed for the top-performing and average-performing groups to compare how comprehension skills influenced math outcomes across different learner profiles. This allowed for a more nuanced understanding of which comprehension domains were most strongly associated with problem-solving success in each subgroup.

Ethical Considerations

This study was conducted with strict adherence to ethical research standards. Approval was obtained from the academic chair and the school principal, and the study underwent further review by the Center for Policy, Research, and Development Studies (CPRDS) before data collection. Informed consent was obtained from parents and guardians, while verbal and written assent were secured from participating students.

Participants were assured of confidentiality, anonymity, and the voluntary nature of their involvement. No personally identifiable information was collected or disclosed. Classifying learners into performance groups was done solely for research purposes and was not shared with students to avoid any impact on their self-esteem or performance.

RESULTS

This study investigated the relationship between reading comprehension levels and mathematical problem-solving performance among sixth-grade pupils. The respondents were grouped into two categories: the top-performing learners (n = 30), representing the top 20% of the cohort based on their academic standing, and the average-performing learners (n = 123), consisting of the remaining 80%. Two validated assessment tools were used—one for comprehension and one for math, each aligned with Barrett's five levels of comprehension.

Table 1. *Top Learners Data Descriptives*

Variable	N	Mean	SE	SD	Range	W	p
Literal Comp	30	2.60	0.113	0.621	2	0.656	< .001
Reorganization	30	1.27	0.166	0.907	3	0.875	0.002
Inferential	30	1.07	0.143	0.785	3	0.804	< .001
Evaluation	30	1.10	0.147	0.803	3	0.857	< .001
Appreciation	30	1.70	0.145	0.794	3	0.851	< .001
Math Performance	30	12.77	0.184	1.006	3	0.747	< .001

0.00 - 0.75 (Poor); 0.76 - 1.50 (Below Average); 1.51 - 2.25 (Average); 2.26 - 3.00 (Excellent)

Table 2. *Top Performers Data Correlation Matrix*

	Math Performance	Literal Comp	Reorganization	Inferential	Evaluation
Literal Comp	Spearman's rho	0.225	—		
	df	28	—		
	p-value	0.231	—		

Table 2. *continued*

		Math Performance	Literal Comp	Reorganization	Inferential	Evaluation
Reorganization	Spearman's rho	0.381 •	0.008	—		
	df	28	28			
	p-value	0.038	0.965			
Inferential	Spearman's rho	-0.440 •	0.054	-0.253	—	
	df	28	28	28		
	p-value	0.015	0.778	0.178		
Evaluation	Spearman's rho	-0.080	0.282	-0.258	0.161	
	df	28	28	28	28	
	p-value	0.673	0.130	0.169	0.395	
Appreciation	Spearman's rho	-0.133	-0.057	-0.089	-0.042	
	df	28	28	28	28	
	p-value	0.484	0.763	0.640	0.824	

*p < .05, ** p < .01, *** p < .001*

Table 3. *Average Group Learners Data Descriptives*
Descriptive Statistics and Shapiro-Wilk Normality Test (Average Performers, n = 123)

Variable	N	Mean	SE	SD	Range	W	p
Literal Comp	123	2.59	0.0651	0.722	3	0.612	< .001
Reorganization	123	1.23	0.0747	0.828	3	0.864	< .001
Inferential	123	1.02	0.0757	0.839	3	0.846	< .001
Evaluation	123	1.07	0.0645	0.715	3	0.829	< .001
Appreciation	123	1.25	0.0745	0.826	3	0.864	< .001
Math Performance	123	7.63	0.2517	2.792	11	0.930	< .001

0.00 - 0.75 (Poor); 0.76 - 1.50 (Below Average); 1.51 - 2.25 (Average); 2.26 - 3.00 (Excellent)

Table 4. *Average Group Performers Data Correlation Matrix*

	Math Performance	Literal Comp	Reorganization	Inferential	Evaluation
Literal Comp	Spearman's rho	0.296 ***	—		
	df	121	—		
	p-value	< .001	—		
Reorganization	Spearman's rho	-0.030	0.243 **	—	
	df	121	121		
	p-value	0.742	0.007		
Inferential	Spearman's rho	-0.144	0.025	0.012	—
	df	121	121	121	
	p-value	0.112	0.787	0.898	
Evaluation	Spearman's rho	0.068	0.052	0.027	-0.110
	df	121	121	121	121
	p-value	0.452	0.566	0.767	0.225
Appreciation	Spearman's rho	0.157	0.194 *	0.114	0.059
	df	121	121	121	121
	p-value	0.082	0.032	0.211	0.520

*p < .05, ** p < .01, *** p < .001*

DISCUSSION

The study results confirm that reading comprehension is associated with mathematical problem-solving performance among Grade 6 learners aged 11-12. However, the specific comprehension domains that significantly influence performance vary depending on the learners' achievement levels. This supports the idea that literacy and numeracy are not isolated academic domains but are interconnected cognitive processes. By examining comprehension through the lens of Barrett's Taxonomy, this study offers insights into how different cognitive levels contribute uniquely to mathematics performance. These distinctions help clarify why some students excel in solving word problems while others struggle despite having similar computational skills. The findings affect instructional practices integrating reading strategies into mathematics teaching.

Among top-performing learners, reorganization comprehension was found to have a statistically significant positive correlation with math performance ($\rho = 0.381$, $p = 0.038$). This suggests that learners in this group excel when they can logically organize, categorize, and structure textual information, which is essential in solving multi-step word problems. The ability to reorganize information helps students understand the components of a problem and connect them with the appropriate mathematical operations. Passolunghi et al. (2019) support this by demonstrating that working memory and reading comprehension skills significantly influence children's success in solving mathematical word problems, particularly those requiring the integration and reorganization of information. Likewise, Kwok and Kwan (2025) emphasize that reorganizational reading skills play a pivotal role in bridging linguistic comprehension and quantitative reasoning, particularly in complex, realistic mathematical problem-solving contexts.

Conversely, inferential comprehension showed a statistically significant negative correlation with math performance among top performers ($\rho = -0.440$, $p = 0.015$). Although this may appear counterintuitive, it supports Sáenz and Fuchs's (2002) assertion that excessive inferencing can sometimes lead students to misinterpret key elements of a problem. High-achieving learners may overanalyze problem contexts, applying unnecessary complexity when more straightforward reasoning would suffice. This tendency could lead to errors in selecting the correct operations or identifying the essential data within a problem. As such, there is a need to guide even top-performing students in balancing inferential thinking with direct and practical interpretation strategies.

Other comprehension domains—literal, evaluation, and appreciation—did not show statistically significant correlations with math performance among the top-performing group. Although these skills are important in broader literacy development, they appear to have a limited direct impact this group's mathematical problem-solving success. These findings align with those of Fitzpatrick et al. (2020), who emphasized that while general academic abilities influence overall achievement, reading comprehension specifically serves as a unique predictor in solving realistic mathematical word problems. For this reason, the instructional focus for top-performing math learners should prioritize enhancing reorganization and managing inferencing rather than strengthening unrelated comprehension domains.

In contrast, among the average-performing learners, only literal comprehension showed a statistically significant positive correlation with math performance ($\rho = 0.296$, $p < .001$). This highlights the importance of accurately recalling and interpreting explicitly stated information when solving word problems. Students in this group may struggle with abstract reasoning but succeed when the task requires directly retrieving facts from the text. Kwok and Kwan (2025) similarly emphasize that interventions aimed at improving math achievement should also focus on strengthening reading strategies to enhance overall academic performance. They also pointed out that reading comprehension significantly influences students' ability to solve mathematical word problems. Their research highlights how foundational reading skills, particularly literal and inferential comprehension, serve as essential components for interpreting, analyzing, and solving contextualized math tasks.

The remaining comprehension domains—reorganization, inferential, evaluation, and appreciation—did not yield statistically significant correlations with math performance among average performers. This outcome supports the conclusions of Boonen et al. (2016), who emphasize that while reading comprehension builds essential mental representations necessary for solving word problems, not all levels of comprehension equally

influence mathematical reasoning. They argue that specific text-based skills, such as understanding problem context and semantic complexity, are more critical than others in bridging literacy and math performance. Interestingly, inferential comprehension again showed a weak negative correlation with math performance (ρ = -0.144, p = 0.112), mirroring the trend observed among top performers. This implies that inferential overreach may be a general issue across proficiency levels, affecting learners regardless of academic standing. Therefore, while inferencing is an advanced skill, it must be taught with caution and strategic guidance to avoid misinterpretation. Evaluation and appreciation skills likewise showed no significant contribution to math performance, likely due to their emotional or subjective nature being less aligned with numeric reasoning.

Overall, the findings suggest that the influence of comprehension on mathematical performance varies across different learner profiles. Top performers benefit most from strong comprehension skills in reorganization, which support analytical thinking and structured information processing. However, they may be hindered by the overuse of inferencing, which introduces complexity beyond what is necessary. On the other hand, average performers rely more heavily on literal comprehension, which enables them to understand and solve problems by focusing on directly stated information. These group-specific patterns highlight the need for tailored instructional approaches.

This differentiation underscores the importance of using tiered reading strategies in mathematics instruction. Teachers should design interventions emphasizing literal comprehension for developing learners and reorganizing comprehension for advanced students. By aligning instruction with learners' cognitive readiness, educators can better support the integration of reading and mathematical reasoning. Ultimately, differentiated literacy-infused math instruction can enhance learners' comprehension and computational accuracy, improving performance across diverse student populations.

CONCLUSION

The findings of this study confirm that reading comprehension significantly influences the mathematical problem-solving performance of Grade 6 learners aged 11 to 12. Specific comprehension domains affected learner groups differently depending on their academic performance levels. Among top performers, comprehension of reorganization positively correlated with math performance, indicating that organizing and structuring information supports success in multi-step problems. In contrast, inferential comprehension was negatively associated with performance, suggesting that over-analysis can hinder accurate interpretation. For average performers, literal comprehension proved most beneficial, reinforcing the importance of understanding directly stated information when solving math word problems.

In light of these findings, it is recommended that teachers incorporate comprehension development strategies into mathematics instruction. Using Barrett's Taxonomy as a guide, educators can align reading strategies with mathematical tasks to address learners' specific cognitive needs. For average learners, instruction should focus on strengthening literal comprehension through guided reading and keyword identification. For top performers, strategies should be designed to manage inferential thinking and avoid unnecessary complexity. A differentiated approach to integrating literacy into math instruction can help all learners build conceptual understanding and problem-solving confidence.

Author Contributions

M. J. Ersando, J. M. Ferolino, C. Guiral, M. A. Jose, R. Jabal, L. Villarta, J. R. Jabal, & J. Longos: Conceptualization, Methodology, Data curation, Writing – original draft preparation, Investigation, Visualization, Supervision, Writing – review and editing.

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Ethical Approval

Approval was obtained from the academic chair and the school principal, and the study underwent further review

by the Center for Policy, Research, and Development Studies (CPRDS) prior to data collection. Informed consent and assent were obtained from all subjects involved in the study. Participants were assured of confidentiality, anonymity, and the voluntary nature of their involvement.

Competing Interest
The authors declare that they have no conflicts of interest.

Data Availability
The corresponding author will make the data available upon request.

Declaration of Artificial Intelligence Use
In this work, the author utilized artificial intelligence (AI) tools and methodologies, specifically OpenAI's ChatGPT, for language refinement, formatting, and editorial assistance. After using this tool, the author evaluated and revised the content as necessary, taking full responsibility for the published content.

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