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INVESTIGATING THE RELATIONSHIP OF READING COMPREHENSION ON THE SOLUTION PROCESSES OF MATHEMATICAL WORD PROBLEMS

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Abstract:
This study investigates the relationship between reading comprehension and the solution processes of mathematical word problems and the difference in the solution processes in solving mathematical word problems when grouped according to reading comprehension skills. A descriptive-correlational research design was utilized to explore this relationship, while causal-comparative analysis was employed to examine these differences. The study included one hundred seventy-nine (179) students from Grades 7 to 10 enrolled in a private institution for the school year 2023-2024. The findings revealed that junior high school students exhibited poor levels in their reading comprehension skills, and their solution processes in solving mathematical word problems were at a low level. The investigation showed no significant relationship between respondents' reading comprehension skills and their ability to solve mathematical word problems, indicating a weak positive relationship. Moreover, the findings indicate that there is a significant difference between the respondents' solution processes in solving mathematical word problems when grouped according to frustration/poor, instructional, and independent. The poor level, representing the lowest proficiency in reading, exhibits higher performance in solving mathematical word problems compared to the instructional level, which is at a middle proficiency level. The independent level, representing the highest

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proficiency in reading, demonstrates the highest performance in solving mathematical word problems compared to the other two levels.

Keywords: reading comprehension, solution processes, mathematical word problems

1. Introduction

Teaching mathematics among junior high school students holds immense significance as it lays the foundation for crucial cognitive and analytical skills essential for future academic and professional success. Mathematics education at this stage imparts numerical proficiency and cultivates logical reasoning, problem-solving abilities, and critical thinking. These foundational skills are integral for students as they progress in their education, providing a framework for understanding complex mathematical concepts in higher grades and disciplines. Moreover, a strong mathematical foundation enhances students' quantitative literacy, empowering them to navigate real-world situations, make informed decisions, and pursue careers in various fields (Sabin & Smith, 2021).

According to Quiambao (2019), in her study among Grade 7 students, poor reading comprehension impedes students' ability to accurately translate the verbal context into mathematical expressions, leading to errors in problem-solving. Students encounter difficulties in extracting relevant information from the text, understanding the intricacies of the problem statement, and deciphering the mathematical operations required for a solution. This issue highlights the interconnected nature of reading and mathematical skills, emphasizing the need for targeted interventions to enhance both literacy and numeracy competencies, ultimately improving students' proficiency in solving word problems (Schult *et al.*, 2021).

In recent years, increasing attention has been paid to reading and writing tasks and their linguistic characteristics, such as academic language, that challenge the task's processing (Gürsoy & Elif, 2018). Students with limited reading comprehension may struggle to grasp the nuances of mathematical word problems, impeding their ability to identify critical information and formulate appropriate strategies for solving the problems. This struggle emphasizes the necessity of integrated educational approaches that address literacy and numeracy to ensure students can effectively navigate and excel in the interdisciplinary demands of word problem-solving (Torppa *et al.*, 2020).

However, only a few studies focus on reading skills as a factor in explaining students' difficulties in dealing with word problems. Since reading and comprehending the text of the task are fundamental for solving word problems, it follows that reading proficiency plays a crucial role in the solution process in addition to the task text's linguistic features. (Spitzer & Musslick, 2021).

There has been a study also that focused on the reading comprehension level and academic achievement of fifth graders as well as the teaching strategies employed by their teachers (Cantero, 2005). However, the recent study will focus on the reading

comprehension level of junior high school students and its relationship to their solution process of solving word problems**.**

2. Review of Related Literature/Related Literature

2.1 Reading Comprehension Levels and Skills

2.1.1 The Foundation of Literacy Development through Reading

The development of literacy skills is essentially influenced by reading, as literacy encompasses both reading and writing (Akın *et al.*, 2015; Ekorini, 2018). When individuals engage in reading, they embark on an interactive journey with the text, where the reader actively seeks meaning to prevent misinterpretation and enhance information reception (Kusumadewi *et al.*, 2020). Reading serves as a pathway for students to expand their minds, fostering critical thinking and problem-solving skills (Rogiers *et al.*, 2020; Semerci & Sumerci, 2017). Within the realm of language learning, reading is a vital component that not only enhances cognitive abilities but also contributes to the broadening of perspectives and the cultivation of critical thinking skills as students interpret and comprehend texts (Wilson, 2016). Furthermore, reading serves as a valuable means for students to acquire an extensive vocabulary and knowledge base (Duran & Yalçintaş, 2015).

2.1.2 The Program for International Student Assessment Results in the Philippines

The Program for International Student Assessment (PISA) is an international study initiated in 2000. The Organization for Economic Co-operation and Development (OECD) is conducting a global survey assessing the academic achievements of 15-year-old students across various nations. PISA evaluates students' abilities in applying math, reading, and science to real-world scenarios, aiming to uncover effective educational policies and practices while providing governments with comparative data about their education systems.

As a participant in PISA, the Philippines underwent multiple evaluations in 2018 and 2022, which facilitated an interesting longitudinal analysis of its educational system. Filipino students continue to rank among the least proficient globally in math, reading, and science. According to the CPBRD (2024) report, the Philippines performed poorly in the Programme for International Student Assessment (PISA). In 2018, it ranked last out of 78 countries, and in 2022, it ranked 77th out of 81. The PISA assesses 15-year-old students in reading, mathematics, and science. Unfortunately, the Philippines' scores remained below the OECD average in both years. Despite the latest PISA 2022 test results, the nation's performance in 2018 showed no significant improvement (Chi, 2023). The Philippine government has implemented various measures to address these issues, including curriculum revisions, infrastructure improvements, and teacher training programs. Following a two-year research period, the Department of Education introduced the MATATAG K-10 curriculum, reducing the number of competencies students must master.

2.1.3 Investigating Reading Comprehension Levels: A Philippine Perspective

A separate study in the Philippines targeted Junior High School (JHS) students at Malibud National High School, comprising a total population of 200 students officially enrolled for the 2020-2021 school year. The selection of respondents was deliberate, focusing on those with Reading Efficiency Index levels predominantly categorized as frustration level. Modeled after the Research and Development (R&D) framework, the study resulted in the creation of a Reading Program for Junior High School. The researchers performed a needs analysis to assess the reading comprehension levels of the participants, utilizing the outcomes to formulate the reading program.

Moreover, the study utilized QDA (Qualitative Document Analysis) during the assessment phase. This qualitative research method involves the researcher interpreting documents to gain insights and understanding about a specific assessment topic, similar to how content is coded in focus groups or interview transcripts (Bowen, 2009). The document analysis process involves coding content for examination.

The findings revealed that sixty-seven percent of the respondents' Reading Efficiency Index falls within the Frustration Level. This reading level indicates that the readers lack sufficient background knowledge for a given lesson and do not meet the criteria for instructional levels of accuracy and rate. Consequently, readers at this level necessitate significant assistance from their teachers. The Frustration Level is the lowest reading level, and it is characterized by students withdrawing from reading situations, often manifested by a refusal to read (Palacio, 2022).

2.1.4 Enhancing Reading Comprehension Performance through Contextualized Teaching

Incorporating reading comprehension instruction into real-life situations enhances learners' interaction with the material and deepens their understanding of its importance (Bonganciso, 2016). Achieving this involves designing reading lessons and activities around the learners' interests and surroundings. As the study examined the impacts of Contextualized Teaching and Learning on learners' reading comprehension performance, the developed Reading Program proved beneficial in addressing the respondents' comprehension challenges. Following the intervention, the learners' reading comprehension performance improved from the lowest rank of the Frustration Level to the Instructional Level. Evaluating reading comprehension involves appraising one's grasp of literal and inferential aspects, critical thinking skills, recognition of text structures, mastery of vocabulary, and proficiency in answering questions. The Phil-IRI assessment tool employs various methods, including standardized tests and teacher observations, to measure a reader's competency in understanding texts. This tool likely considers elements like text complexity, comprehension strategies, and contextual understanding, comprehensively evaluating a reader's abilities. These skills are typically categorized into frustration, instructional, and independent levels (Mercado-Banguis, 2018).

2.1.5 Factors Influencing Reading Comprehension

Findings of the study of Lynch (2020), suggested that an individual's reading comprehension proficiency is impacted by various elements such as phonological awareness, deficiencies in vocabulary, and learning disabilities. Suwanaroa (2021), further highlighted that beyond challenges in reading, factors such as learners' attitudes, parental support, and the quality of classroom instruction and learning also play crucial roles in influencing reading comprehension. The reading comprehension of learners is influenced by various factors, posing challenges, particularly for those at the frustration level. Learners in this category benefit from a conducive and socially interactive environment that fosters successful reading comprehension. Consequently, English language educators should create supportive teaching environments to enhance reading comprehension, as emphasized by Lazarus and Aransiola (2016).

Meanwhile, instructional readers are influenced by good factors, such as wide background knowledge, good home environment, and interest level, this reader can read and understand text but still needs enhancement, this reader still needs constant practice, parents and teachers can be helpful to their development (Alicum, 2018). Independent readers are those who can read and have good comprehension. Liu *et al.* (2022), assert that independent reader is influenced by positive factors such as good family support, high reading interest and motivation, good social and cultural status, excellent school instruction, high IQ, good vocabulary skills and broad background knowledge and experiences, these factors are really very helpful in developing the learner's reading comprehension. However, Guthrie *et al.* (2012) emphasized the importance of motivation and engagement in reading, suggesting that frustrated readers may lack the intrinsic motivation necessary to persist and overcome comprehension difficulties. Thus, addressing these challenges requires a multifaceted approach that considers both cognitive and affective aspects of reading development.

2.2 Solution Processes of Solving Mathematical Word Problems

2.2.1 The Significance of Mathematics in Education

Mathematics is a mandatory subject studied from primary to higher education, holding a crucial role in advancing science and technology while directly contributing to human survival. Beyond mere arithmetic, mathematics encompasses a range of thinking skills, encompassing critical thinking, logical thinking, and creative thinking (Lince, 2016) and advanced cognitive abilities (Apino & Retnawati, 2017, 2018). The global emphasis on the significance of mathematics prompts continual innovation in teaching strategies, aiming to enhance the comprehensibility and practical applicability of mathematics in real-life scenarios. Problem-solving is identified as a key aspect of learning mathematics, aligning with the fundamental spirit of mathematics as a tool for developing critical thinking skills (Palmér & van Bommel, 2020; Van Zanten & Van den Heuvel-Panhuizen, 2018). In mathematics education, problem-solving introduces students to understanding phenomena related to mathematical concepts and their applications in everyday life (Osman *et al.*, 2018).

2.2.2 Developing Critical Thinking through Problem-Solving

Through problem-solving, students are anticipated to develop the capacity to methodically and logically plan and resolve diverse challenges (Albay, 2019). This skill is fundamentally crucial, empowering students to confront increasingly intricate challenges in life. Various sources consider problem-solving a critical competency for success in the 21st century, alongside critical thinking, creativity, collaboration, and communication (Albay, 2019; Partnership for 21st Century Learning, 2019). Today, problem-solving is not merely perceived as a written skill; instead, it has evolved into a vital competence essential for thriving in the professional realm and addressing the challenges of this era. In order to acquire this skill, additional capabilities are required. As NCTM (2000) outlined in the mathematics learning standards, students are encouraged to practice another skill, specifically mathematical connection, alongside problem-solving. NCTM (2000) underscores that mathematical connection serves as a facilitator for problem-solving. The application of mathematical connections assists students in identifying and utilizing relationships between mathematical concepts, enabling them to apply these connections in various contexts (Dolores Flores *et al.*, 2019).

2.2.3 Mathematical Connections

The development of strong mathematical connections is also linked to an improved comprehension of mathematics (García-García & Dolores-Flores, 2018; Kenedi *et al.*, 2019) and enhanced student performance (Kartikasari & Widjajanti, 2017; Ndiung & Nendi, 2018). Therefore, fostering mathematical connections becomes imperative for students to thrive in mathematics education. These connections generally encompass three aspects: the application of mathematics to real-life situations (Özgen, 2016), the integration of mathematics with other disciplines (Özgen, 2016), and the interrelationships between different mathematical ideas or concepts.

Businskas (2008) proposes a practical framework for conceptualizing mathematical connections, operationalized through five categories that serve as indicators of mathematical interconnections. This structure comprises five classifications:

1) diverse representations serving as mathematical connections;
2) relationships involving parts and wholes;
3) connections in which A implies B;
4) connections illustrating that A functions as a procedure for executing B; and
5) instructional-oriented connections reveal certain concepts as prerequisites for comprehending associated concepts (Businskas, 2008).

Similarly, Siregar and Surya (2017) assessed the mathematical connection abilities of junior high school students through mathematical connection tests, uncovering that their proficiency is low.

2.2.4 Evaluating Mathematical Solution Processes

Ultimately, evaluating mathematical solution processes entails assessing an individual's proficiency in approaching and solving mathematical problems. This evaluation

encompasses a range of elements, such as problem-solving abilities, critical thinking, and the application of mathematical concepts. Assessors consider the clarity and coherence of the individual's presentation of solutions, along with the efficiency and accuracy demonstrated throughout the solution process. The assessment tasks may require individuals to adapt problem-solving strategies to diverse types of mathematical problems, and, in some instances, real-world applications may be incorporated. Various measurement methods, including written exams, projects, and observations, are employed, with educators often employing rubrics to systematically assess and provide feedback on the quality of the solution processes demonstrated by the individuals under assessment. Detailing the sequence of steps involves a systematic process utilizing formulas, substitution processes, and solution procedures and ultimately arriving at accurate solutions (Hendrycks *et al.*, 2021).

2.2.5 Factors Influencing Mathematical Performance

Acharya (2017) asserted that there are many factors affecting the numerical level of the learners, it appeared that most of the learners struggle in mathematics because of math anxiety, prior knowledge of the students, lack of parental support, non-conducive environment, and poor learning motivation. Yusta *et al.* (2016) added that aside from having math anxiety and poor understanding of how to perform mathematical operations, there are also other factors that affect the mathematical performance of the learners, such as dyscalculia, in which the learners have difficulty performing basic calculations and manipulating numbers, dysgraphia where learners having a hard time writing symbols and equations, and lastly, learners with visual processing disorders might lack visual processing skills.

Moreover, Son and Fatimah (2020) emphasized that junior high school students demonstrate difficulties in solving mathematical word problems, which corresponds to research findings highlighting the complexity of this task and the various cognitive processes involved. Solving word problems requires not only mathematical knowledge but also language comprehension, problem representation, and strategic planning. These findings underscore the multifaceted nature of mathematical problem-solving and the need for instructional approaches that foster both mathematical understanding and problem-solving skills. Thus, interventions should encompass strategies for improving students' comprehension of mathematical language, enhancing their problem-solving heuristics, and promoting flexible application of mathematical concepts in diverse problem-solving scenarios.

2.3 Differences in Word Problem-Solving and Reading Comprehension Skills

Jordan *et al.* (2002) investigation states that difficulties in reading foretold student's advancement in math, whereas challenges in math did not hinder their progress in reading. They further observed that after controlling for demographic variables, the group facing only math challenges showed a quicker improvement in math skills compared to the group facing reading difficulties.

Furthermore, Kurshumlia and Vula (2019) assert that employing reading comprehension strategies significantly influences students' reading comprehension and positively enhances their ability to solve mathematical word problems. Reading in mathematics requires a correct understanding of mathematical terms and concepts to develop and comprehend problem solutions. Students must grasp the meaning of word problems, not just read them, to solve them effectively; they need to be proficient readers. These strategies help students understand and interpret the word problems more clearly.

Consequently, after being taught these strategies, students demonstrate improved performance in solving mathematical word problems.

Geary (2011) examined how mathematical skills are connected to various cognitive functions. He proposed that while certain cognitive abilities, such as problem-solving skills and working memory, are common to both mathematical tasks and other areas, a deficiency in one does not inevitably result in poor performance in the other.

3. Methodology/Methods

3.1 Research Design

The study employs a descriptive-correlational and causal-comparative research design in obtaining the data from the respondents. It describes the profile of the respondents in terms of their grade level. This also includes describing the respondents' level of comprehension skills as well the respondents' attainment of the solution processes in solving mathematical word problems. It is correlational since it facilitates predicting and explaining the relationship among interval variables between the level of comprehension skills and attainment of the solution processes in solving mathematical word problems (Seeram, 2019). In addition, it is causal-comparative since it is used to identify cause-effect relationships between groups of reading comprehension skills and the solution processes of solving mathematical word problems. This can assist in identifying the effects or reasons for differences that currently exist among or between different groups, and the variables are illustrated into two or more groups (Lawrence, 2023).

3.2 Sampling Design

Purposive sampling involves choosing participants likely to provide relevant and valuable information, as stated by Kelly (2010). It helps identify and select cases efficiently, using limited research resources optimally (Palinkas *et al.*, 2015). In this study, purposive sampling is utilized to select participants from the middle sections of Grade 7 to Grade 10 to ensure heterogeneity in the sample. Heterogeneous ensures diversity in the sample, considering factors such as cognitive abilities, learning styles, and educational backgrounds.

3.3 Locale and Respondents of the Study

The study was conducted in a High School Department of a private institution in the municipality of Midsayap. It caters for learners from different walks of life regardless of

tribe and religion. It also continually excels in the different aspects of academic and skills development, as manifested by the honor and pride it gives to the community. The respondents are junior high school students enrolled in school year 2023-2024.

3.4 Instrumentation

The instrument used in this study was the DepEd Philippine Informal Reading Inventory (Phil-IRI) standardized reading assessment tool in determining the level of comprehension skills as to independent, instructional, and frustration; and a standardized scale skills assessment tool for the attainment of mathematical skills of learners as to non-numerates, low, average and high.

4. Results

This chapter presents and discusses the results of the statistical treatment of the data gathered.

4.1 The Level of Reading Comprehension Skills

Table 1a presents the frequency and percentage distribution of the respondents on the level of reading comprehension skills.

Table 1a: Frequency and Percentage Distribution of the Respondents on the Level of Reading Comprehension Skills

Level	Frequency	Percentage
Independent	29	16.20
Instructional	45	25.14
Frustration	105	58.66
Total	**179**	**100.00**

Table 1a above shows the frequency and percentage distribution of the respondents based on the Phil-IRI in reading comprehension assessment. Based on the given table, the majority of the students, specifically 105 out of 179, constituting 58.66%, are classified under the Frustration Level. This suggests that although students can read, their comprehension is limited, and they lack the necessary background knowledge.

In the meantime, 45 students, constituting 25.14%, fall into the Instructional Level. This indicates that these students are not independent but possess sufficient background knowledge of a given lesson and can quickly access text with minimal errors. On the other hand, there were twenty-nine (29) students, constituting 16.20 %, whose level of comprehension was Independent Level. This implies that students possess sufficient prior knowledge about the lesson and can rapidly comprehend text with no or minimal errors.

Table 1b presents the mean and interpretation of the junior high school's level of reading comprehension skills.

Table 1b: Mean and Interpretation of the Respondents on the Level of Reading Comprehension Skills

Grade Level	Mean	SD	Interpretation
Grade 7	3.17	1.38	Frustration
Grade 8	2.93	1.40	Frustration
Grade 9	3.40	.82	Frustration
Grade 10	3.73	1.21	Frustration
Mean	**3.32**	**1.22**	**Frustration**

Table 1b reveals that of the four grade levels, Grade 7 has a mean of 3.17, and a standard deviation of 1.38 is interpreted as frustration. Then, Grade 8, with a mean of 2.93 and a standard deviation of 1.40, interpreted as frustration, followed by Grade 9, with a mean of 3.40 and a standard deviation of 0.82, interpreted as frustration. Lastly, Grade 10, with a mean of 3.73 and a standard deviation of 1.22, was interpreted as frustration.

Generally, the mean reading comprehension level of the junior high school students is 3.32, and a standard deviation of 1.22 is interpreted as frustration.

4.2 The Level of Solution Processes in Mathematical Word Problems

Table 2a: Frequency and Percentage Distribution of the Respondents on the Level of Solution Processes in Mathematical Word Problems

Level	Frequency	Percentage
High	2	1.10
Average	48	26.81
Low	114	63.69
Non-numerates	15	8.49
Total	**179**	**100.00**

Table 2a shows the frequency and percentage distribution of the respondents based on the solution processes of mathematical word problems of junior high school. The table above indicates that the majority of students, specifically 114 out of 179, constituting 63.69%, fall under Low Level, which means they had little numerical comprehension and limited understanding of mathematical concepts and struggled with basic arithmetic and problem-solving. Meanwhile, 48 students, constituting 26.81%, fall under the Average Level, which means they possess a basic understanding of mathematical concepts, perform routine mathematical tasks, and solve problems within a standard range of complexity.

However, from the 179 respondents, 2 of the students, constituting 1.10%, fall under High Level, which means that these very few students have a strong proficiency or advanced competence in mathematical concepts, skills, and problem-solving, and 15 students, constituting 8.49%, fall under Non-numerate Level, which means they lack proficiency or comfort in dealing with numerical concepts or mathematical tasks and may struggle with basic arithmetic, and problem-solving.

Table 2b presents the mean and interpretation of the Junior High School's level of solution processes in mathematical word problems.

Table 2b: Mean and Interpretation of the Respondents on the Level of Solution Processes in Mathematical Word Problems

Grade Level	Mean	SD	Interpretation
Grade 7	7.98	2.21	Low
Grade 8	9.35	2.12	Low
Grade 9	8.46	2.58	Low
Grade 10	9.93	3.45	Low
Mean	**8.88**	**2.72**	**Low**

Table 2b reveals that Grade 7 has a mean of 7.98 and a standard deviation of 2.21, interpreted as low. Then, Grade 8, with a mean of 9.35 and a standard deviation of 2.12, was interpreted as low. It was followed by Grade 9 with a mean of 8.46 and a standard deviation of 2.58. Finally, Grade 10 has a mean of 9.93 and a standard deviation of 3.45, interpreted as low.

Generally, the mean level of solution processes of mathematical word problems is 8.88, with a standard deviation of 2.72, which was interpreted as low.

4.3 The Relationship of Reading Comprehension and the Solution Processes of Mathematical Word Problems

Table 3 presents the relationship between reading comprehension and mathematical word problem-solving of the respondents.

Table 3: Relationship of Reading Comprehension and Mathematical Word Problems

Variables	r-value	Description	p-value	Indication	Decision
MEANRCS	0.146	Very weak positive relationship	0.052	Not significant	Do not reject the null hypothesis
MEANMWPS					

*. Correlation is significant at <0.05 level (2-tailed).

Table 3 shows the Pearson correlation and significance (2-tailed) between reading comprehension and the solution processes of mathematical word problems.

The analysis shows a computed r-value of 0.146, which means a very weak positive relationship exists between the students' reading comprehension and the solution processes of mathematical word problems. It appears that the p-value is 0.052, which is not significant, and the evidence is not enough to reject the null hypothesis.

4.4 The Difference in the Solution Processes of Mathematical Word Problems when Grouped According to Frustration, Instructional and Independent

Table 4a presents the one-way Analysis of Variance (ANOVA) on the solution processes of mathematical word problems when grouped according to frustration, instructional and independent.

Table 4a: Difference in the Solution Processes of Mathematical Word Problems when Grouped According to Frustration, Instructional and Independent

	RCL	Mean	SD	p-value	Indication	Decision
MWPS	1. (Frustration)	8.64	2.31	0.001	Significant	Reject the null hypothesis
	2. (Instructional)	8.36	2.74			
	3. (Independent)	10.59	3.41			
Total		**8.88**	**2.72**			

*. The mean difference is significant at the 0.05 level.

Table 4a shows a One-Way ANOVA analysis of the difference in the solution processes of mathematical word problems and groups of reading comprehension skills as to frustration, instructional and independent.

The p-value of 0.001 indicates that there is a significant difference between the solution processes of MWPS and the RCL groups which is less than the level of significance of 0.05. As a result, the decision is to reject the null hypothesis, suggesting that there is indeed a notable distinction between the solution processes of mathematical word problems and the reading comprehension skill groups.

Table 4b presents the multiple comparisons using the Turkey HSD test on the solution processes of mathematical word problems according to groups of reading comprehension skills.

Table 4b: Multiple Comparisons on the Solution Processes of Mathematical Word Problems according to groups of Reading Comprehension Skills

Multiple Comparisons				
Turkey HSD				
Dependent Variable	**(I) RCL**	**(J) RCL**	**Mean Difference (I-J)**	**Sig.**
MWPS	1	2	.283	.818
	2	3	2.231*	.001
	3	1	1.948*	.001

Table 4b shows multiple comparisons using the Turkey HSD test of the solution processes of mathematical word problems and groups of reading comprehension skills as to frustration, instructional, and independent.

The p-value of 0.818 indicates that there is no significant difference between frustration and instructional levels in the solution processes of solving mathematical word problems, which is greater than the level of significance of 0.05. Furthermore, the p-value of 0.001 shows a significant difference between instructional and independent levels in the solution processes of solving mathematical word problems, which is less than the level of significance of 0.05. Similarly, the p-value of 0.001 indicates a significant difference between independent and frustration levels in the solution processes of solving mathematical word problems, also less than the level of significance of 0.05.

5. Conclusions

Based on the findings of this study, many Junior High School students struggled to comprehend written texts effectively, potentially hindering their ability to understand and solve mathematical word problems that require reading comprehension. There is a crucial challenge in students' mathematical abilities, indicating that they encountered difficulties in applying problem-solving strategies and techniques effectively.

Moreover, while reading comprehension was important, it did not directly correlate with students' abilities to solve mathematical problems. Factors beyond comprehension alone may influence word problem-solving skills. Assessing and considering these additional factors in the evaluation process is essential.

Individuals excelling in reading comprehension skills may not necessarily excel in solving mathematical word problems, and vice versa. It can be concluded that although some shared cognitive abilities are involved in both tasks, such as problem-solving skills and working memory, a deficiency or poor performance in one area does not automatically translate to poor performance in the other.

6. Recommendations

Based on the findings and conclusion of the study, the following recommendations are proposed:

A. For Possible Courses of Action

1) Educational Institutions may implement targeted reading comprehension interventions and math problem-solving workshops to address frustrations and improve student skills.
2) Teachers may utilize differentiated instruction methods to cater to varied levels of reading comprehension and mathematical abilities, integrating diverse teaching strategies to enhance student learning.
3) Parents/Guardians may foster a supportive home environment by encouraging reading activities and practicing problem-solving together, reinforcing both literacy and math skills.

B. For Further Study

1) Future researchers may conduct a similar study but using experimental research methods.
2) Future researchers may conduct other researches that concentrates on alternative factors influencing students' reading comprehension and mathematical word problem-solving abilities.

C. For Possible Policy Formulation

1) Mandatory weekly reading comprehension and math problem-solving sessions tailored to students' proficiency levels.
2) Regular assessments and progress tracking to monitor improvements in reading and math skills.
3) Implementing a buddy system where high-level readers help peers struggling with reading comprehension.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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References

Acharya, B. R. (2017). Factors affecting difficulties in learning mathematics by mathematics learners. *International Journal of Elementary Education, 6*(2), 8-15. http://dx.doi.org/10.11648/j.ijeedu.20170602.11

Akın, F., Koray, Ö., & Tavukçu, K. (2015). How Effective is Critical Reading in the Understanding of Scientific Texts? *Procedia -Social and Behavioral Sciences, 174*, 2444–2451. https://doi.org/10.1016/j.sbspro.2015.01.915

Albay, E. M. (2019). Analyzing the effects of the problem-solving approach to the performance and attitude of first-year university students. *Social Sciences & Humanities Open, 1*(1), 100006. https://doi.org/10.1016/j.ssaho.2019.100006

Alicum, R. (2018, May 16). *Factors Affecting Reading*. Robi Rob.

Apino, E., & Retnawati, H. (2017). Developing instructional design to improve mathematical higher order thinking skills of students. *Journal of Physics: Conference Series,* 812, 1–7. Retrieved from https://iopscience.iop.org/article/10.1088/1742-6596/812/1/012100

Apino, E., & Retnawati, H. (2018). Creative problem-solving for improving students' higher-order thinking skills (HOTS) and characters. Character Education for 21st Century Global Citizens, 249-256. http://dx.doi.org/10.1201/9781315104188-32

Bonganciso, R. T. (2016). Effects of contextualization on the reading comprehension performance of Filipino learners. *Asia Pacific Higher Education Research Journal (APHERJ), 3*(1). https://doi.org/10.56278/apherj.v3i1.202

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative research journal, 9*(2), 27-40. http://dx.doi.org/10.3316/QRJ0902027

Businskas, A. (2008). Conversations About Connections: how secondary mathematics teachers conceptualize and contend with mathematical connections. 2008. 183f (Doctoral dissertation, Thesis (Doctor of Philosophy) Faculty of Education, Simon Fraser University, Canada). Retrieved from https://books.google.ro/books/about/Conversations_about_Connections.html?id=gNlz0AEACAAJ&redir_esc=y

Cantero, W. R. (2005). Reading comprehension level and academic performance of the fifth graders as well as teaching strategies employed by their teachers. Retrieved from https://library.ched.gov.ph/cgi-bin/koha/opac-detail.pl?biblionumber=811&query_desc=su%3A%22Academic%20achievement%22

Chi, C., (December 6, 2023). Philippines still lags behind world in math, reading and science — PISA 2022/ Philstar.com. Retrieved from https://www.philstar.com/headlines/2023/12/06/2316732/philippines-still-lags-behind-world-math-reading-and-science-pisa-2022

Congressional Policy and Budget Research Department (CPBRD). (2024, February). https://cpbrd.congress.gov.ph/2012-06-30-13-06-51/2012-06-30-13-36-50/1715-ff2024-11-philippines-performance-in-the-2018-and-2022-

pisa?fbclid=IwY2xjawH6tD1leHRuA2FlbQIxMAABHUYQ4LW2iDthvVAbbtkrmE06P6FBZEZQVw49uMqhXB4LqULOV6rHkwXenw_aem_z7dFrqzGDpMdwuSnmGTPMg#:~:text=One%20indicator%20of%20the%20country's,and%2077%2F81%20in%202022

Dolores-Flores, C., Rivera-López, M. I., & García-García, J. (2019). Exploring mathematical connections of pre-university students through tasks involving rates of change. *International Journal of Mathematical Education in Science and Technology, 50*(3), 369-389. https://doi.org/10.1080/0020739X.2018.1507050

Duran, E., & Yalçintaş, E. (2015). Review of the critical reading education in the primary schools. *Procedia-Social and Behavioral Sciences, 174*, 1560-1566. https://doi.org/10.1016/j.sbspro.2015.01.788

Ekorini, P. Z. (2018). Efektivitas Cooperative Script dalam Pembelajaran Reading Skill pada Mata Kuliah Reading Comprehension II (Skripsi). *STKIP PGRI Nganjuk*. Retrieved from https://journal.unublitar.ac.id/pendidikan/index.php/Riset_Konseptual/article/view/48

García-García, J., & Dolores-Flores, C. (2018). Intra-mathematical connections made by high school students in performing calculus tasks. *International Journal of Mathematical Education in Science and Technology, 49*(2), 227-252. https://doi.org/10.1080/0020739X.2017.1355994

García-García, J., & Dolores-Flores, C. (2020). Exploring pre-university students' mathematical connections when solving calculus application problems. *International Journal of Mathematical Education in Science and Technology, 51*(7), 1–25. http://dx.doi.org/10.1080/0020739X.2020.1729429

Geary, D. C. (2011). Consequences, characteristics, and causes of mathematical learning disabilities and persistent low achievement in mathematics. *Journal of Developmental & Behavioral Pediatrics, 32(*3), 250-263. https://doi.org/10.1097/dbp.0b013e318209edef

Gürsoy, E., & Elif, E. (2018). English teachers' understanding of the new English language teaching program and their classroom implementations. *Journal of Language and Linguistic Studies, 14*(2), 18-33. Retrieved from https://www.researchgate.net/publication/327253096_English_teachers_understanding_of_the_new_English_language_teaching_program_and_their_classroom_implementations

Guthrie, J. T., Wigfield, A., & You, W. (2012). Instructional contexts for engagement and achievement in reading. In Handbook of research on student engagement (pp. 601-634). Boston, MA: Springer US. Retrieved from https://link.springer.com/book/10.1007/978-1-4614-2018-7

Hendrycks, D., Burns, C., Kadavath, S., Arora, A., Basart, S., Tang, E., ... & Steinhardt, J. (2021). Measuring mathematical problem solving with the math dataset. arXiv preprint Retrieved from https://arxiv.org/abs/2103.03874

Jordan, N. C., Kaplan, D., & Hanich, L. B. (2002). Achievement growth in children with learning difficulties in mathematics: Findings of a two-year longitudinal study. *Journal of Educational Psychology, 94*(3), 586. http://dx.doi.org/10.1037/0022-0663.94.3.586

Kartikasari, A., & Widjajanti, D. B. (2017). The Effectiveness of Problem-Based Learning Approach Based on Multiple Intelligences in Terms of Student's Achievement, Mathematical Connection Ability, and Self-Esteem. *Journal of Physics: Conference Series, 812*, 012097. Retrieved from https://iopscience.iop.org/article/10.1088/1742-6596/812/1/012097

Kartikawati, Y., Fauziati, E., & Hikmat, M. H. (2015). The implementation of scientific approach in teaching English at the eight grade of SMP Muhammadiyah 10 Surakarta in 2014/2015 academic year: A naturalistic study (Doctoral dissertation, Universitas Muhammadiyah Surakarta). Retrieved from https://www.semanticscholar.org/paper/The-Implementation-Of-Scientific-Approach-In-At-The-Kartikawati/72cf8f3d711b6a02f5040527cb34297538089c29

Kelly S (2010) Qualitative interviewing techniques and styles. In: Bourgeault I, Dingwall R and de Vries R (eds) *The Sage Handbook of Qualitative Methods in Health Research*. Thousand Oaks: Sage Publications. https://doi.org/10.4135/9781446268247.n17

Kenedi, A. K., Helsa, Y., Ariani, Y., Zainil, M., & Hendri, S. (2019). Mathematical Connection of Elementary School Students to Solve Mathematical Problems. *Journal on Mathematics Education, 10*(1), 69-80. Retrieved from https://files.eric.ed.gov/fulltext/EJ1204804.pdf

Kurshumlia, R., & Vula, E. (2019). The impact of reading comprehension on mathematics word problem solving. In International Conference on Education and New Developments (pp. 331-335). Retrieved from https://end-educationconference.org/2019/wp-content/uploads/2020/05/2019v2end076.pdf

Kusumadewi, N. W. E., Tantra, D. K., & Utami, I. G. A. L. P. (2020). The students' reading competency on High Order items in the Junior High School. *Journal of Education Research and Evaluation, 4*(4), 358-365. http://dx.doi.org/10.23887/jere.v4i4.27720

Lawrence, F. (2023). Causal-Comparative Research. Retrieved from https://www.phoenix.edu/content/dam/edu/research/doc/2023/causal-comparative-research.pdf

Lazarus, K. U., & Aransiola, M. O. (2016). Effects of self-monitoring and self-questioning strategies on comprehension of expository texts among students with learning disabilities in Ibadan. Retrieved from http://repository.ui.edu.ng/handle/123456789/7389

Lince, R. (2016). Creative Thinking Ability to Increase Student Mathematical of Junior High School by Applying Models Numbered Heads Together. *Journal of Education and Practice 7*(6). https://files.eric.ed.gov/fulltext/EJ1092494.pdf

Liu, H., Chen, X., & Liu, X. (2022). Factors influencing secondary school students' reading literacy: An analysis based on XGBoost and SHAP methods. *Frontiers in Psychology, 13*.

Lynch, M. (2020). Why students struggle with reading comprehension. https://www.theedadvocate.org/why-students-struggle-with-reading-comprehension.

Mercado-Banguis, R. (2018). Literature-Based Teaching Reading Strategy, Media Exposure, and Students' Reading Level. Senior Editor: Paul Robertson, 238. https://www.researchgate.net/profile/Intan-Pradita-2/publication/324941436_The_Asian_EFL_Journal/links/61b87c114b318a6970dd7e17/The-Asian-EFL-Journal.pdf#page=238

NCTM. (2000). *Principles and standards for school mathematics.* Reston, VA. Retrieved from https://www.nctm.org/Standards-and-Positions/Principles-and-Standards/

Ndiung, S., & Nendi, F. (2018). Mathematics connection ability and students mathematics learning achievement at elementary school. In SHS Web of Conferences (Vol. 42, p. 00009). EDP Sciences. Retrieved from http://dx.doi.org/10.1051/shsconf/20184200009

Osman, S., Yang, C. N. A. C., Abu, M. S., Ismail, N., Jambari, H., & Kumar, J. A. (2018). Enhancing Students' Mathematical Problem-Solving Skills through Bar Model Visualisation Technique. *International Electronic Journal of Mathematics Education, 13*(3), 273–279.

Özgen, K. (2016). A theoretical study on the mathematical connection. In International Conference on Research in Education and Science (pp. 220-230). Bodrum: ICRES Publishing. Retrieved from https://www.researchgate.net/publication/326976697_A_theoretical_study_on_mathematical_learning_activities_A_case_of_function_concept

Palacio, H. (2022). Improving Reading Level of Identified Grade Four Pupils along Word Recognition through e-Reading Package. *International Journal of Science and Research 11*(8). Retrieved from https://www.ijsr.net/archive/v11i8/SR22804213530.pdf

Palinkas LA, Horwitz SM, Green CA, *et al.* (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research 42*(5): 533–544.

Palmér, H., van Bommel, J. (2020) Young students posing problem-solving tasks: what does posing a similar task imply to students? *ZDM - the International Journal on Mathematics Education, 52*(4): 743-752. https://doi.org/10.1007/s11858-020-01129-x

Partnership for 21st Century Learning. (2019). Framework for 21st century learning. Retrieved from https://static.battelleforkids.org/documents/p21/p21_framework_definitionsbfk.pdf

Payton, S. (2019). Fostering mathematical connections in introductory linear algebra through adapted inquiry. *ZDM – Mathematics Education, 51*(7), 1239– 1252. https://doi.org/10.1007/s11858-019-01029-9

Quiambao, C. (2019). Level of Reading Comprehension and Mathematical Problem Solving Skills of Grade 7 Students of Alfonso National High School. *Ascendens Asia Journal of Multidisciplinary Research Abstracts*, 3(2F). Retrieved from https://ojs.aaresearchindex.com/index.php/AAJMRA/article/view/8780

Rafi, I., & Retnawati, H. (2018). What are the common errors made by students in solving logarithm problems? Journal of Physics: Conference Series, 1097, 012157. https://doi.org/10.1088/1742-6596/1097/1/012157

Rogiers, A., Van Keer, H., & Merchie, E. (2020). The profile of the skilled reader: An investigation into the role of reading enjoyment and student characteristics. International Journal of Educational Research, 99, 101512. https://doi.org/10.1016/j.ijer.2019.101512

Sabin, M., Jin, K. H., & Smith, A. (2021). Oral exams in shift to remote learning. In Proceedings of the 52nd ACM Technical Symposium on Computer Science Education (pp. 666-672). Retrieved from https://dl.acm.org/doi/10.1145/3408877.3432511

Schleicher, A. (2018). Educating learners for their future, not our past. *ECNU Review of Education, 1*(1), 58-75. https://doi.org/10.30926/ecnuroe2018010104

Schult, J., Mahler, N., Fauth, B., & Lindner, M. A. (2021). Did students learn less during the COVID-19 pandemic. Reading and mathematics competencies before and after the first pandemic wave, *School Effectiveness and School Improvement - An International Journal of Research, Policy and Practice,* 33 https://doi.org/10.1080/09243453.2022.2061014

Seeram, E. (2019). An overview of correlational research. *Radiologic Technology, 91*(2), 176-179. Retrieved from https://pubmed.ncbi.nlm.nih.gov/31685592/

Semerci, N., & Sumerci, Ç. (2017). The Effect of Teacher Candidates' Critical Literacy Levels on Their Media Literacy Levels. *Universal Journal of Educational Research, 5*(12A), 13-18. https://doi.org/10.13189/ujer.2017.051303

Siregar, N. D., & Surya, E. (2017). Analysis of students' junior high school mathematical connection ability. *International Journal of Sciences: Basic and Applied Research (IJSBAR), 33*(2), 309-320.

Son, A. L., & Fatimah, S. (2020). Students' Mathematical Problem-Solving Ability Based on Teaching Models Intervention and Cognitive Style. *Journal on Mathematics Education, 11*(2), 209-222.

Spitzer, M. W. H., & Musslick, S. (2021). Academic performance of K-12 students in an online-learning environment for mathematics increased during the shutdown of schools in the wake of the COVID-19 pandemic. *PloS one, 16*(8), e0255629. https://doi.org/10.1371/journal.pone.0255629

Suwanaroa, S. (2021). Factors and problems affecting reading comprehension of undergraduate students. *International Journal of Linguistics, Literature and Translation, 4*(12), 15–29. https://doi.org/10.32996/ijllt.2021.4.12.3

Torppa, M., Niemi, P., Vasalampi, K., Lerkkanen, M. K., Tolvanen, A., & Poikkeus, A. M. (2020). Leisure reading (but not any kind) and reading comprehension support

each other—A longitudinal study across grades 1 and 9. *Child development, 91*(3), 876-900. https://doi.org/10.1111/cdev.13241

Van Zanten, M., & Van den Heuvel-Panhuizen, M. (2018). Opportunity to learn problem-solving in Dutch primary school mathematics textbooks. ZDM, 50 (5), 827–838. https://doi.org/10.1007/s11858-018-0973-x

Wijaya, A., Van den Heuvel-Panhuizen, M., Doorman, M., & Robitzsch, A. (2014). Difficulties in solving context-based PISA mathematics tasks: An analysis of students' errors. *The Mathematics Enthusiast, 11*(3), 555–584. https://doi.org/10.54870/1551-3440.1317

Wilson, K. (2016). Critical reading, critical thinking: Delicate scaffolding in English for Academic Purposes (EAP). *Thinking skills and creativity, 22*, 256-265. https://doi.org/10.1016/j.tsc.2016.10.002

Yusta, N., Karugu, G., Muthee, J., & Tekle, T. (2016). Impact of Instructional Resources on Mathematics Performance of Learners with Dyscalculia in Integrated Primary Schools, Arusha City, Tanzania. *Journal of education and practice, 7*(3), 12-18.

Zengin, Y. (2019). Development of mathematical connection skills in a dynamic learning environment. *Education and Information Technologies, 24*(3), 2175–2194. https://doi.org/10.1007/s10639-019-09870-x

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