SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 8 | August 2024 - Peer Reviewed Journal

MEDIATING EFFECT OF STUDY HABITS ON THE RELATIONSHIP BETWEEN MATHEMATICAL READING COMPREHENSION AND PROBLEM-SOLVING SKILLS OF JUNIOR HIGH SCHOOL STUDENTS

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Article DOI: https://doi.org/10.36713/epra17897
DOI No: 10.36713/epra17897

ABSTRACT
This study aimed to determine whether study habits significantly mediate the relationship between mathematical reading comprehension and problem-solving of students in mathematics of Grade 8 students in the Division of Davao del Norte. A descriptive-correlational research design was used. The respondents of this research were 302 Grade 8 learners from four public secondary high schools in Davao del Norte. A stratified random sampling was utilized. This study used one adapted questionnaire and two researcher-made questionnaires. Mean, spearman rho, standard deviation, and bootstrapping were used as statistical tools. Results of the study revealed that mathematical reading comprehension is infrequently manifested, problem-solving skills of students is rarely manifested, while the study habits of the students are oftentimes manifested. The findings further revealed that the variables mathematical reading comprehension and problem-solving skills are significant with one another but infrequently manifested that they are not significant with study habits. Moreover, mathematical reading comprehension exhibits a direct significant effect on problem- solving skills but study habits do not significantly mediate the relationship between mathematical reading comprehension and the problem-solving skills of the students. The results conclude that mathematical reading comprehension is contributory factor to improve the problem-solving skills of the students. The researcher recommends that the school administrators provide an opportunity to the teachers in professional development programs to improve students' mathematical reading comprehension and problem-solving skills.

KEYWORDS: *Mathematics education, problem-solving skills, mathematical reading comprehension, study habits, descriptive and correlational design, bootstrapping, Davao del Norte, Philippines*

INTRODUCTION

Problem-solving skills helped students gain confidence in their ability to handle difficult situations in the real world. To develop these abilities, mathematical reading comprehension is required (Krawitz et al., 2021). Problem-solving was more difficult for people who believe they lack the ability to do so since they will put less effort into it (Ozturk et al., 2020). On the other hand, several studies have attested that a students' problem-solving skill is heavily affected by their mathematical reading comprehension and study habits (Capone et al., 2021; Fitriani et al., 2018). Students with lower levels of reading comprehension may struggle to understand the material presented in a problem,whereas those with higher levels of reading comprehension are more likely to make connections and effectively solve the problem (Capone et al. 2021). Additionally, Fitriani et al. (2018) suggested that students who do not take the time to review their math concepts may struggle when presented with a problem-based learning situation. Also, students who struggle to comprehend mathematical texts may face difficulty understanding directions, formulas, and the underlying concepts of a problem (Horne & Lowe, 2018).

In Indonesia, the 2019 PISA test results showed that students aged 15 had an average math score of 386, which is still considered to be at level two. It was identified that students' problem-solving skills have not yet advanced to the point where they can draw conclusions from a variety of data and solve problems using a variety of procedures (OECD, 2020). In India, Nurkaeti (2018) observed that some junior high school students still struggle with the ability to solve mathematical problems, carry out numerical operations, and provide reasonable justifications and consideration, particularly comprehending the mathematical problem, coming up with a plan for how to solve it, connecting different mathematical ideas, and checking the accuracy of the answers with questions. The difficulties faced by students in these areas are causing them to struggle in solving mathematical problems, leading to incorrect or incomplete solutions. Moreover, in Turkey, a study revealed that a significant percentage of high school students struggle with problem-solving skills, with a percentage of 77.6% experiencing difficulty. In the initial test, 17.10% of students left their answer sheet blank,64.80% of answers were incorrect, and only 18.10% of junior high school students obtained a correct answer. These findings highlight a concerning issue of insufficient problem-solving skills among high school students in Turkey, indicating the

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need for effective interventions to improve students' mathematical abilities (Ulu, 2017).

In the Philippines, Filipino students have consistently exhibit far below average on national achievement exams (NAT) (Suarez & Casinillo, 2019). In the 2018 NAT, the average score of Grade 6 students in Mathematics was only 49.54%, which is significantly lower than the international average of 61.37%. Moreover, in the 2019 NAT, the average score of Grade 10 students in Mathematics was only 36.48%, which is also significantly lower than the international average of 55.49%. Filipino students performed worse than the majority of students from other countries, especially when it comes to problem-solving, in the 2018 Programme for International Student Assessment (PISA), Filipino students' average score in problem-solving was only 353 points, significantly lower than the international average of 487 points. These statistics indicate a pressing issue of insufficient problem-solving skills among Filipino students (Oclarit & Casinillo, 2020).

In the division of Davao del Norte, based on the proficiency level report in the firstquarter of one school, the grade 8 students score poorly in problem-solving during the exams in the school year 2022-2023. The results of the item about problem-solving in periodical exam shows that out of 1127 students took the exam, 56% of students failed to answer the six (6) problem-solving questions correctly and they got 43.69% of proficiency level which is far below from at least 75% required by Department of Education in DepEd order number 55, series 2016.

This study could be used to inform educational practices, policies, and curriculumdevelopment particularly in improving the mathematical reading comprehension and problem-solving skills of students. Further, this could lead to the formation and development of effective study habits, and the use of educational practice such as study groups and tutoring. This study could also raise awareness in the educational society and serve as a basis for finding interventions in the teaching and learning process in mathematics education. Solve it, connecting different mathematical ideas, and checking the accuracy of the answers with questions. The difficulties faced by students in these areas are causing them to struggle in solving mathematical problems, leading to incorrect or incomplete solutions.

OBJECTIVES

The purpose of the study was to determine whether study habits significantly mediate the relationship between mathematical reading comprehension and problem- solving of students in mathematics of Grade 8 students in the Division of Davao del Norte.
Specifically, this sought answers to the following questions:

1. What is the level of mathematical reading comprehension of students interms of: (a) reading comprehension of mathematics with symbols; and (b) reading comprehension of mathematics without symbols?
2. What is the level of study habits of students in terms of: (a) note taking; (b) use of library; and (c) time allocation to study?
3. What is the level of problem-solving skills of students in terms of: (a) understanding the problem, (b) devising a plan; (c) carrying out the plan; and (d) looking back?
4. Is there a significant relationship between: (a) study habits and mathematical reading comprehension; (b) study habits and problem-solving skills; and (c) mathematical reading comprehension and problem-solving skills?
5. Do study habits significantly mediate the relationship between mathematicalreading comprehension and problem-solving skills?

METHODOLOGY

Research Design

This quantitative study employed descriptive and correlational approaches. Quantitative research design is used to discover trends, averages, forecasts, as well as cause-and-effect connections between variables being investigated (Bhandari, 2022). In this study, the researcher used this design to determine, describe, and measure the level of mathematical reading comprehension, problem-solving skills, and study habits of junior high school students.

On the other hand, descriptive approach is to precisely and methodically describea population, situation, or phenomena. It can also be used to explore a certain population or group of people in order to gain a better understanding of their attitudes, beliefs, and behaviors (McCombes, 2022).

Moreover, correlational research design examines the correlations between variables without the researcher influencing or regulating them. In addition, indicates the intensity and/or direction of the association between two or more variables (Bhandari, 2022). The overall exposure-outcome impact is decomposed into a direct effect and an indirect effect via a mediator variable in mediation analysis. As a result, mediation analysis is an essential statistical method for learning about variable processes (Nguyen et al., 2021).

The correlation design, on the other hand, examined the relationship between the study habits, mathematical reading comprehension, and problem-solving skills to determine if there is a significant correlation between the three variables. This provided the researcher

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with an understanding of the mediating effect of study habits on the relationship between mathematical reading comprehension and problem-solving skills among junior high school students.

The above mentioned descriptive and correlation research designs are bothappropriate for this type of study because they are used to understand existing relationships and identify causal relationships between variables. The descriptive design allows for the collection and analysis of data related to the study habits, mathematical reading comprehension, and problem-solving skills of junior high school students. The information was then used to determine the extent to which study habits mediate the relationship between these two variables. The correlation design, on the other hand, examined the relationship between the study habits, mathematical reading comprehension, and problem-solving skills to determine if there is a significant correlation between the three variables. This provided the researcher with an understanding of the mediating effect of study habits on the relationship between mathematical reading comprehension and problem-solving skills among junior high school students.

Sampling Design

The respondents of this research were the Grade 8 learners of the four public secondary high schools in the west district of Santo Tomas, Davao del Norte enrolled during the school year 2023-2024. The population size of all four schools were 1400 students. There were 1100 students in school A, 133 students in school B, 115 students in school C, and 52 students in school D. In gathering data from the population, stratified random sampling technique utilizedfor the final selection of respondents. Based on the computation of the qualtrics online sample size calculator, and by following a 95% confidence level (Z-Score=1.96) as well as a 5% margin of error, the recommended sample size was 302 respondents. There were 237 students in school A, 28 students in school B, 25 students in school C, and 12 students in school D. On the other hand, figure 2 presents the map for Davao del Norte, where the study was conducted.

Research Instrument

This study collected data using one adapted instrument and two researcher-made instrument to assess study habits, mathematical reading comprehension, and problem-solving skills ofthe students in mathematics.

Mathematical Reading Comprehension Questionnaire (MRCQ) was a researcher-made questionnaire and assesses two components: reading comprehension of mathematics with symbols and reading comprehension of mathematics without symbols.

Problem-Solving Skill Questionnaire (PSQ) was researcher-made questionnaire. It contains a 10-item questionnaires comprising the following dimensions such as understanding the problem, devising the plan, carrying out the plan; and looking back.

Study Habits Questionnaires (SHQ) was from Sarikudeen and Sanni (2017) and is divided in three dimensions: note-taking, use of library and time allocation to study.

Statistical Design

In this research, the data from each instrument were tallied and recorded accurately. In context of the purpose of the study, the following statistical tools wereused to evaluate and interpret the data in the analysis of data.

Mean. This is also known as an arithmetic mean, which is a value that helps summarize a large number set. This statistical tool was used to determine the level of study habit, problem-solving skills, and mathematical reading comprehension of students in mathematics. This answered research questions 1, 2, 3, and 4.

Standard Deviation. A standard deviation is a measure of a data set's dispersion in proportion to its mean. This statistical tool was used to determine if the scores are evenly distributed or close to the mean. This answered research questions 1, 2, and 3.

Spearman rho. This statistical tool is a measure of correlation used toevaluate the strength of a linear relationship between two variables. This statistical tool was used to determine the significance of the relationship between study habits and mathematical reading comprehension, study habits and problem-solving skills, and mathematical reading and problem-solving skills. This answered research questions 4, 4.1, 4.2, and 4.3.

Bootstrapping. This statistical tool was utilized to ascertain the mediating effect of study habits on the connection between mathematical reading comprehension and problem-solving skills of the students in Mathematics. This tool was utilized to address the research question 5.

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RESULTS

1. The over-all mean on the level of mathematical reading comprehension is 37.38 with a standard deviation of 14.18 and a descriptive equivalent of low.
2. The over-all mean on the level of study habits is 3.13 with a standard deviationof 0.57 and a descriptive equivalent of moderate.
3. The over-all mean on the level of problem-solving skills of students is 8.83 witha standard deviation of 11.06 with a descriptive equivalent of very low.
4. The relationship of mathematical reading comprehension (rs=*0.046,* p=*0.43)* tostudy habits of students has no significance, and the relationship between mathematical reading comprehension (rs= 0.047, p=0.419) to study habits has no significance. Both values mentioned have a p-value greater than 0.05 level of significance, therefore, the null hypothesis failed to reject. While the mathematical reading comprehension (rs=0.289, p=<.001 has a positive correlation. The values mentioned have a p-value lessthan 0.05 level of confidence. Thus, the null hypothesis was rejected.
5. Based on the mediation analysis, the result revealed a non-significant indirect and direct effects of study habits on the relationship between mathematical reading comprehension and problem-solving skills of the students.

SUGGESTION

Based on the findings, analysis, and conclusions drawn in this study, the following recommendations are summarized:

1. To improve mathematical reading comprehension, the teachers may conduct concept mapping, visualize concepts, key information identification, and various solution approaches. They may also conduct surveys to understand students' study habits and focus on building a strong foundation in mathematical reading comprehension, enabling more effective problem-solving approaches.
2. Students are encouraged to be an active reader and practice solving mathematical problem regularly to develop the comprehension in the mathematical text. This is particularly in leading students to enhance their comprehension, improve problem- solving skills, have better application of concepts, and develop their critical thinking skills. Also, students may enroll in a tutorial or mentoring services to help them develop mathematical reading comprehension and identify the areas where the students would need reinforcement.
3. School administrators may provide equal opportunities to all teachers in professionaldevelopment programs to improve students' mathematical reading comprehension and problem-solving skills. They may also incorporate study skills workshops intothe curriculum to foster effective learning habits. Additionally, they may support research-based instructional methods that directly target these skills, enhancing students' understanding of math concepts.
4. The researcher also recommends similar study to be done by the other researchers to investigate further if study habits have mediating effect on the mathematical reading comprehension and problem-solving skills with different respondents. Future research for developing intervention programs may be needed to improve mathematical reading comprehension and problem-solving skills.Top of Form

CONCLUSION

The findings of the study led the researcher to draw the following conclusions. The students' level of mathematical reading comprehension is poor, students' level of study habits is fairly evident, students' level of problem-solving skills is very poor, there is no significant relationship between study habits and mathematical reading comprehension, nor between study habits and problem-solving skills. However,a statistically significant relationship exists between mathematical reading comprehension and problem-solving skills and study habits do not significantly mediate the relationship between mathematical reading comprehension and problem-solving skills.

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FIGURES

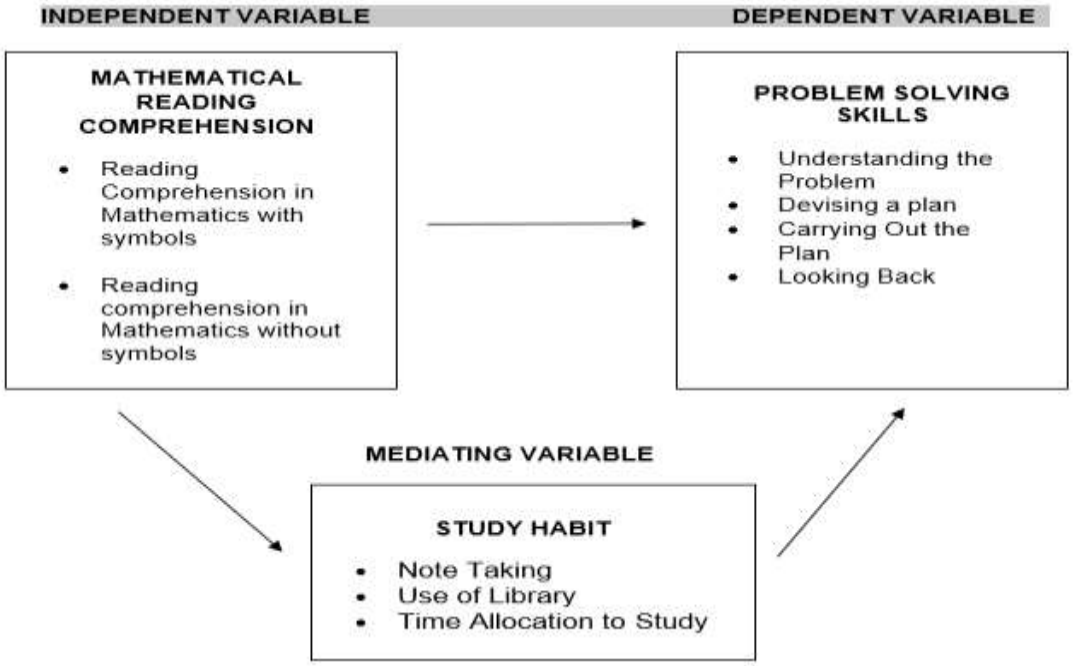


Figure 1. Conceptual Framework of the Study



Source: https://store.mapsofworld.com/digital-maps/spanish/davao-del-norte-map

Figure 2. Map of Davao del Norte

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TABLES

Table 1
Level of Mathematical Reading Comprehension of students

Indicators	SD	Mean	Descriptive Equivalent
Reading Comprehension mathematicswith symbol	15.30	39.10	Low
Reading Comprehension of mathematics without symbol	14.57	35.65	Low
Category Mean	**14.18**	**37.38**	**Low**

Table 2
Level of Study Habits

Indicators	Mean	SD	Descriptive Equivalent
Note Taking	3.60	0.63	High
Use of Library	2.49	0.82	Low
Time Allocation to Study	3.29	0.83	Moderate
Overall Mean	**3.13**	**0.57**	**Moderate**

Table 3
Level of problem-solving skills of students

Indicators	Mean	SD	Descriptive Equivalent
Understanding the Problem	5.75	12.95	Very Low
Devising a Plan	16.61	18.43	Very Low
Carrying out the Plan	12.18	15.31	Very Low
Looking Back	0.78	3.41	Very Low
Category Mean	**8.83**	**11.06**	**Very Low**

Table 4
Significance of the Relationship Among Mathematical Reading Comprehension, Study Habits and Problem-Solving Skills of the Students

Variables Correlated	rs	p-value	Decision on Ho	Decision on Relationship
Mathematical Reading Comprehension and Study Habits	*0.46*	0.43	Failed to reject H_o	Not significant
Study Habits and Problem-SolvingSkills	*0.47*	0.419	Failed to reject	Not significant
Mathematical Reading Comprehension and Problem-Solving Skills	0.189	.001	Reject H_o	Significant

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Table 5

Mediation Analysis of Study Habits to the Relationship betweenMathematical Reading Comprehension and Problem-Solving Skills

				95% C.I. (a)				
Type	Effect	Estimate	SE	Lower	Upper	β	z	p
Indirect Component	Mathematical Reading Comprehension ⇒ Study Habits ⇒ Problem Solving Skills	-0.004	0.004	-0.019	0.004	-0.005	-0.856	0.392
	Mathematical Reading Comprehension ⇒ Study Habits	0.003	0.002	-0.002	0.008	0.066	1.154	0.248
	Study Habits ⇒ Problem Solving Skills	-1.420	1.113	-3.296	0.623	-0.073	-1.276	0.202
Direct	Mathematical Reading Comprehension ⇒ Problem Solving Skills	-0.103	0.044	-0.194	-0.016	-0.131	-2.306	0.021
Total	Mathematical Reading Comprehension ⇒ Problem Solving Skills	-0.106	0.045	-0.197	-0.011	-0.136	-2.386	0.017

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