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READING COMPREHENSION AND PROBLEM SOLVING SKILLS OF GRADE SEVENSTUDENTS: A MIXED SEQUENTIAL EXPLANATORY APPROACH

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ABSTRACT: The purpose of this study was to determine the relationship between the extent of students' reading comprehension and problem solving skills and identify teaching strategies that would address the problem in teaching problem solving in Mathematics. The research utilized mixed explanatory design. The subject consists of 189 grade 7 students who were part of the general section enrolled at Davao City National High School. Purposive sampling was used in identifying the respondents taking the reading comprehension test and problem solving test while random sampling was used in identifying participants for the key informant interview. The result of the study revealed that students reading comprehension and problem solving skills were at developing level. Moreover, reading comprehension skill was a predictor of problem solving skill. This means that students' problem solving skill is dependent on their reading skills. Results also showed from the conducted focus group discussion that students gave importance to vocabulary and main idea in learning problem solving. Furthermore, using differentiated instruction was the identified best teaching strategy to understand problem solving.

I. INTRODUCTION

Mathematics as a discipline is fun and full of excitement. It explains various phenomenon that exists in the world today. However, majority of the students experience a lot of difficulties and sometimes it confuses them to solve problems in Mathematics. According to Brumbaugh, Moch & Wilkinson (2005) mathematics is a way of expressing certain ideas and opinions to be understood by others. Moreover, it does not limit only to numbers and symbols, but rather it is understanding about numbers and symbols put out (Frensch & Funke, 2014). This means that reading comprehension as a process of making meaning and gaining an overall understanding of what is described in the text is fundamentally essential (Woolley 2011). Murcia (2018) explained that students solving various math problems entails reading and computing skills at the same time. Moreover, a lot of students at their high school levels both public and private schools were both poor in comprehending and analyzing math word problems. This means that problem solving is an important part in Mathematics.

In Malaysia, students were reported to have difficulties in solving mathematical problems as they lacked possession of mathematical skills and cognitive abilities (Tambychik & Meerah 2010). This was strengthened from a qualitative study conducted in United States that teachers 'responses showed that students' abilities to read and understand the problem was the mostfrequently cited difficulty (Pearce et. al 2013).

In a study of Silva et al (2006), revealed that non performing Filipino students in Metro Manila experience difficulties attributed to reading deficiency and learning styles in Mathematics. It only shows that reading comprehension skill is important in understanding the context of problem solving in Mathematics. Furthermore, Trance (2013) investigated the common errors committed by the students on oral problem-solving in Iloilo city. Results showed that aside from transformation skill (47.69%) as the top most error committed by the students, comprehension skill constitutes 24.62% and ranked second. This implies that even Filipinos are known to be English-speaking country, yet lots of Filipinos weren't able to comprehend the meaning of language as well as translate the language in the context of Mathematics.

In the implementation of K-12 program, problem solving is one of the focal skills in Mathematics that students must possess. Therefore, it is important that students must be able to comprehend and understand concepts in solving problems. As National Council of Teachers for Mathematics (NCTM) released its Principles & Standards for School Mathematics during year 2000 stated that problem-solving is the heart of any solid mathematics curriculum (Carpenter et al., 1996) However, results of National Achievement Test S.Y. 2012 for secondary students showed a poor performance in Mathematics with a mean percentage score of 46.37% which was less than the 75% minimum requirement of the Department of Education (de Dios, 2013). Moreover, even

the Trends in International Mathematics and Science Study (TIMMS) Advanced Mathematics category, Philippines ranked the lowest among the countries who participated (The Manila Times, 2012). These results implied that the Philippines has not met the standards set by the NCTM such as ability to make sense of problems and persevere in solving them and to reason abstractly and quantitatively.

In Davao City particularly at Davao City National High School, majority of the students in the senior high school belongs in the Technical-Vocational and Livelihood (TVL). For the past two years, the population of TVL students comprises 42% in the school year 2018-2019 while 46% in the school year 2017-1018. Most of the students faced difficulties in analyzing worded problems in the topic Business Mathematics particularly topics on annuity, business and consumer loans.Results of their assessment on these topics are considered as poor performance. They cannot identify what formula to use because they cannot fully understand some technical words found on the text which result in misunderstanding of the context. With this observation, the researcher feels that this problem would have been resolved if it has been addressed at the start of their junior high school.

Reading comprehension which is understanding, gaining meaning and interpreting the text depends on a variety of reader-related, text-related, and situational factors (De Corte et al. 2001). Meaning is formed in the reader's head, that is, a person's prior knowledge affects the kinds of meanings constructed from the text information (Fukkink and de Glopper 1998; Lipson 1983). From this perspective an individual's existing knowledge is a major determinant in acquiring new information (Ausubel 1968; Cain and Oakhill 1999; Griffin et al. 1995). Furthermore, the reader's comprehension of the text is considered to be linked to the reader's ability to construct hypotheses, rules, schemas, and mental models (Vipond 1980).

Morales (2006) argued that solving worded problems in Mathematics is a challenge for students since it requires identifying and understanding the problem, and solving mathematical equations. The statement was supported by Bautista, Mitchelmore and Mulligan (2009) saying that solving worded problems is difficult if the student is not proficient in the language. In addition, Guerriero (2010) identified three important steps of problem solving. These are comprehension, modelling equations and computation. Furthermore, he added that difficulties in any of the steps inflict an effect to other steps. This was even supported that problem solving skill involves comprehension, computation and reasoning skills (Vincent, 2009).

Prakitipong and Nakamura (2006) reported that the level of students reading comprehension with higher problem solving success was high, but there was no significant difference between students with high and low problem solving success in relation to their ability in basic Mathematics. Studies of Wijaya et. al. (2014), confirmed that students with low problem solving skills were more likely to commit errors in translation and computation than those with high problem solving skills. More importantly, there was no significant difference between students with high and low problem solving skills in terms of operations in Mathematics.

It was found out from the study conducted by Kroll and Miller (1993) on elementary students, when questions were first asked as fundamental operations and later same questions were asked again in the form of problem texts; some students couldn't solve the problem but could do the fundamental operations. Tertemiz (1994) concluded that besides from fundamental operations, reading comprehension skills were also high with problem solving skills but on the other hand, fundamental operation skills of students with low performance was only at approaching proficiency.

The findings of this study will redound to the benefit of math teachers in identifying what teaching strategy to apply considering that problem solving is not easy to teach for the students. These would also serve as a recommendation to the School heads that the results of this study should be emphasized by Math teachers in incorporating the teaching strategy in instruction as well as planning in lessons on problem solving. For administrators, this study will help them identify solutions in the teaching and learning needs assessment of teachers by crafting seminar-workshops for teachers to make them adept of the identified teaching strategy appropriate for the Math teachers in improving the quality of students' problem solving skill.

Thus, this endeavor will focus on the Grade 7 students of Davao City National High School as it seeks to determine the extent of their reading comprehension on its influence on the students problem-solving skills. This study will also investigate the challenges faced by the studentsabout comprehending worded problems in Mathematics.Furthermore, this study aims to answer the following questions: 1. What is the extent of Reading Comprehension of the respondents in terms of Vocabulary, Main Idea and Critical Comprehension? 2. What is the level of problem-solving skills of the respondents in terms of Translation and Computation? 3. Which domains of reading comprehension significantly correlates to problem-solving skills? 4. Which domains of reading comprehension significantly predicts problem solving skills? 5. What are the problems encountered by the respondents in solving worded problems?

This study is primarily based on the George Polya's principle on problem-solving. According to him, there are four principles in solving a certain problem. First principle is to understand the problem. It refers to understanding the words used in the statement to be able to know the given information and determine what is sought or asked. The student may also restate the problem in his own words. Second is to devise a plan. These

are strategies and techniques to solve problems. Some strategies common are "Guess & Check, make a list, eliminatingpossibilities, looking for a pattern, drawing a picture, using a model, Working Backwards and using a formula". It could also be selection of numbers as well as operations to make a clear representation of the problem. Third, carry out a plan wherein the plan must be properly used. Lastly, look back by examining the solution obtained or do a checking process by substituting the result to the original equation or formula (How to Solve it by George Polya 2nd ed., Princeton University Press, 1957).

II. METHOD

This study employed a mixed method sequential explanatory design which according to John Creswell (2006) consists of two distinct phase: quantitative followed by qualitative. The main rationale of this approach is that the quantitative data result provides a general disposition on the research problem. The analysis on qualitative data clarifies and refines those statistical analyses by exploring participants' views in more depth. Respondents in this study were Grade 7 students who were part of general sections at Davao City National High School. The samples consisted the four classroom sections which were handled by one math teacher with a total of 189 students which will take both reading comprehension and problem-solving skill test. Out of 189, the researcher randomly identified six students from the four sections those with low results of problem solving skills as participants for the focus group discussion (FGD).The main instrument used in this study was a researcher made test in determining the extent of reading comprehension andproblem-solving skill of the respondents. The tests questionnaires were validated by experts. It was pilot tested to 35 respondents who were Grade XI students of Davao City National High School. The items of the questionnaire undergone item analysis and Kuder-Richardson coefficient formula 20 using Classical Item and Test Analysis Spreadsheet (CITAS) for reliability analysis. Result showed that the reliability coefficient of reading comprehension questionnaire was 0.72 while the reliability coefficient of problem solving questionnaire was 0.80 which indicates that both questionnaires were reliable to used.

The statistical tools that were used in analyzing the data were the Mean, Standard Deviation, Pearson-r and Linear Regression. The Mean and Standard Deviation were used to describe the level of reading comprehension and problem-solving skills. The Pearson r was used to determine the significant relationship of reading comprehension and problem solving skills while linear regression was used to determine which among the domains of reading comprehension significantly predicts problem solving skills.

III. RESULTS AND DISCUSSION

This section displays the analysis of the data gathered and was given significant interpretation.

Table 1. Mean Percentage Score of Reading Comprehension Skills of Grade 7 students

Reading ComprehensionSkills	Sample	Mean Percentage	Standard Deviation	Qualitative Description
Vocabulary	189	28.97	13.91	Developing
Main Idea		26.65	12.22	Developing
Critical Comprehension		38.98	18.53	Developing
Overall Mean		**31.53**	**9.34**	**Developing**

The extent of reading comprehension in mean percentage (%), in terms of vocabulary, main idea and critical comprehension are shown in Table 5. With a sample of 189 Grade 7 students from the four general sections, the mean percentage score of vocabulary skill in reading comprehension was 28.97% (SD=13.91%) which indicates "developing". Meanwhile, students' skill in Main idea was 26.65% (SD=12.22%) which indicates "developing" while the students' critical comprehension skill was 38.98% (SD=18.53%) which also indicates "developing". The over-all mean percentage in reading comprehension of Grade 7 students was 31.53% (SD=9.34%) which indicates "developing". The result implies that Grade 7 students reading comprehension skill is less evident. Students at this level possesses only the minimum knowledge and skills and core understandings of reading comprehension but still needs help throughout the process. Moreover, the result revealed that elementary graduates' upon entering high school were not proficient enough in determining the meaning of the words, making inferences and into evaluation of sentences of the texts or passages.

Table 2. Mean Percentage Score of Problem-Solving Skills of Grade 7 students

Problem Solving Skills	Sample	Mean Percentage	Standard Deviation	Qualitative Description
Translation	189	29.04	16.47	Developing
Computation		20.34	12.67	Developing
Overall Mean		**24.69**	**9.39**	**Developing**

The level of problem solving skills of Grade 7 students in terms of Translation and Computation are shown in Table 6. With a sample of 189 students from the four general sections, the mean percentage score of translation skill in problem solving was 29.04% (SD=16.47%) which indicates "developing", while the students' computation skills in problem solving was 20.34% (SD=12.67%) which also indicates "developing". Meanwhile, the overall mean percentage score of Grade 7 students in terms of problem-solving skill was 24.69% (SD=9.39%) which indicates "developing". The result tells us that the problem-solving skills of Grade 7 students is less evident which means the students possess only the minimum knowledge and skills as well as core understandings in solving worded problems in Mathematics. Moreover, the results revealed that elementary graduates upon entering high school were not proficient in translating the problem into an equation and capable of solving it.

Table 7 The relationship between students' reading comprehension skills and problem-solving skills

	Samples	**r**	**Sig. (2 – tailed)**	**Interpretation**
Vocabulary and Translation	189	0.19	0.01**	Significant correlation
Vocabulary and Computation		-0.05	0.50	No significant correlation
Main Idea and Translation		0.15	0.04*	Significant correlation
Main Idea and Computation		-0.01	0.88	No significant correlation
Critical Comprehension and Translation		0.21	0.00**	Significant correlation
Critical Comprehension and Computation		0.15	0.04*	Significant correlation
Reading Comprehension and Problem Solving		**0.31**	**0.00****	**Significant correlation**

**sig at 0.05*
***sig at 0.01*

Table 7 shows the significance of relationship exists between reading comprehension skills and problem solving skills. The over-all coefficient correlation denoted by r is 0.31, $p < 0.05$, which indicates that there was a positive moderate significant relationship between students' reading comprehension and problem-solving skill. This means that a student with a high score in reading comprehension had high score also in problem-solving and a student with low score in reading comprehension had low score also in problem-solving. Moreover, it also implies that when students are good in reading comprehension they can translate the problem into equation and can solve the problems.

Correlation between domains of reading comprehension skills and domains of problem solving skills were determined. There was a significant low positive relationship between vocabulary and translation with coefficient r of 0.19, $p < 0.05$. On the other hand, there was no significant relationship between vocabulary and computation with coefficient r of -0.05, $p > 0.05$. The result implies that vocabulary is important in translating problems into equations and no longer needed when solving equations.

Main idea and translation showed a low positive significant relationship with coefficient r of 0.15, $p < 0.05$. On the other hand, there was no significant negative relationship between main idea and computation with coefficient r of -0.01, $p > 0.05$.

Moreover, there was a low positive significant relationship between critical comprehension and translation with a coefficient r of 0.21 as well as critical comprehension and computation with coefficient r of 0.15, $p < 0.05$.

Table 8 Influence of Reading Comprehension skills to Problem-Solving Skills

	B	**SE**	**t**	**Sig. (2 – tailed)**	**Interpretation Ho at 0.05**
Vocabulary and Translation	0.23	0.09	2.66	0.01*	Rejected
Vocabulary and Computation	-0.05	0.07	-0.68	0.50	Accepted
Main Idea and	0.20	0.10	2.06	0.04*	Rejected

Translation					
Main Idea and Computation	-0.01	0.08	-0.12	0.91	Accepted
Critical Comprehension and Translation	0.19	0.06	2.97	0.00**	Rejected
Critical Comprehension and Computation	0.10	0.05	2.08	0.04*	Rejected
Reading Comprehension and Translation	0.53	0.12	4.31	0.00**	Rejected
Reading Comprehension and Computation	0.10	0.10	0.98	0.33	Accepted
Reading Comprehension and Problem Solving	**0.31**	**0.07**	**4.48**	**0.00****	**Rejected**

**sig at 0.05*
***sig at 0.01*

Table 8 revealed the significant predictor of problem solving skills. The result showed that the overall mean of reading comprehension skills was significantly a predictor of problem solving skills ($B = 0.31, SE = 0.07, t = 4.48, p \leq 0.05$). Moreover, domains of the reading comprehensions were also compared to the domains of problem-solving skill. Vocabulary, main idea and critical comprehension were predictors of translation skill while critical comprehension is a predictor of problem solving skills. However, vocabulary and main idea are not predictors of computation skills.

IV. RESULTS OF KEY INFORMANT INTERVIEW

Table 9 Emerging Themes on Student's difficulties in Mathematics

Theme	Subthemes
1. Negative Attitude, Poor Retention and Memory Skills	1.1 Students' Negative Attitude
	1.2 Poor background on problem-solving
	1.3 Poor Memorization Skills
2. Effect of Reading Comprehension on Problem-Solving	2.1 Importance of English in problem-solving
	2.2 Vocabulary and Main Idea as main factors in understanding Problem-Solving
3. The Effective Math Teacher	3.1 A teacher that is caring and approachable
	3.2 Apply Differentiated instruction with Peer-Related Activities

Negative Attitude, Poor Retention and Memory Skills.

One of the problems that arises why lots of students have challenges or difficulties in problem solving lessons is because of having negative attitude towards the subject and their own behavior. They do not listen attentively to the teacher and easily get distracted during lessons which results in their poor retention of the subject and ability to familiarize the concepts and formulas used.

According to a study conducted by Candeias et. al (2010) there is a need for teachers to focus on students' attitudes. It implies that attitude of students towards school, attitude towards learning and attitude towards motivation were significant factors on students' academic performance or academic environment. Thus, good academic performance can be achieved if students were conditioned in good classroom environment.

The result was also similar to a study conducted by Tuminaro and Redish (2004) that students were performing poorly on mathematical problem solving tasks in Physics due to their poor background on mathematical skills such as algebraic properties and different Mathematics laws applicable to solve equations. Moreover, students were also having a hard time how to apply these mathematical skills in various problems in Physics.

Effect of Reading Comprehension on Problem Solving.

Worded problems in Mathematics were purely textual and it is on the ability of the students to comprehend and analyze to attain the intended goal of a problem. Thus, the second arise problem of students is their ability to understand the context of the problem. There are words or phrases in which they cannot translate into Math symbols especially if they are not familiar with some technical terms applied.

Several studies confirmed that performance in problem solving was negatively affected by a higher complexity of the words used in the problem text. It means that using difficult words which may not be familiar

to students affects his understanding on problem solving (Abedi& Lord, 2001) as well as low reading ability of the students (Jordan &Hanich, 2000). As observed in the results, there is a need for students for more literacy skills when reading and solving worded problems.

The Effective Math Teacher.

The participants were asked about what strategies they prefer when the teacher teaches problem solving. Results revealed that they want a teacher that is caring and approachable and applies differentiated instruction to his or her lesson. The succeeding paragraphs will explain the different subthemes:

In a study conducted by Varga (2017), building and maintaining positive relationships between teacher and students will improve student engagement and motivation during class and at the same time minimizes their off-task behaviors. There were also changes in the attitudes and demeanors of the students. The students for whom the intervention was intended were more likely to comply with directions and participate during class.

The result was similar to the study of Bosnjak and Krizanac (2012) that learning Mathematics using differentiated instruction against traditional teaching methods was found to be effective and result to an increase on their mathematical achievement. It implies that students were able to learn Mathematics subject using variety of strategies done by the teacher. However, in a similar study conducted by Cannon (2017) differentiated instruction as a method of teaching Mathematics was found ineffective in increasing the mathematics performance of students which involves traditional lecture style instruction, small group instructions with the teacher, collaborative learning and using technology in Mathematics as compared to the traditional way of teaching.

V. CONCLUSION

Based on the results, hereunder are the conclusion drawn by the researcher:

1. The reading comprehension skill of grade 7 students was at developing level.
2. The problem solving skill of grade 7 students was at developing level.
3. Students with high score in reading comprehension had high scores in problem solving. Consequently, students with low score in reading comprehension had low scores also in problem solving.
4. Vocabulary was important in translating words and phrases into math symbols but not needed when solving equations.
5. Main idea was important in identifying the overall message of the problem and helped the students formulate an equation that would answer what was been asked. However, it was not important during solving equations.
6. Critical comprehension was a pre requisite in formulating equation and as well as solving equations.
7. Students' reading comprehension skill was a factor of problem solving skill and it may affect the result of problem solving skills. A student with good background on reading comprehension can easily solve problems.
8. Vocabulary was a predictor of translation. The ability of a student to translate words or phrases into math symbols was dependent on the ability of the child on vocabulary skills. Skills on vocabulary and main idea were not needed when solving equations.
9. Students' ability to formulate equations from worded problems can be explained with their skills in identifying the main idea.
10. Critical comprehension was a predictor of problem solving skills. Students with this skill could formulate equations properly and able to derived the correct answer.
11. The difficulties of students when dealing with problem solving includes their negative attitude towards the subject due to the treatment of their math teacher, poor memorization skills and poor background on the subject. They skip classes, mind chitchatting as well as having low motivation and self-esteem. The best teaching strategy identified from their responses were teacher's having a positive behavior in and out of the classroom and applies differentiated learning with focus on collaborative activities.

VI. RECOMMENDATIONS

Based on the findings of the study, the researcher recommends the following:

1. Mathematics teachers must know the idea that students' problem solving skill is link to reading comprehension. With this, they would be able to help improve the ability of students to understand worded problems.
2. Mathematics teachers must coordinate English teachers in crafting various activities related to differentiated learning that will both improve students' reading comprehension skills and problem solving skills. Math teachers must seek help from English teachers incorporate lessons related to reading comprehension to become adept of his or her expertise.

3. Since most of the students find Mathematics difficult, Math teachers must maintain good positive behavior that is being approachable and student centered. Students are always into teachers who can freely ask questions and motivate them to do their tasks.
4. School Heads, Curriculum developers or Academic Program Heads may organize a seminar workshop for the faculty to enhance their skills in differentiated instruction in math so they can also be adept with skills on how to attack the lessons in problem solving. Incorporation of differentiated learning activities must be fully implemented, as recommendation during class observations where the topic falls on problem solving and must be integrated in the learning plans across grade levels.
5. The study will serve as basis for future researchers to conduct related studies with innovation of problem solving teaching strategies to address low skills in problem solving.

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