

An Integrative Approach through Reading Comprehension to Enhance Problem-Solving Skills of Grade 7 Mathematics Students

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Abstract

The purpose of this sequential mixed method study was to learn about the effectiveness of the integrative approach through reading comprehension as a strategy in teaching mathematics to enhance the problem-solving skills of Grade 7 students. The first phase of the study involved quasi-experimentation to determine the effect of the integration of reading comprehension skills in teaching mathematics on the problem-solving skills of the students. The second phase of the study involved an exploration of the effects of the intervention through qualitative interviews. Quantitative results showed a significant difference in the performance of students exposed to the integrative approach against the conventional approach, in favor of the experimental group. In terms of qualitative results, students interviewed perceived the strategy as a primary tool for learning and an essential for fostering self-mastery and development of sense of focus and concentration. They stressed that poor listening ability, limited vocabulary, and poor retention were the problems that they experienced. They also recommended that in order to improve the implementation of the strategy, teachers may provide more examples, discussion, evaluation and intervention activities, and collaborative activities; enrich the vocabulary of the students; and improve the means of instruction.

Introduction

The ability to solve problems is a basic life skill and is essential to understand technical subjects. Problem-solving is a subset of critical thinking and employs the same strategies. It is the process of reasoning to solutions using more than a simple application of previously learned procedures (Keller, 2001). Being able to effectively improve comprehensive ability in mathematics is important for a child's success in school.

The comprehension skill, on the other hand, plays a vital role in developing the problem-solving skills of students. One cannot answer a certain word problem unless he or she fully grasps the concepts and understands the given situation. Thus, when one student tries to solve a certain problem, they also at the same time exercise their reading comprehension skills. Roldan, Neuhaus, Boulware-Gooden and Swank (2006) emphasized that reading comprehension and problem-solving skills always go together. Comprehension ability must be developed by the students in order to understand and apply factual information that is relevant, clear, and comprehensive which can give alternative meanings or solutions to any given problem.

Language proficiency and mathematical proficiency appear to be linked, such that lower language proficiency tends to translate into poorer mathematics performance. This not only points to the role of literacy skills in learning other content areas, but it also has important implications for constructing, selecting, and teaching mathematical word problems (MacGregor & Price, 1999).

In past years, the Philippines has been continuously experiencing a decrease of students' performance in mathematics. Local, national and international surveys showed the deteriorating ranks of Filipino students in mathematics and even in other areas. As a result of this, the Philippines is challenged to step up in educating its people in mathematics and science to be competitive since many in the business community have complained about the country's state of education. Indeed, in global competitiveness indices, the Philippines have been rated poorly in terms of the quality of basic education, quality of science and mathematics education, a low collaboration between industry and the academe, and low in innovation (Luz, 2011).

The Department of Education (DepEd) singled out low reading comprehension as a primary factor for the failure of public school students in mathematics that threatens global competitiveness. Reading problems attributed as the main culprit for the poor performance of some students in the National Achievement Test (Quijano, 2010). Thus, reading cannot be taken for granted if mathematics performance needs to be enhanced. Reading particularly in the early years of schooling paves a way to achievement in other content areas like mathematics. It is regarded as an indispensable part of mathematics and mathematical knowledge (Snow, Burns, & Griffin, 1998). Learning to love and value mathematics language requires a good foundation in reading. Mathematics and reading go together. In other words, improving mathematics achievement necessitates enhancing students' reading. It is also vital to recognize that young learners develop reading and mathematics skills at different rates (Fuentes, 1998).

Moreover, comprehension has often been called teacher's bugbear. Many students achieve accuracy in recognition and pronunciation, but few succeed in comprehension. To comprehend means to understand the meaning not only of a single word or a sentence but also to have a full grasp of an author's style and the features of the local setting against which the story unfolds (Alcantara, Cabanilla, Espina, & Villamin, 2003). Reading difficulties become most apparent when the reader is unable to grasp the meaning of a text passage. Reading comprehension may be affected by difficulty of the text, the vocabulary words used in the text, and the reader's familiarity with the subject matter, among other factors. If there is any indication of a reading comprehension difficulty, then a reading skills assessment should be made (Roldan, et al., 2006).

The National Council of Teachers in Mathematics (NCTM, 2000) stressed the learning principle that students must learn mathematics with understanding. If students were not able to read the questions accurately and understand what was being asked, then students were not getting a full understanding of the mathematics topics because their reading skills were an obstacle to comprehension. To compensate, the students tend to memorize the facts and procedures instead of fully understanding them.

Various studies have been undertaken to examine the relationship of the reading comprehension and problem-solving skills and have established that reading is a tool in learning in other fields, including mathematics, especially reading comprehension which is a critical skill in understanding mathematical process (Balas, 2000). Success in reading is seen as a significant measure of achievement in mathematics. Previous studies reveal the existence

of close relationship between mathematics performance and reading skills (Vilenius-Tuohimaa, Aunola, & Nurmi, 2008), reading ability and performance on mathematics items assessing higher level cognitive skills (Walker, Zhang, & Surber, 2008), language and test performance on mathematics word problems (Abedi & Lord, 2001), and early reading skills and changes in mathematics (Grimm, 2008).

Feedback from experts in the field also connected the relevance of comprehension ability to problem-solving skills. For instance, the study of Versoza (2011) provided a rich description of how language proficiency and reading skill interact with word problem-solving performance. It found out that all children who had advanced text processing strategies in English also utilized advanced mathematical strategies which suggests possible connections between mathematical strategies and the ability to solve word problems in an imported language. The same result was concluded by Imam, Mastura and Jamil (2013) who found a correlation between reading comprehension skills and students' performance in mathematics. The study showed that the poor reading comprehension skills of students are consistent with their performance in mathematics. Also, the findings of the investigation of Larwin (2010) on reading as fundamental in predicting mathematics achievement in 10th graders showed that student achievement can be explained by students' reading ability. The higher-level reading comprehension ability was associated with higher mathematics achievement scores.

Reading processes can affect the problem-solving process, but can also act as an integral part of the solving process according to the result of the study of Österholm (2004) who investigated reading comprehension perspectives on problem-solving. Many types of research have given examples of how the problem-solving situation seems to affect the reading process, that is, the reader seems to act quite differently depending on prior experiences in similar situations, something that can have far-reaching consequences on the reading process. Further, Orhun (2003) found that there was a significant relationship between the problem-solving skill performance and knowledge-skill acquired in lectures of mathematics. In particular, the knowledge-skill acquired in the lecture of mathematics plays an important role in determining the problem. Similarly, there are researchers who found the skills of reading comprehension to have a meaningful effect on problem-solving performance. It can be concluded that students' knowledge-skill acquired in the lecture of mathematics and reading comprehension ability can be correlated with their mathematical problem-solving performance.

Hite (2009), in an investigation on the impact of the use of different reading strategies to the students' problem-solving ability, found that reading strategies help individuals to improve their abilities to focus on and solve word problems. Hite's study focused on improving problem-solving by enhancing reading skills. It utilized two classes of fifth grade mathematics students composed of 11 and 10 students per class. Hite implemented various reading strategies throughout a three-month time period. She taught students to break down story problems, learn the steps in solving them, write their own story problems, create math dictionaries, write story problem webs, and listening to themselves reading problems, created more confidence in the students and increased the likelihood that they would use these strategies on their own. She utilized pre- and post-math surveys and interviews to determine the perception and impression of students towards mathematics as a subject. Also, she gave pre- and post-math test and problems of the week to examine the progress of learning and knowledge of students in the content. Despite the strong correlation between problem-solving and comprehension skills, research showed that instruction involving reading comprehension strategies is not taking place in many classrooms (Pressley, 1998). There are only a few programs that encourage using the two skills at the same time. By explicitly teaching and co-

teaching reading comprehension strategies, teachers can make a positive impact on students' reading development. These strategies are easily integrated into teaching-learning process and story time learning objectives. When a classroom teacher uses the same terminology in modeling and guiding students' practice of reading comprehension strategies, readers have a consistent and viable scaffold for learning these strategies (Moreillon, 2007).

Thus, in this study, the researchers integrated reading comprehension strategies as an integrative approach to teaching mathematics, with a specific focus on developing students' problem-solving skills. The aim of the research was to determine the effect of the integrative approach through reading comprehension on the development of problem-solving skills.

This study may prove significant in contributing to the ways in which mathematics teachers can enhance the problem-solving skills of their students. This may also give them additional insights into the use of reading comprehension skills to improve problem-solving skills. Students, on the other hand, may benefit from this research through improved classroom instruction and the development of reading comprehension and problem-solving skills. Administrators may benefit from this investigation by upgrading teachers' competence in teaching mathematics and providing instructional support through coaching and provision of instructional materials.

Method

Research design

This study utilized the sequential explanatory design, consisting of two distinct phases. The first phase was the collection and analysis of quantitative data in the form of a pretest-posttest of the control and experimental group followed by the second phase, which was the collection and analysis of qualitative data in the form of an in-depth interview. Weight typically was given to the quantitative data, and the mixing of the data occurred when the initial quantitative results inform the secondary qualitative data collection. Thus, the two forms of data were separate but are connected (Creswell, 2002).

The mixed methods design is a procedure for collecting, analyzing and “mixing” both quantitative and qualitative data at some stage of the research process within a single study, to understand a research problem more completely (Creswell, 2002). The rationale for mixing is that neither quantitative nor qualitative methods are sufficient by themselves to capture the trends and details of the situation.

According to Creswell, Plano-Clark, Gutman and Hanson (2003), the sequential explanatory design is “characterized by the collection and analysis of quantitative data followed by the collection and analysis of qualitative data”. In this design, priority is generally given to the quantitative data, and then the two methods are integrated during the interpretation phase of the study (see Figure 1).

The objective of the sequential explanatory design is “typically to use qualitative results to assist in explaining and interpreting the findings of a primarily quantitative study” (Creswell et al., 2003). Morse (1991) stated that this method can be particularly useful when unexpected results arise in a quantitative study. The qualitative data are useful in examining unexpected results in greater detail. The simplicity of this design is one of its main strengths (Creswell, et al., 2003).

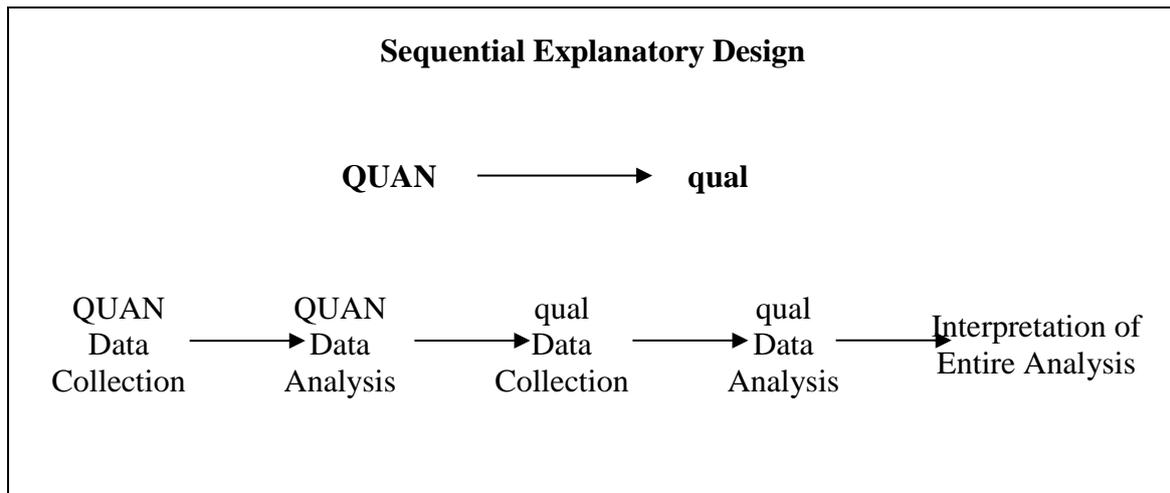


Figure 1: Diagram showing the sequential explanatory design

In the quantitative phase of the research, the researchers relied on numerical data taken from the result of the quasi-experimental method of ‘pretest-posttest control and experimental group’ in their problem-solving skills. Experimental group students were taught by integrating reading comprehension in teaching while the control group of students was taught via a conventional teaching strategy. A total of 30 Grade 7 students were part of the experimental group, while another 30 Grade 7 students were part of the control group. The quasi-experimentation phase was conducted from August 2016 to October 2016 of 2016–2017 school year. The topics covered focused on absolute value of a number, absolute value equations, numbers on a number line, representation of real life situations which involve real numbers, solving problems involving real numbers, and operations on integers.

In the qualitative phase of the study, the researchers gathered qualitative data through interviewing the experiences of six students in the experimental group. They were asked their views, challenges, and recommendations on the new strategy applied in the teaching-learning process.

Locale of the study

This study was conducted in La Filipina National High School located at Tagum City, Davao del Norte, Philippines. It is one of the secondary schools under the Division of Tagum City. It primarily caters the seven neighboring elementary schools in Tagum City, namely: Suaybaguio-Riña Elementary School, Florentino Catalan Elementary School, Mesaoy Elementary School, Col. Rosalio C. Saldares Elementary School, Union Elementary School, Magdum Elementary School and La Filipina Elementary School. The school was chosen since one of the researchers is a teacher in the said school handling Grade 7 mathematics.

Research instruments

Phase I: Quantitative

To assess the effectiveness of the integrative approach through reading comprehension on the problem-solving skills of the Grade 7 students, the researchers developed a problem-solving skills test consisting of multiple-choice items with four options. It was a 58-item test that dealt with the different competencies and problem-solving skills covering the topics in the second quarter of Grade 7 mathematics for the 2016–2017 school year. Fourteen (14) items fell under content-related reasoning; 14 fell under evaluating; 13 fell under ordering/integrating; and 17

fell under critical thinking. Below are sample questions for each indicator of the problem-solving skills test.

Content-related reasoning

1. What is the opposite of -6?
 a. 0 b. 3 c. 6 d. 12
2. What is the absolute value of -5.4?
 a. 0 b. -54 c. 5.4 d. -5.4
3. What is |6.6|?
 a. 3.3 b. -3.3 c. 6.6 d. -6.6
4. What is the absolute value of $\frac{7}{9}$?
 a. 1 b. $\frac{7}{9}$ c. $-1\frac{7}{9}$ d. $\frac{-7}{9}$

Evaluating

1. There was a diver 20 feet below the water surface. She is now 20 feet below the surface. Which integer represents her change in depth?
 a. -10 b. 10 c. 0 d. -1
2. Bruce bought P5,000 fancy watch. If Bruce had a beginning balance of P7,000, which integer represents how much money he ended up with?
 a. 3000 b. 1000 c. 2000 d. 12000
3. Gwen deposited P200 she made from helping out with chores. If Gwen's bank account started out with a balance of P700, which integer represents the final balance?
 a. 1000 b. 900 c. 800 d. 500

Ordering/integrating

1. Arturo wants to buy a video-game system worth Php 17,000. He can pay for the system in 12 months if he pays Php 5,000 now and then Php 1,000 each month. How will the number of monthly payment be affected if Arturo pays Php 5,000 now and Php 1,200 each month?
 a. He will make 2 fewer monthly payments.
 b. He will make 3 fewer monthly payments.
 c. He will make 5 fewer monthly payments.
 d. He will make 10 fewer monthly payments.
2. The price of gasoline at 4 different gas stations is shown in the table at the right. Which station offers the cheapest price of gasoline per liter?
 a. Gas Station D
 b. Gas Station V
 c. Gas Station I
 d. Gas Station E

Gas Station	Amount of Gasoline (liters)	Price
D	15	Php 723.00
I	12	Php 575.40
V	10	Php 482.50
E	8	Php 386.40

Critical thinking

1. Karen wanted to buy a pen that cost Php 18 but did not have enough money for it. Dante agreed to lend her as much money as she had with her. After buying the pen, Karen was left with Php 2. How much money did she have at first?
 - a. Php 10
 - b. Php 11
 - c. Php 12
 - d. Php 13

2. Gary wants to buy a refrigerator whose cash price is Php 8,463. If he buys it on credit, he needs to pay Php 1,542 for 6 months. How much more is the price of the refrigerator when purchased on credit than in cash?
 - a. Php 628
 - b. Php 789
 - c. Php 812
 - d. Php 944

In preparing the test questionnaire, the researchers followed the rigor of constructing research instruments, following the procedure outlined by Oriondo and Antonio (1984). The researchers developed an 80-item test which was the first draft of the questionnaire. This was distributed to a limited number of students for a pilot trial in order to test vocabulary load and clarity of expressions of the test. Suggestions and comments from the students regarding the content and formulation of questions were taken for improvement. Then, the questionnaire was revised incorporating the suggestions from students and changing/eliminating words that created confusion. The revised questionnaire was used in conducting the first trial with a large sample of students for item analysis. After the revision, the first trial of the item analysis was carried out. Some questions were discarded, while others were revised and retained. After which, the second trial of the item analysis was done to a new set of samples with the same conditions as the first trial. The second item analysis was done to determine if the revised test items had improved the test in terms of difficulty index and discrimination index. After the second item analysis, the validation of the final instrument was carried out by experts in the field of Grade 7 mathematics including master teachers, the head teacher, and the education program supervisor in mathematics. A form for the content validity was provided for them. After the validation, the questionnaire was subjected to reliability testing. The reliability coefficient of the final questionnaire was 0.895.

Phase II: Qualitative

To capture the experiences of the students on the integration of reading comprehension to enhance problem-solving skills, the researchers used the structured face-to-face interview with six participants from the experimental group. Maximum variance sampling was employed based on the increase or decrease of scores in the problem-solving skills test. The questions in the interview explored the experiences of the students, their feelings, perceptions, challenges and recommendations to improve the implementation of integration of reading comprehension as an integrative approach.

Interview analysis sheets were prepared in order to create a set of analytic notes to accompany each interview. These helped the researchers to adapt the research process as the analysis was conducted. It was useful to have some standard form to the sheets so that they could be compared. This was best achieved by making the sheets as simple as possible (Gibson & Brown, 2009).

Data collection procedures

Phase I: Quantitative

The quantitative phase of the study focused on determining whether the integrative approach through reading comprehension as a strategy in teaching have an effect on enhancing problem-solving skills in mathematics of the Grade 7 students. The primary technique for collecting the quantitative data was the researcher-developed test, containing multiple choice items distributed to the control and experimental group during the pretest and posttest. Mathematics teachers, education program supervisor in mathematics, and expert teachers were invited to secure the content validity of the instrument.

Pretest was conducted in the first day of implementation. Students in the experimental and control group was properly informed on the purpose of the test. The students answered the test in one and a half hours. After that, the checking of the responses of students were done by the researchers. After the conduct of the pretest, the application of the integrative approach followed. One class with 30 students became the experimental group, while another class with 30 students became the control group. The quasi-experimentation phase was carried out in one and a half months. The researchers used reading strategies in teaching mathematical content, including Verbal and Visual Word Association (VVWA), Student VOC Strategy, KWL, and Story Telling, which procedures were taken from the book of Barton and Heidema (2002) entitled *Teaching Reading in Mathematics: A Supplement to Teaching Reading in the Content Areas*. Meanwhile in the control group, the researchers used the conventional way of delivering the topics and competencies. After the given period, the control and experimental groups were given the posttest to determine the effect of the integration of reading comprehension on problem-solving skill of the students.

Phase II: Qualitative

The general objective of the qualitative phase in this study was to find out how students in the experimental group view their experiences in class where reading comprehension was integrated into teaching mathematics. A set of structured questions was prepared for the six participants in the face-to-face interview. These questions explored the experiences of the students, their feelings, perceptions, challenges and recommendations to improve the implementation of integration of reading comprehension as an integrative approach. Maximum variation sampling was used to determine the participants to be interviewed. This is a purposeful sampling strategy, which aims to sample for heterogeneity (Cohen & Crabtree, 2006). Hence, the results of the quantitative phase were used in the selection of participants for the qualitative phase – those who performed well and did not perform well in the experimental group. Prior to the interview, an informed consent was sought from the parents, and an informed assent was sought from the student-participants. The interview ran for about an hour for each participant.

Data analysis procedure

Phase I: Quantitative

Before the data analysis, raw data were checked against the test results of the students for accuracy of scores. All statistical analyses of the quantitative results were conducted with the help of a statistical software. The data were first entered. These included percentage scores in problem-solving skills test in the pretest and posttest of the students under the experimental and control groups. Case summaries were generated involving mean, standard deviation and number of cases. Before conducting the one-way Analysis of Covariance (ANCOVA), the researchers tested the data for the assumptions underlying ANCOVA, namely: independence, normality, and homogeneity of the regression (slopes). Results revealed that, in terms of

homogeneity of the regression (slopes), all domains of problem-solving skills suggested non-significant interaction between the covariate (pretest) and the factor (experimental and control groups). Having obtained a non-significant interaction result for each domain, the researchers proceeded with the ANCOVA analysis. The ANCOVA examines the influence of an independent variable on a dependent variable while removing the effect of the covariate factor (Statistics Solutions, n.d.).

Phase II: Qualitative

In the qualitative analysis, data collection and analysis proceed simultaneously. The second phase of the study employed Colaizzi's (1978) strategy for descriptive phenomenology. Audio records were transcribed by the researchers. Each transcript was read several times to gain a sense of the whole content. Afterwards, significant statements pertaining to each qualitative research question were extracted from each transcript. Then, meanings were formulated from the significant statements. After having formulated the meanings, the process of grouping all these formulated meanings into categories (clustered themes) was initiated. Each cluster of themes was coded to include all formulated meanings related to that group of meanings. After creating categories, all emergent themes were defined into an exhaustive description. The results of the qualitative data analysis were returned and discussed to the participants (Shosha, n.d.).

Results and discussion

Pretest and posttest mean percentage scores of the students exposed in an integrative approach and conventional approach of instruction

Figure 2 shows the pretest and posttest mean percentage scores of the students exposed to the conventional method of instruction in terms of content-related reasoning (Mean Percentage Score=66.9048; MPS=62.8571), evaluating (MPS=39.0476; MPS=46.6667), ordering/integrating (MPS=26.6667; MPS=26.6667) and critical thinking (MPS=41.7647; MPS=41.7647) in grade 7 mathematics. The overall pretest and posttest mean percentage scores of the students are 43.7943 and 44.6553, respectively. The overall mean percentage scores of the students exposed to conventional methods on problem-solving skills, in total, do not reach the passing standard of the Department of Education in the Philippines, which is 60, which can be transmuted to 75 in the final report. However, it could be observed that the students exposed to conventional methods of instruction reached the passing standard in terms of content-related reasoning. It could also be observed that there was a decrease in content-related reasoning after the intervention. This could be due to the conceptual density of mathematics text. According to Schell, as cited in Reehm and Long (1996), mathematics texts presents more concepts per word, sentence, and paragraph than any other content-area text.

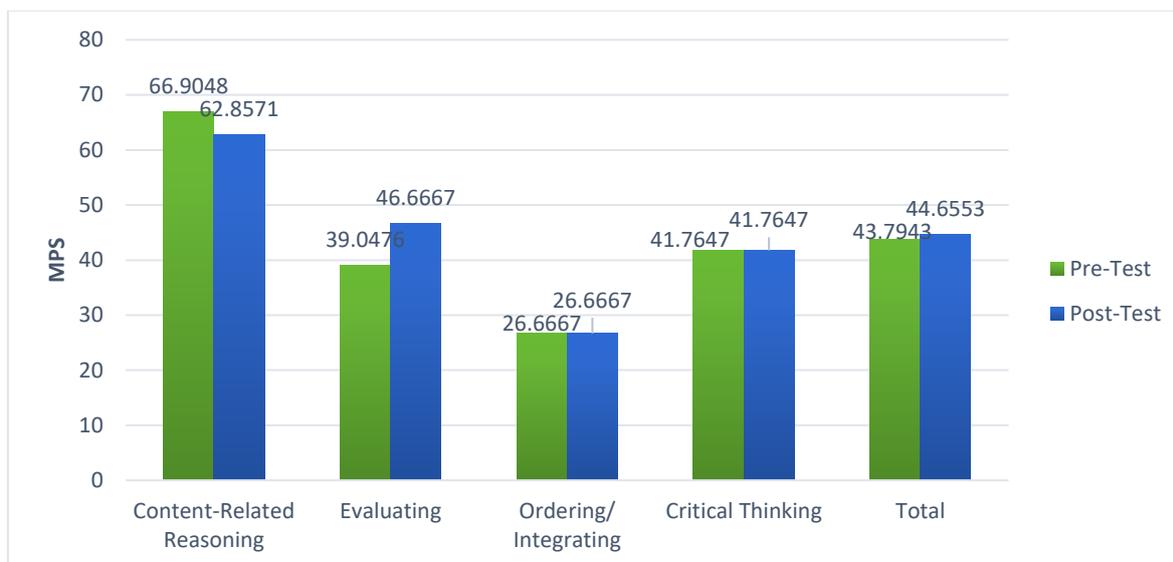


Figure 2: Multiple bar graph showing the pretest and posttest mean percentage scores of students exposed to conventional method of instruction

Figure 3 shows the pretest and posttest mean percentage scores of the students exposed to the integrative approach of instruction through reading comprehension in terms of content-related reasoning (MPS=45.4762; MPS=63.5714), evaluating (MPS=39.5238; MPS=48.3333), ordering/integrating (MPS=21.7949; MPS=33.3333) and critical thinking (MPS=17.4510; MPS=61.7647) in grade 7 mathematics. The overall pretest and posttest mean percentage scores of the students are 30.5177 and 52.5863, respectively. The overall mean percentage scores of the students exposed to integrative approach to instruction on problem-solving skills, in total, do not reach the passing standard of the Department of Education in the Philippines, which is 60, which can be transmuted to 75 in the final report. However, it could be observed that the students exposed to the integrative approach reached the passing standard in terms of content-related reasoning and critical thinking. In addition, the problem-solving skills of the students improved after being exposed to the intervention. This is supported by Hite (2009) who investigated the impact of the use of different reading strategies to the students’ problem-solving ability and found out that reading strategies help individuals improve on their abilities to focus on and solve word problems.

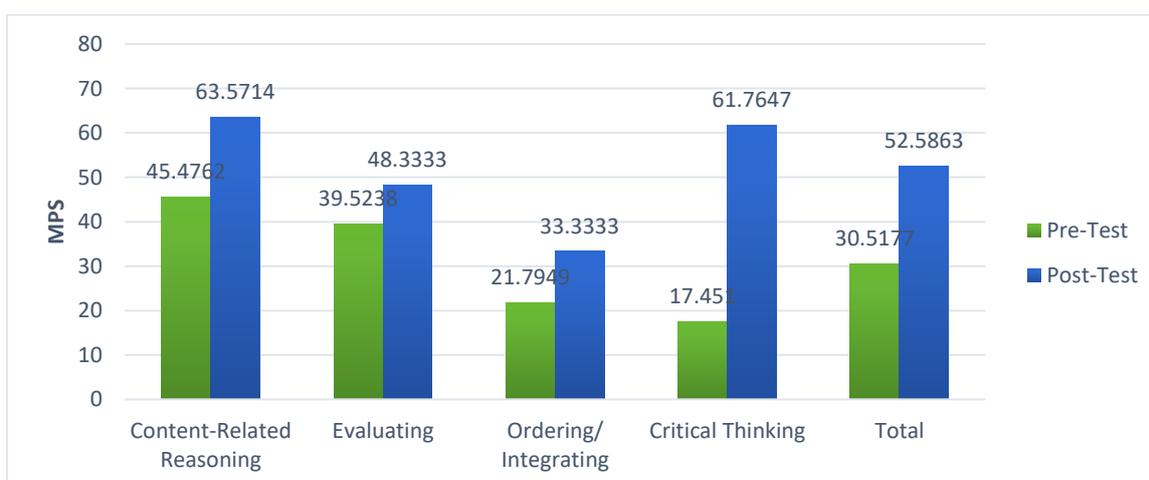


Figure 3: Multiple bar graph showing the pretest and posttest mean percentage scores of students exposed to integrative approach of instruction

Figure 4 shows the posttest mean percentage scores of the students exposed in an integrative approach of instruction through reading comprehension and conventional approach of instruction in terms of content-related Reasoning (MPS=63.5714; MPS=62.851), Evaluating (MPS=48.3333; MPS=46.6667), ordering/integrating (MPS=33.3333; MPS=26.6667) and critical thinking (MPS=61.7647; MPS=41.7647). The overall pretest mean percentage scores of students exposed to integrative approach and conventional approach are 52.5863 and 44.6553, respectively. The overall mean percentage scores of the students exposed to the integrative approach and conventional methods of instruction in teaching problem-solving skills, in total, do not reach the passing standard of the Department of Education in the Philippines, which is 60, which can be transmuted to 75 in the final report. However, it could be observed that the students exposed to the integrative approach reached the passing standard in terms of content-related reasoning and critical thinking. This is supported by Larwin (2010) who stressed that student math achievement could be explained by students' reading ability. The higher level reading comprehension ability was associated with higher math achievement scores.

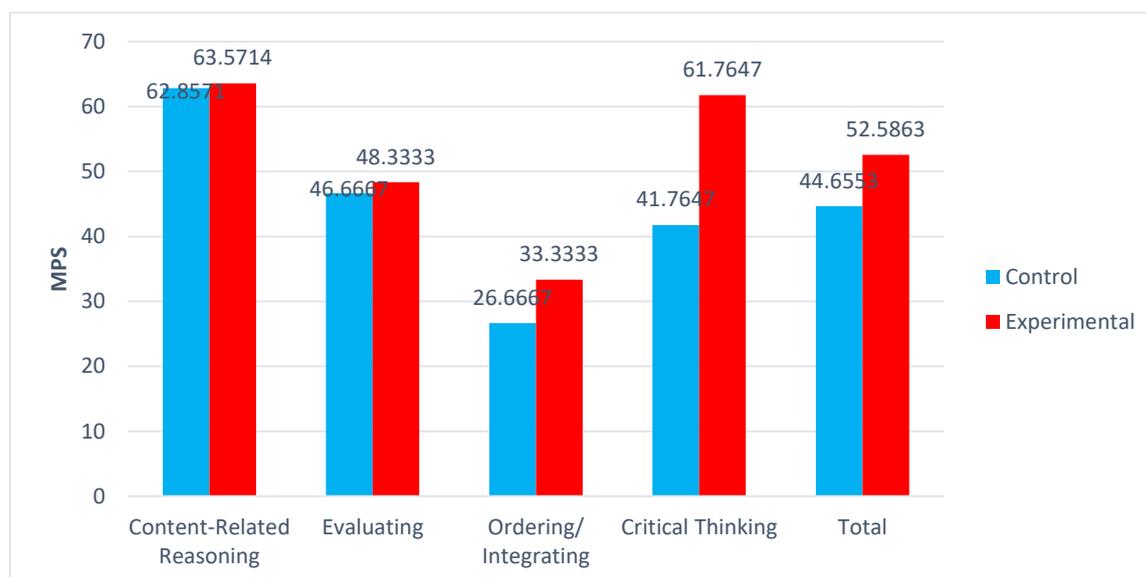


Figure 4: Multiple bar graph showing the posttest mean percentage scores of students exposed to integrative approach and conventional approach of instruction

Significance of the difference in the post-test scores between the integrative approach and conventional approach of instruction

Content-related reasoning

Table 1 results reveal that there was no significant difference in the performance of the students between the experimental and control groups after controlling for the effect of the covariate which is the pretest, $F(1,57) = 13.861$, $p = 0.067$. This implies that the use of an integrative approach does not enhance the problem-solving skills of students in terms of content-related reasoning. This may be due to a lack of appropriate schemata that can fit within the content of the text. According to Nunan (2001), there are at least three (3) possible reasons to account for the students' failure in comprehending a passage: (1) Students may not have appropriate schemata the author anticipated so they simply cannot understand the concept being communicated; (2) Students may find a consistent interpretation of the text, but will

misunderstand the author; (3) Students may have the appropriate schemata, but the author does not provide sufficient clues in the text to effectively utilize a bottom-up skill to activate the content schemata the reader may already possess.

Table 1: Analysis of covariance (Ancova) in students' performance in integrative approach and conventional approach of instruction in terms of content-related reasoning

Source	SS	df	MS	F	p
Group	888.102	1	888.102	3.489	.067
Pretest	3527.960	1	3527.960	13.861	.000
Error	14507.755	57	254.522		

Evaluating

Results of Table 2 show that there was no significant difference in the performance of the students between the experimental and control groups in terms of Evaluating after controlling for the effect of the covariate which is the pretest, $F(1,57) = 0.195$, $p = .660$. This implies that the use of Integrative Approach does not enhance the problem-solving skills of students in terms of evaluating. This may be due to the failure of the students to use concrete logical operations. Logical thinking is thinking in terms of causes and consequences, which in its turn means that it is sequential thinking (Strydom, 2005).

Table 2. Analysis of covariance (ANCOVA) in students' performance in integrative approach and conventional approach of instruction in terms of evaluating

Source	SS	df	MS	F	p
Group	35.232	1	35.232	0.195	.660
Pretest	1295.340	1	1295.340	7.184	.010
Error	10277.789	57	180.312		

Ordering/integrating

Table 3 results reveal that there was a significant difference in the performance of the students between the experimental and control groups in terms of ordering/integrating after controlling for the effect of the covariate which is the pretest, $F(1,57) = 6.318$, $p = .015$. This implies that the use of an integrative approach enhances the problem-solving skills of students in terms of ordering/integrating. This implies further that the students exposed to the integrative approach were able to use formal operations to integrate multidimensional or ill-defined goals, and to cope with non-transparent or multiple dependent constraints (Reeff, Zabal, & Blech, 2006).

Table 3: Analysis of covariance (ANCOVA) in students' performance in integrative approach and conventional approach of instruction in terms of ordering/integrating

Source	SS	df	MS	F	p
Group	877.506	1	877.506	6.318	.015
Pretest	612.420	1	612.420	4.410	.040
Error	7916.179	57	138.880		

Critical thinking

Table 4 results reveal that there was a significant difference in the performance of the students between the experimental and control groups in terms of critical thinking after controlling the pretest, $F(1,57) = 15.810$, $p = .000$. This implies that the use of an integrative approach

enhances the problem-solving skills of students in terms of critical thinking. In the environment of an integrative approach, collaborative activities in a class promoting critical thinking can be created by providing the conditions for the students to communicate with one another in order to reflect together on the solution to the problem. Cooperative-learning settings address many of the concerns that teachers have and give them ways to deal with some problems that they face in their classrooms. Moreover, educational research points out the great contribution of cooperative learning to academic and social fields of the learning process (Artzt & Newman, 1990). Some studies suggest that students with different levels of ability become more involved in task related interactions as a result of cooperative learning and that students' attitudes toward to the school and toward to the discipline become more positive. While learning mathematics in certain cooperative-learning settings, students often improve their problem-solving abilities, solve more abstract mathematical problems, and develop their mathematical understanding (Leikin & Zaslavsky, 1999).

Table 4: Analysis of covariance (ANCOVA) in students' performance in integrative approach and conventional approach of instruction in terms of critical thinking

Source	SS	df	MS	F	p
Group	4508.531	1	4508.531	15.810	.000
Pretest	14.798	1	14.798	.052	.821
Error	16255.098	57	285.177		

Overall performance

Table 5 results reveal that there was a significant difference in the overall performance of the students between the integrative approach and conventional approach of instruction, $F(1,57) = 22.029$, $p = .000$, in favor of those exposed to integrative approach.. This implies that the use of an integrative approach enhances the problem-solving skills of students in mathematics. It is therefore encouraged to use integrative approach in teaching mathematical concepts. This is supported by Clarkson and Williams (1994) who posited that students' reading ability as well as computational proficiency are factors important to success in mathematics including the ability to solve word problems. Furthermore, they emphasized that when students are taught how to read math, their problem-solving performance improves.

Table 5: Analysis of covariance (ANCOVA) in overall students' performance in integrative approach and conventional approach of instruction

Source	SS	df	MS	F	p
Group	596.415	1	596.415	22.029	.000
Pretest	340.978	1	340.798	12.594	.001
Error	1543.222	57	27.074		

Students' views on experiences

The second phase of the study employed Collaizi's (1978) strategy for descriptive phenomenology. Audio records were transcribed by the researchers. Each transcript was read several times to gain a sense of the whole content. Afterwards, significant statements pertaining to each qualitative research question were extracted from each transcript. Then, meanings were formulated from the significant statements. After having formulated the meanings, the process of grouping all these formulated meanings into categories (clustered themes) was initiated. Each cluster of themes was coded to include all formulated meanings related to that group of meanings. After creating categories, all emergent themes were defined

into an exhaustive description. The results of the qualitative data analysis were returned and discussed to the six participants.

The themes on students' view on the strategy discussed on the perception of students exposed to the intervention based on their experiences on the integration of reading comprehension skills as a strategy to enhance mathematical problem-solving skills in the class.

**Students' Views on Experiences:
Themes and Core Ideas**

Reading Activities as a primary tool in Learning
<ul style="list-style-type: none">• Motivates students to learn in a fun and enjoyable manner• Empowers and awakens students' competitiveness and energy in participation• Tests understanding on the problems heard• Promotes hands-on activities (learning by doing).• Arouses students feelings and sensitivity over situations
Self-mastery
<ul style="list-style-type: none">• Adept to solving word problems• Grasps well the process in solving through the use of keywords, examples and multi-media in teaching• Boosts students' guts and confidence in solving problems
Sense of Focus and Concentration
<ul style="list-style-type: none">• Provides an avenue for students to focus and concentrate

Reading activities as a primary tool in learning

A significant theme of reading activities as a primary tool in learning emerged from the data. All participants found the essence of using reading strategies as an effective tool in the teaching-learning process. It motivated students to learn in a fun and enjoyable manner. The emphases of the word fun and enjoyable were mostly mentioned by the participants when asked about their experiences on the strategy, as quoted:

Our activity using the "cue cards" game was really fun. I learned a lot. The was just easy to play and the phrases are quite easy to analyze. (S002)

I enjoy our activity using the "cue card" game. It's fun and the phrase sentences are clear and easy to understand what it meant. (S003)

The participants also noted the significance and positive effect of the strategies when it comes to their understanding on the lesson. Aside from its being fun, students saw clear manifestation of the strategy as a motivating factor in learning the lesson in an enjoyable manner where students learned and understood the concepts integrated in it. As one student revealed:

The activities helped a lot especially in my understanding with the process in sc problems. It's nice because we're not only learning but the activities are enjo and fun as well. (S005)

Another student also disclosed:

The activities are helpful because it makes me analyze better the selections and problems that I'm reading. (S002)

The students showed evidently their competitive side while becoming cooperative with their group mates in performing the activity especially on strategies that entails competition. Strategies like games empower and awaken students' competitiveness and energy in participation. Competition makes the students think fast and be alert in solving for the right answer. As one student described his experience on some games:

You can really think fast during the game about the meaning of given phrase because you are competing with the other group and you really have to be alert in thinking and at the same time in selecting the right cue card. (S002)

The integration of games and competition in teaching the lesson made the class fun and enjoyable. Students were fond of the trick and playful words or phrases that enhance learning, as students further remarked:

I like games in the class just like the "cue cards" because we easily understand the lesson and we learn a lot. It's fun because even though you turn and twist the words and phrases, it sometimes gives the same meaning (although sometimes it does not). The phrases are tricky and playful. (S004)

The use of games in the class just like "cue cards" makes the class enjoyable. I really had fun in competing with my classmates in posting the corresponding mathematical expression of the given mathematical sentence to the board. However, the phrases are sometimes confusing but still it's fun. The competition makes it fun and enjoyable. (S001)

Reading activities promoted testing of one's understanding of a certain selection, sentences, or stories that have been read by others. Two of the participants viewed it as an activity that enhances listening skills and understanding clearly the concepts especially when it comes to solving word problems without reading it, they said:

I can say that the activities help me in testing my understanding on what I have heard. Like for example on our activity "word problem roulette", it really tests my understanding on the problem that I have listened. It will really show whether or not I understand correctly what is being read by my group mate. When I solve word problems read by our teacher on the board, it will clearly reflect how I understand the problem by how I solve it. (S003)

I know that solving word problems is hard especially when I don't understand it. When I solve word problems, I read and re-read it for many times just to picture out clearly what is in it. It's even harder when others are the one reading it. Even though it's confusing at first but little by little, I think I was able to adjust. And little by little I started to like it because it enhances my listening ability. Also, it will really show my understanding on the situation in the problem through my solutions. (S001)

Students learn in a variety of ways. Therefore, it is suggested that they will be exposed to different activities that promotes hands-on learning. Students perceived reading activities as an effective and enjoyable form of learning. It allowed the students to learn and understand the lesson better by doing it themselves. It allows students' minds to grow and learn based on their reading comprehension experiences, as students emphasized in one of the reading activities, as quoted:

When we do the activity on making our own story (by group) and telling and c it to the class, I better understand the concept of integers and its examples. I lik activity also because we integrate in the story the meaning, description and exa of integers. It's nice because we could hardly forget the main point about int since we really are the one who think and brainstorm the concept that we put story about integer. (S001)

I better understand and I learn more the lesson because we really are the one who conceptualize and make our own story and we are the one who make and solve the problems in it. (S002)

Aside from learning the concept, the students also demonstrated emotional affection over the examples given in the activity. Their reaction and responses to learning sometimes depends upon how the examples and situation affects them. Their perception of the activities is not limited only to the concept itself which is purely intellectual, but also to the emotional side. It aroused students' feelings and sensitivity over situations that eventually influence their mode and interest in doing the activities, as they strongly pointed out:

I like the storytelling especially on the pumpkin story because I love stories. I better because aside from the story, there are also problems at the end of chapter that we are going to answer. (S003)

I like the activity the storytelling but I don't like much the character of the main character in the story (the pumpkin) because it has peculiar attitude. I don't like its inconsistent and complicated character. I can't understand why he is changing his mind always that's why I can't connect well the order of situations in the story. I don't like it in general. (S004)

I like our activity on storytelling and creating story because it's fun. I enjoy in making our own story and acting it in the class. I find it easy to understand our lesson that we integrate in the story; and it's not difficult to do. (S005)

Self-mastery

Students perceived reading comprehension activities as a tool in promoting self-mastery of concepts. They appreciated the word problem activities given as means of exercising their problem-solving skills. Students became adept at solving word problems. One student stressed:

Through these activities, I get used to solve word problems which I think is nece: Aside from that, word problems are hard to learn. (S003)

A range of examples, keywords and media were also noted as an important exercise leading to mastery of the concepts. The students were able to grasp well the processes in solving through the use of keywords, examples and multi-media in teaching. Good examples open more and better ideas to students in doing the task. The explanation of the answers and giving more examples were also observed.

I like the examples of the story on understanding the concept of integers because it gives me lots of idea on creating my own story. The examples guide us in making our story in our activity 'creating and telling stories.' (S002)

It was all explained and examples were given to us; because for me, if there are examples, we can really solve the given problem and we will easily remember how it was done. (S001)

The use of keywords in teaching the process in solving helps the students easily understand and remember the processes. One participant commented:

The use of keywords in teaching the lesson makes it easier to learn and understand. Say for example in our lesson in subtracting integers, we use the keywords "keep-change-opposite", until now I could still remember it and every time I subtract integers, I always remember these words and it makes it easier. The keywords are hard to forget. (S001)

The different media of instruction became effective tools in the learning process and served its real purpose which is to be an aid for efficient learning of the students. Visual materials, power point presentations, handouts and the like help them to easily remember and understand the lesson. As a participant remarked:

Aside from that, the activities are projected in a powerpoint presentation and are visual materials and handouts that it makes easy to remember and understand. (S005)

One indicator of mastery is the enthusiasm of the students to share answers to the group or class. Reading activities boosts students' determination and confidence in solving problems as well as in sharing answers to others. As one student quoted:

I also like the cue cards game. It makes us all members of the group to help other in order for us to win. The game is also fun especially when you answer correctly the problem. (S005)

Sense of focus and concentration

Concentration is the ability to focus the attention on one single thought or subject, excluding everything else from the field of awareness. The ability to focus the mind is one of the most important abilities one should possess. However, most students lack the ability to concentrate. Their attention usually wanders.

Reading comprehension strategies helped students fix their mind on the subject. It provided an avenue for students to focus and concentrate. Having focused on reading and understanding word problem makes the student easily comprehend the concept. Getting focus on the lesson helps students understand the concept despite having occasional confusion in some areas. As students emphasized:

The activities help me because it makes me focus on reading and understanding the problem. Every time we have a quiz, I find it easy because I could understand it well. (S004)

In general, the activities are helpful. Even though it's confusing sometimes on some areas but I really learn something because the activities will really make you to focus. (S006)

Consequently, the students gained interest in answering questions that entail deep thinking that can exercise their brains. Students also were able to think well when doing the activity that requires analysis and brainstorming, as they stressed:

Our activity in Student VOC Strategy makes me think deep in order to answer the different questions in it. It can really exercise your brain and it makes us think well. (S005)

Example in the storytelling, I have analyze better the main point of each paragraph/chapter because it was divided to us by group. I can understand it better because we analyze and brainstorm it by group in order to share and explain it to other group as to what happen in the chapter that is assigned to us. That way, we can really think well. (S002)

Difficulties encountered

The second theme focused on the difficulties encountered by the students. It generally talked about the problems and struggles in areas where they felt unconfident and difficult.

Difficulties Encountered: Themes and Core Ideas

Poor Listening Ability

- Comprehension of sentences through listening
- Understanding correctly the concept because of reader-related factors

Limited Vocabulary

- Comprehension of unfamiliar words
- Expressing answers in English language
- Restating own understanding of a certain word
- Understanding and comprehending problems

Poor Retention

- Recollecting understanding of concepts integrated in the game
- Grasping well the lesson integrated in the game

Poor listening ability

Being able to listen well is an important part of communication especially for students. A student with good listening comprehension skills will be able to participate more effectively in class specifically in communicative situations. However, in the integrative approach class where reading comprehension is applied, it found out that students had difficulty in some aspect of listening comprehension skills that affects their understanding and comprehension of mathematical word problems. Students had difficulty in the comprehension of sentences and questions when it was just read by others. As one student observed:

I find our activity in Pairs Read difficult because some sentences are hard to understand and questions are just read. It's confusing when problems is read only by others, I can't comprehend and analyze well. (S001)

More so, listening comprehension became more difficult due to reader-related factors like the reader's soft voice, improper reading, and erroneous pronunciations. These added to the confusion of the students, as further observed:

I find our activity on "pairs read" hard to do. Even though it helps me exercise my skill in listening but it's hard to analyze and understand the sentence if it is read by others compared to reading it by yourself. Some of my group mates cannot read it properly and has soft voice that it makes confusing to listen. (S002)

It's also confusing when the questions and sentences are read by classmates alone because others have very soft voice and erroneous pronunciations. (S003)

Limited vocabulary

Limited vocabulary became also a burden to students. Unfamiliar words seemed like a foreign thing that gives a blurry vision to students understanding and comprehension of problems and concepts. This resulted to further disorientation of ideas and analysis of problems. Limited vocabulary deprived students to further explore the given situation and hinders students to use its problem-solving ability. As one student emphasized:

It's difficult to comprehend profound words. (S003)

In effect, students showed difficulty in comprehending words and explaining answers including in restating their own understanding of a certain word, as one participant revealed:

I hardly understand our activity on Student VOC Strategy. It has lots of explanations and other words are confusing and difficult to comprehend. (S003)

Aside from understanding words, students also noted difficulty in expressing answers in the English language. Some students preferred to express answers verbally in vernacular rather than writing explanations in English language, they stressed:

It's difficult to express the answer in English especially on our activity in KWL. It's better to just say orally what I have learned in the lesson than to write it in the paper. (S004)

It's difficult to state the meaning of the chosen keyword especially the portion where we write our own meaning on our understanding on the certain keyword. It's difficult to express (in English) what we really want to say. (S005)

However, I'm not so at ease with our K-W-L activity because it confuses me. I'm not so good in English especially in expressing my answer in the language. It's hard to express what I really want to say in English. (S005)

Limited vocabulary leads to poor understanding and comprehending complexities of problems. Students found it difficult to find solutions to word problems and to answer questions that they did not understand, as quoted:

Some words also used in the story are difficult to understand. (S004)

I find it really hard to do our activity using “Student VOC Strategy” where we have to select a certain keyword or phrase from the selection that we read and explore the chosen keyword. I don’t understand what to answer in some questions because some questions are hard to understand. I really find it hard to answer. (S001)

Students’ uncomfortable feelings over the use of English language sometimes lead to being doubtful and lacking confidence in their answers.

However, I find the activity on the Frayer Model hard because I don’t know what to answer. Say for example in the lesson “integer”, I’m not sure of my answer in the Facts/Characteristics box. I’m worried that my answers are not correct. (S006)

Poor retention

Retention is the ability of a person, specifically the students for this study, to remember the concepts that have been learned. It is an important ability since the students will be able to keep the learning and use it in higher topics.

In the first theme, students perceived positive views on the use of games in the class, especially on the high level of participation that the students have shown. The idea of competition also brought energy to students. However, students expressed difficulty in retaining the concepts they learned from the game. They found it difficult to recall understanding of concepts integrated into the game. As one student remarked:

During our activity in cue cards, some of the phrases are confusing although we can understand some phrases given during the game but these were easily forgotten especially the main concept. (S002)

Students also expressed difficulty in grasping well the lesson integrated into the game. The students focused merely on winning and tended not to think deeply and grasp thoroughly the main emphasis of the lesson which was incorporated in the game. One participant disclosed:

Some of us also don’t think deep and don’t grasp well the main thought and depend only the answer given by bright students in the group because we are only after of winning the game. (S002)

Students’ recommendations for improving the strategy

As an effect to the difficulty encountered as well as the views of the strategy that the students gave, they also expressed some recommendations to improve the strategy.

Students' Recommendations for Improving the Strategy: Themes and Core Ideas

Providing Ample of Examples

- Giving examples in every task/activity for better understanding
- Making own examples of problems with solutions.

Discussion, Evaluation and Intervention Activities

- Discussing the concept thoroughly
- Evaluating students' understanding
- Giving proper instruction at all tasks
- Tutoring students who needs assistance

Collaborative Activities

- Giving due credits and motivation for group activity performances.
- Providing partner to students to work with

Enriching Students' Vocabulary

- Explain confusing words and sentences
- Use common and simple words

Means of Instruction

- Utilizing of multi-media in presenting the lesson
- Writing the processes and solutions of problems on the board

Providing a variety of examples

Examples have been seen as an effective tool to guide students on what to do. Once the students were given examples, they instantly knew what exactly the teacher was saying or what the instruction of a specific task was. Examples meant better understanding and a clearer view of the picture especially in mathematical problem-solving, as some students commented:

There must always be examples given in each activity so that it is easily understood. (S001)

There must always be examples so that we can understand well what it really means. (S004)

It's always better if there are examples because we can clearly understand and we get the idea first. (S006)

Aside from examples provided, students also recommended that they be encouraged to provide their own examples, especially on word problems, with solutions to better understand and easily remember the concept. This, they believed, would somehow enhance retention skills of the students, as one participant remarked:

It is good also if we were ask to make our own example because from there we can understand it well. Example in our story telling activity where we were asked to make our own story about encounters on integers, we understand better the concept of integers. Also, it was not easily forgotten. (S001)

Discussion, evaluation and intervention activities

Deep understanding was the result of thorough exploration of the concept and full discussion of the process. Students suggested that aside from giving examples, there must also be deep

discussion of the concept and thorough evaluation of the students' understanding. One concept cannot be fully understood when the preliminary process is vague. Also, students tended to ignore understanding some concepts thinking it was acceptable not to clearly know everything. During the process of evaluation, if there were students who lagged behind others, students suggested that tutorials be provided, tutored by the classmate or by the teacher. Some students suggested:

The concept must be discussed first then we must be checked one-by-one whether we understand deeply the lesson or not because some of us only pretend that we understand it even if we really do not lesson or not because some of us only pretend that we understand it even if we really do not. The concept must be discussed first then we must be checked one-by-one whether we understand deeply the lesson. (S002)

I would also suggest tutorials especially those who do not understand the lesson. (S002)

Clear instruction was seen to be important especially in comprehension skills. Explicit instructions provide a clear vision of what the teacher was saying for a specific task. Students' shared that clear and proper instructions must be given to students for all tasks. As one student observed:

The concept must be explained well. The activities are good but we must be instructed well because some of just don't do it correctly. (S003)

Collaborative activities

Collaborative activities like paired, triad or group activities, enhance collaboration and teamwork among the group or partner. Brainstorming and sharing of ideas benefit the students. Students are not closed to their own idea alone, but rather also learn from others and together they develop one better ideas.

Students emphasized on the beauty of group activities but become distracted by the attitude of some students over the group. Students recommended giving due credits and motivation for group activity performances where students were provided with an environment where they can focus and take the activities seriously. As one student complained:

During the activities, the member must do it seriously so that we can focus on doing the activity. Others are just playing and getting naughty in the group. (S004)

Partners in all tasks were also appreciated by the students. It gave them the confidence to do the task and the self-assurance to present whether they felt it was right or wrong. Students suggested giving them a partner to work with:

The group activities are good because you have you classmates to help you especially when you do not clearly understand the concept and instruction. It's really good when there's someone who can help you. (S005)

Enriching students' vocabulary

Poor vocabulary was found to be one of the difficulties experienced by the students. Poor understanding and comprehension, vague explanation of ideas and answers, especially on questions that required details and clarification, and uncertain interpretation of questions especially on problem-solving, is often caused by a poor vocabulary. Students also perceived that they gave poor judgment on the mathematical processes to be utilized in a specific problem

due to doubtful understanding of the details of the given problem. Therefore, the students recommended enriching their vocabulary in order for them to better grasp the concepts taught to them. As one student stressed:

I wish that I'm good in English so that I can easily understand the problem. It's better for us if the confusing words were explained well so that we easily understand the problem and sentences. Also, it's good also if we were helped in developing our skills in expressing in English. (S005)

The use of simple words was also recommended. Ambiguous words added to students' burden on comprehension. Also, consideration should be given to reducing the explanations in questions with lots of explanations. Some participants remarked:

Make words simpler-as simple as possible because there are some words that are hard to understand. Use common words if possible so that it can easily be understood. (S003)

If possible, lessen the explanations. (S002)

During activities with explanations just like the student VOC, students suggested providing a sample of responses for each question so they can easily understand what the question means. As one student suggested:

There must be sample of responses or answers in activities that need explanation in the question so that we will know what it means. (S001)

Means of instruction

Media of instruction played vital role especially in the presentation of lesson. It motivated students to listen, to learn and to pay more attention. Various multi-media like projected power point presentations attract students' attention and interest. A participant commented:

It's better to use power point presentation in the lesson because it has lots of animation. (S005)

Students also recommended always writing or projecting processes and solutions on the board. Understanding is better when it is clearly written on the board rather than just explaining it verbally. As one student stressed:

The examples should always be written on the board, not just explain it verbally. (S005)

Implications for practice and further research

The use of an Integrative Approach through reading comprehension is encouraged to enhance the problem-solving skills of students in mathematics. In-service trainings for the teachers may be done to orient teachers on the proper use of the approach. Lesson plans and modules may be developed by a pool of teachers for the consumption of mathematics teachers. Further study is recommended taking into account the recommendations given by the students to improve the approach.

Conclusion

In light of the results of the study, it is concluded that the use of an integrative approach through reading comprehension is more effective in enhancing the problem-solving skills of students, particularly in the areas of ordering/integrating and critical thinking, than the use of a conventional method. Students interviewed perceived the strategy as a primary tool for learning and an essential for fostering self-mastery and development of sense of focus and concentration. They stressed that poor listening ability, limited vocabulary, and poor retention were the problems that they experienced. They also recommended that in order to improve the implementation of the strategy, teachers may provide more examples, discussion, evaluation and intervention activities, and collaborative activities; enrich the vocabulary of the students; and improve the means of instruction.

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