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Language strategies in teaching senior high school mathematics

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Abstract

This study aimed to examine the effect of language strategies on the Mathematical Problem-Solving Skills of Senior High School students. Specifically, it described the language strategies used in mathematics instruction in terms of composing with keywords, metacognition, defining format, profile, and frame, and determined how these strategies influenced students' ability to solve mathematical problems.

Using a quasi-experimental one-group pretest–posttest design, the study measured students' Mathematical Problem-Solving Skills through a 50-item test administered before and after exposure to the language strategies. A survey questionnaire was used to describe how the language strategies were manifested during the problem-solving process, while interviews were conducted to explore students' experiences in applying these strategies.

Language plays a crucial role in understanding mathematical problems. Many students struggle not because of computation but because of difficulty in interpreting problem statements, organizing information, and identifying appropriate solution processes. By integrating language strategies into instruction, students were guided to analyze keywords, reflect on their thinking, structure their solutions, and frame mathematical ideas more clearly.

The findings revealed a significant improvement in students' Mathematical Problem-Solving Skills from pretest to posttest after the integration of language strategies. Results also showed that language strategies significantly affected students' performance in solving mathematical problems. Students reported that these strategies helped them better understand problem statements, organize their thoughts, and approach solutions more systematically.

The study highlighted the importance of incorporating language strategies in teaching mathematics to enhance students' problem-solving abilities. The results provided a basis for developing instructional practices that strengthen students' comprehension and performance in Senior High School Mathematics.

Keywords: Language Strategies; Mathematical Problem-Solving Skills; Senior High School; Quasi-Experimental Design; Mathematics Instruction; Composing with Keywords; Metacognition; Defining Format; Problem-Solving Framework; Student Learning Experience

1. Introduction

Today as in the past, many students struggle with mathematics and become affected as they continually encounter difficulties in solving Mathematical problems. Mathematics is generally seen as a difficult subject and how this subject is communicated to students will influence the way the students learn the subject. Classroom routines play an important role in developing students' mathematical thinking and reasoning. Language makes it possible for the students to objectify and conceptualize his world and himself and to share the responsibility for his destiny. Language is a prime vehicle of expression and exchange of thought in the classroom.

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Mathematical language, like other languages, has its peculiar grammar, syntax, vocabulary, word order, synonyms, negations, conventions, abbreviations, sentence structure, and paragraph structure. It has certain language features unparalleled with other languages. Developing the language of mathematics is an essential aspect of teaching mathematics to young children; this process continues throughout an individual's mathematics education. Because the understanding of mathematical vocabulary affords access to concepts, mathematical instruction in the areas of language is imperative. The term language is defined as ''the words, their pronunciation, and the methods of combining them used and understood by a community' (Van der Walt,2008).

Mathematics is crucial for an increased student's achievement in school, for producing informed citizens, success in careers, as well as in personal fulfilment. Nowadays, in a technology driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information and complex situations. Despite the critical value of mathematics in society, a United Nation Development Program report says that the results of the yearly-administered National Achievement Test (NAT) are quite dismaying. The performance of the country's public high school students in the NAT has been on the decline and is significantly lower than the scores of public elementary students. DepEd data showed that the average NAT score for public high school students for school year 2011-2012 was significantly lower at 48.9% (Ordinario, 2013).

- "I thought the word quotient meant any problem, when it means a division problem. So, a negative divided by a negative would be a positive."
- "I didn't know the definition of congruent so I couldn't come up with an answer." "I forgot what congruent meant, so I guessed."
- "I thought the word sum meant multiply so I did -3 x 4 which always comes out negative" (Sprosty, 2011).

The above quotes were taken from Kelli Sprosty's seventh grade students who were trying to explain their mistakes on the Ohio Mathematics Achievement Practice Test. It shows the problems that can occur when students do not have a firm knowledge or understanding mathematics language.

If the students cannot understand the question being asked to them, or in essence, the language, they may not be successful in answering the question. The language of Mathematics is a critical factor in students' understanding of the subject. Mathematics is an essential tool in many fields, including Natural Science, Engineering, Medicine, and Social Sciences. Mathematics education as a part of the formal education setup is the study of the practices and methods or the learning progress of the students. According to Masciulli as cited by Mendoza (2011), it aims to develop a sense of enjoyment and to learn Mathematics as a process of deriving new knowledge to be applied in real life situations. Teaching and learning Mathematics is considered satisfactory if the students can reach or meet at least the passing rate of 75%. According to UNESCO (2003), this rate as the standard mastery level must be achieved by the students so that they must told that they master at least 80% of the subject's objectives. Thus, this minimum level of learning can be achieved if creative teaching and learning will be given emphasis through creative process (Custodio, 2003). Students lack problem-solving skills because they are not aware of the problem-solving strategies available to assist them in solving word problems (Chamot, et.al, 2012).

Students under General Academic Strand are the students who are still undecided on what course to take in college. The General Academic Strand was implemented to give ways for the undecided students to think about their preferred bachelor's degree once they stepped into college. The researcher who handled General Academic Strand 11, assessed that the performances of the General Academic Strand students who were in the section A were different from section B and C. Based on the observation of the teacher, some of the students from General Academic Strand 11 B and C did not focus in Mathematics since they took the strand because they do not know yet what courses really fit to them. They took General Academic Strand to help them decide what courses really suit them. When it comes to their Mathematical problem solving, it was obvious that the students found it difficult to answer based on the results of their midterm and final examinations. To help the students ease their Mathematical difficulties, the researcher who is a Mathematics teacher employed teaching strategy.

According to the study of Seethaler, et al, (2011), language is a pivotal component of mathematics success. If students' language development is weak or underdeveloped, their overall mathematics learning will become slow (Van der Walt, 2008). The researcher wants to know the place of language on the problem mentioned above about students performing low in examinations. Thus, the researcher decided to use teaching strategies that could potentially improve students' understanding of Mathematical concepts.

Recently the Department of Education held a Regional Training on Language Strategies in Teaching Mathematics at Central Luzon State University. The inability of hundreds of languages around the world that do not have direct translations of core scientific and mathematic terms is a hindrance for learners to face the real world and apply their knowledge, resulting in them being globally incompetent Torres (2018). Student teachers agree that English is necessary in teaching their subjects and Filipino should be used as support language in the Science and Mathematics classes Vizconde (2006). The rationale of the said training was to gain skills in incorporating language strategies in teaching Science and Mathematics, to develop activities to address language issues in Science and Mathematics classrooms and prepare lesson exemplars integrating language strategies. The Education Program Supervisor of Mathematics and Science with three Mathematics teachers and three Science teachers were the participants from Bulacan. The objective of the training was to understand the Language of Mathematics and Science through Logic and Linguistic Interface. It also challenged the teachers to use English for the concepts and the local language as to how each concept is used and applied. The said training introduced the five Language Strategies: Composing with Keywords, Metacognition, Defining Format, Profiles and Frames.

2. Literature Review

This part of the study provides an overview of previous studies and research conducted in relation to this research entitled Language Strategies in Teaching Senior High School Mathematics and Their Effect on Students' Mathematical Problem-Solving Skills. This literature will also discuss the different aspects of language strategies, such as composing with keywords, metacognition, defining format, profiling, and framing. Moreover, it highlights students' Mathematical Problem-Solving Skills, particularly in understanding, organizing, and solving mathematical problems.

2.1. Language Strategies

Language learning strategies are among the main factors that help determine how and how well the students learn a second or foreign language. A second language is a language studied in a setting where that language is the main vehicle of everyday communication and where abundant input exists in that language. A foreign language is a language studied in an environment where it is not the primary vehicle for daily interaction and where input in that language is restricted. An old proverb which states: "Give a man a fish and he eat for a day. Teach him how to fish and he eats for a lifetime". Applied to the language teaching and learning field, this proverb might be interpreted to mean that if students are provided with answers, the immediate problem is solved. But if they are taught the strategies to work out the answers for themselves, they are empowered to manage their own learning (Griffiths, 2004).

Schleppegrell (2007) conducted a review of research by applied linguists and mathematics educators that highlighted the pedagogical challenges of mathematics. The review notes that since at least the mid-1980s researchers have been pointing to ways that language is implicated in the teaching of mathematics. A key influence has been the discussion by Halliday (1978) of the 'mathematical register'. Halliday pointed out that counting, measuring, and other 'everyday' ways of doing mathematics draw on 'everyday' language, but that the kinds of mathematics that students need to develop through schooling use language in new ways to serve new functions.

Language strategies are crucial key for learners and teachers to consider developing students' Mathematical competency. In the classroom, teachers tend to deal with a group of students at one time, but language learning occurs differently in different individuals. Therefore, one learning strategy works for some students, while another learning strategy may not work for other students. Many researchers have tried to reveal what kinds of factors affect the favored language learning strategy use (Cook, 2001). Different factors, such as age, motivation, nationality, gender and so on, are related to different uses of language learning strategies across individual language learners. However, it is important for teachers to pay more attention to creating the learning spaces for students in the classroom to make them successful language learners. Using language learning strategies not only helps students learn the language efficiently and effectively but also helps teachers use the language learning strategies as a tool in the classroom to build their language skills Ghani, (2003). Once students know their preferred language learning strategy, they can apply this to any situation to accelerate their Mathematical competency by themselves. Moreover, knowing what strategy works for students may give teachers some ideas for the teaching methods or teaching techniques in the classroom for teachers' preparation effectively. Therefore, it is important for both students and teachers to examine what kinds of language learning can facilitate effective learning. Vygotsky (1962) believes that language is the outward expression of thinking, the way one makes meaning out of one's thoughts.

2.1.1. Composing with Keyword

A strategy that will help the students develop fluency in composing so that they may better understand the mathematical ideas that the teacher is trying to teach. If we learn better when we pay attention to words, then we must also give students frequent and continuous opportunities to express mathematical ideas in both symbols and words. Using this strategy, students are engaged in reflecting, clarifying, understanding, and incorporating. The possible tasks in Composing with Keywords are composing sentences using mathematical terms; converting number/symbol sentence to word sentence converting word sentence to number/symbol sentence; writing paragraph for mathematics; and composing mathematical ideas in response logs, journals, and proofs (Ibañez, 2018).

2.2. Metacognition

Metacognition includes knowledge about when and how to use strategies for learning or for problem solving. It also refers to higher order thinking which involves active awareness and control over the cognitive processes engaged in learning. Students without metacognitive approaches are essentially learners without direction or opportunity to review their progress, accomplishments, and future directions (Chamot, et.al, 2012). Metacognition helps students develop their reasoning, thinking, and self-evaluation skills to gain higher-order knowledge. Students respond to a variety of metacognitive starters that are variations of "I know that I know". This strategy is also designed to bring about reflection and personal assessment. According to Seeping (2018), it is by knowing what you know, knowing what you don't know, knowing what you need to know, knowing how to use strategies for learning or for problem solving.

Metacognition is the ability to know what the students know and what the students don't know. It is the ability to plan a strategy for producing what information is needed, to be conscious of their steps and strategies during the act of problem solving, and to reflect on and evaluate the productiveness of their thinking. Probably the major components of metacognition are developing a plan of action, maintaining that plan in mind over a period, then reflecting on and evaluating the plan upon its completion. Planning a strategy before embarking on a course of action assists us in keeping track of the steps in the sequence of planned behavior at the conscious awareness level for the duration of the activity. It facilitates making temporal and comparative judgments, assessing the readiness for more or different activities, and monitoring our interpretations, perceptions, decisions and behaviors. In metacognition the teacher will develop a teaching strategy for a lesson, keeping that strategy in mind throughout the instruction, then reflecting upon the strategy to evaluate its effectiveness in producing the desired student outcomes.

2.3. Defining Format

The aim of this strategy is to categorize words in the taxonomy and assess how well the students know the connections between words and choose words from a category and defining them using a specific format. It provides a template for asking questions related to mathematical terms/knowledge. It is a three-part set up to define a mathematical term that consists of question, category, and characteristics. In defining format, the teacher shows the learners how to explain the detailed and precise meanings of the major terms they use to communicate their understanding of mathematics. It also challenges the students to ask a question about a word, find a category about the word, and list characteristics that describe the word according to the given category (Ibañez, 2018).

It also refers to the writing and communicating strategies in Mathematics. Communication is an essential part of mathematics. It is a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, and discussion. The communication process also helps build meaning and permanence for ideas and makes them public. The students communicate to learn mathematics, and they learn to communicate mathematically. (NCTM, 2000).

2.4. Profiles

Profiles guide students in selecting key ideas and essential information which they entered them on the Profile, and eventually "tell it "Or write it" in their own words. Text organizers and outlines that help students keep to the topic and follow a plan, so that they in turn can guide the reader. Templates into which students plug appropriate information to solve a problem or explain a mathematical concept. Allow the student to either organize or reorganize information based on both prior knowledge and research. The Profiles for Organizing Mathematical Information aim to demonstrate knowledge of interconnections of concepts across disciplines using one concept as basis; create a logical profile of a given mathematical term ensuring that the information provide an ample description; acknowledge the importance of "Profiles" in the learning process (Daquioag, 2018).

The brain's susceptibility to paying attention is very much influenced by patterning. We are more likely to see something if we are told to look for it or prompt to its location. Patterns give context to information that otherwise would be dismissed as meaningless (Jensen, 1998). Profiles for organizing mathematical information will pay attention to important details, will present the information logically and ensure that the information provides a complete description.

2.5. Frame

Frames serve as text outlines that provide the writer (students) with a pre-established sequence for writing. Syntactic structure is given, which includes stem or partial sentences. Completing these partial sentences helps students focus on the content of their writing with minimum about organization. Frames make students concentrate on the mathematical information they need to impart with minimum concern about the beginning, middle, and end of their writing. Students learn to practice internalizing the "sound" of good writing, so that eventually they can organize their writing independently and in their own "voice". Students will be able to respond to open –ended and multistep problems. Frames will help the students develop skills in explaining, describing, and discussing mathematical problems. The facilitator can apply the skills in preparing templates for Frames in specific learning areas. The skill of explanation can be developed by training students in logical or step-by-step thinking. The teachers can modify frames to be appropriate to the students' needs but allow for a wide range of abilities (Seeping, 2018).

2.6. Problem Solving

Problem solving has a special importance in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematics problems. Problem solving as a method of teaching may be used to accomplish the instructional goals of learning basic facts, concepts, and procedures, as well as goals for problem solving within problem contexts.

Problem solving is only one type of a larger category of thinking skills that teachers use to teach students how to think. Other means of developing thinking skills are problem-based learning, critical thinking skills, creative thinking skills, decision making, conceptualizing, and information processing (Ellis, 2005).

3. Research Methods

3.1. Research Design

The researcher employed quasi-experimental design. Pretest & Posttest were employed to both control & experimental groups to find out the effectiveness of each strategy on the students' Mathematical Problem-Solving Skills in Statistics and Probability. After the implementation of the said strategies, the researcher obtained a detailed set of responses from the students about their experiences in adapting language strategies using interview and survey questionnaire.

3.2. Respondents and Sampling

The respondents of this study were GAS (General Academic Strand) 11-B and GAS (General Academic Strand) 11-C. The GAS 11-B section was composed of 49 students, and the GAS 11-C was composed of 45 students. Using random sampling, by tossing a coin the control group was GAS 11 C while the experimental group was GAS 11 B.

3.3. Instruments

The study utilized a 50-item Mathematical Problem-Solving Test, a survey questionnaire, and an interview guide to gather the necessary data aligned with the objectives of the research. The 50-item test was administered as pretest and posttest to measure the students' Mathematical Problem-Solving Skills before and after exposure to language strategies in teaching Senior High School Mathematics. The survey questionnaire was designed to describe the implementation of language strategies in terms of composing keywords, metacognition, defining format, profile, and frame. These variables provided a structured way to examine how language strategies are manifested during the problem-solving process. Moreover, interviews were conducted to obtain in-depth qualitative data regarding the students' experiences in adapting language strategies while solving mathematical problems. The instruments were administered to Senior High School students, and the collected data were analyzed to determine: (1) how language strategies may be described based on the identified components; (2) the level of students' Mathematical Problem Solving Skills as reflected in the pretest and posttest results; (3) whether a significant difference exists between pretest and posttest performance after exposure to language strategies; and (4) whether language strategies significantly affect students' Mathematical Problem Solving Skills. The interview results further supported the findings by explaining the students' experiences in applying language strategies during mathematical problem solving.

3.4. Data Analysis

The results from the pre-test & posttest of each section were tallied and collected in tabular form. To determine the effectiveness of the implementation of each method, the mean, standard deviation, and t-test were employed.

Mean was used in describing the performance of the students in pretest and in posttest. Standard deviation determined the variability and homogeneity of the students' score. Thematic analysis was used to analyze the answers from the interview. T-test helped find the significant difference among the performance of the students after exposing them to the different teaching techniques used in Mathematical Problem-Solving Skills. Multiple regression analysis is used to test if the use of language strategies significantly influences the students' Mathematical Problem-Solving Skills.

4. Results and discussion

This chapter includes the presentation of the data and results in terms of quantitative analysis and quantitative discussion of the results of the study on the effects of Language Strategies in teaching problem solving in Senior High School Mathematics General Academic Strand Grade 11 students.

Descriptive Measures on Students' Responses on the Constructs of the Language Strategies

Experience in the adaptation of language strategies is important to determine the effects of the techniques used to the experimental group.

4.1. Composing with Keywords

Composing with Keywords helps the students to develop fluency in composing so that they may better understand the mathematical ideas that the teacher is trying to teach.

Table 1a Summary of students' responses on language strategies

Constructs of Language Strategies	**N = 49**		
	Mean	SD	VD
Composing with keywords			
1. I convert number/symbol sentence to data sentence easily.	4.082	0.6719	AG
2. I easily compose mathematical ideas in math class.	4.735	0.5313	SA
3. I like writing paragraphs in mathematics.	3.776	0.9632	AG
4. I understand relationships in mathematics.	4.531	0.5810	SA
5. I go over the formula and important concepts by myself.	3.510	0.8196	AG
Overall Mean	4.127	0.3233	AG

Legend: Scale: Verbal Description (VD);4.20 – 5.00: Strongly Agree (SA);3.40 – 4.19: Agree (AG); 2.60 – 3.39: Undecided (UD);1.80 – 2.59: Disagree (DA):1.00 – 1.79: Strongly Disagree (SD)

Table 1a summarizes the measures of central tendency and dispersion of students' experiences scale in Mathematics after the adaptation of Language Strategies in teaching Problem Solving. This presents the mean responses of selected Grade 11 students on the use of language strategies in Mathematics. Accordingly, after being taught using language strategies, they were asked to rate it in terms of their problem-solving skills.

As to composing with keywords as the first component of language strategies, item #2 obtained the highest mean (i.e., $\bar{x}$ = 4.735, S.D. = .5313; "strongly agree") such that "they strongly agreed that they easily compose mathematical ideas in math class" while the lowest mean response was for item #5 (i.e., $\bar{x}$ = 3.510, S.D. = .8196; "agree") such that "they agreed that they go over the formula and important concepts by themselves." The rest of the items that described language strategies got mean responses within the range of 3.40 – 4.19 and 4.20 – 5.00, verbally described as agree and strongly agree, respectively. Generally, all items had an overall mean, $\bar{x}$ = 4.127 with a standard deviation, S.D. = .3233; verbally described as "agree."

The results implied that composing with keywords is beneficial to the students when it comes to converting number/symbol sentences, writing paragraphs and going over the formula. They can now easily understand and compose mathematical ideas in math class; and the more convenient to the learners is to compose mathematical ideas and understand relationships in mathematics.

Hence, Pugalee (2005), who researches the relationship between language and mathematics learning, asserts that writing supports mathematical reasoning and problem solving and helps students internalize the characteristics of effective communication. He suggests that teachers read student writing for evidence of logical conclusions, justification of answers and processes, and the use of facts to explain their thinking.

Moreover, reflection and communication are intertwined processes in mathematics learning. Writing in mathematics can also help students consolidate their thinking because it requires them to reflect on their work and clarify their thoughts about their ideas, (NCTM, 2000).

4.2. Metacognition

Metacognition is, put simply, thinking about one's thinking. More precisely, it refers to the processes used to plan, monitor, and assess one's understanding and performance.

Table 1b Summary of students' responses on language strategies

Constructs of Language Strategies	**N = 49**		
	Mean	SD	VD
B.Metacognition			
1. I combine my own idea into the math class learning.	4.714	0.6124	SA
2. I gain higher-order knowledge.	4.612	0.6713	SA
3. I recognize and clarify the confusing points after class.	3.816	0.7267	AG
4. I list related formula first in solving a problem.	4.816	0.3912	SA
5. I develop reasoning and thinking skills.	4.551	0.5796	SA
Overall Mean	4.5020	0.2773	SA

Legend: Scale: Verbal Description (VD);4.20 – 5.00: Strongly Agree (SA);3.40 – 4.19: Agree (AG); 2.60 – 3.39: Undecided (UD);1.80 – 2.59: Disagree (DA):1.00 – 1.79: Strongly Disagree (SD)

Table 1b presents the mean responses of selected Grade 11 students on *metacognition* as the second component of language strategies. Accordingly, item #4 obtained the highest mean (i.e., $\bar{x}$ = 4.816, S.D. = .3912; "strongly agree") such that "they strongly agreed that they list related formula first in solving a problem" while the lowest mean response was for item #3 (i.e., $\bar{x}$ = 3.816, S.D. = .7267; "agree") such that "they agreed that they recognize and clarify the confusing points after class." The rest of the items that described language strategies got mean responses within the range of 3.40 – 4.19 and 4.20 – 5.00, verbally described as agree and strongly agree, respectively. Generally, all items had an overall mean, $\bar{x}$ = 4.5020 with a standard deviation, S.D. = .2773; verbally described as "strongly agree."

The results implied that students had positive responses towards metacognition strategy and appeared to be beneficial and helpful to the students. Among the five statements in composing with keywords, item number three shows the lowest meaning which the students agree that they recognize and clarify confusing points after class. On the other hand, the students strongly agree on the rest of the item. Students also develop reasoning and thinking skills, gain high-order knowledge, and combine their own ideas into the mathematics class.

In addition, the metacognitive practices help students become aware of their strengths and weaknesses as learners, writers, readers, test-takers, group members, etc. Those who know their strengths and weaknesses in these areas will be more likely to "actively monitor their learning strategies and resources and assess their readiness for particular tasks and performances" (Bransford, et.al, 2000).

Similarly, Zulkiply (2014) stated that metacognition enables one to be successful learner, Metacognition refers to higher order thinking which involves active control over the cognitive processes engaged in learning. Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature.

Furthermore, Batang (2015) stated that metacognitive reading comprehension skill has an affirmative consequence on learning a second language and students can expand the skills they need for a successful message in English. Moreover, they also have effective reading strategies which include sounding out mentally parts of the words, understanding meaning of each word, getting the overall meaning of the text, relating the text to what they already know about the topic, looking up words in the dictionary and considering the grammatical structures.

4.3. Defining Format

Definitions function in several ways. The use of definition to distinguish between instances and non-instances of the defined concept is one approach to developing awareness and understanding of the concept itself as well as learning correct application in solving mathematics.

Table 1c Summary of students' responses on language strategies

Constructs of Language Strategies	**N = 49**		
	Mean	SD	VD
C.Defining format			
1. I can easily define mathematical terms.	4.816	0.4862	SA
2. I enjoy enumerating characteristics of mathematical concepts.	3.653	0.8050	AG
3. I can explain detailed and precise meanings of the major terms.	3.449	0.6789	AG
4. I can describe the word according to the given category.	4.469	0.7101	SA
5. It helps me more in understanding concept.	4.878	0.3312	SA
Overall Mean	4.253	0.3286	SA

Legend: Scale: Verbal Description (VD);4.20 – 5.00: Strongly Agree (SA);3.40 – 4.19: Agree (AG); 2.60 – 3.39: Undecided (UD);1.80 – 2.59: Disagree (DA):1.00 – 1.79: Strongly Disagree (SD)

Table 1c presents the mean responses of selected Grade 11 students on defining format as the third component of language strategies. Accordingly, item #5 obtained the highest mean (i.e., $\bar{x}$ = 4.878, S.D. = .3312; "strongly agree") such that "they strongly agreed that the use of language strategies in terms of defining format helps them more in understanding concepts" while the lowest mean response was for item #3 (i.e., $\bar{x}$ = 3.449, S.D. = .6789; "agree") such that "they agreed that they can explain detailed and precise meanings of the major terms." The rest of the items that described language strategies got mean responses within the range of 3.40 – 4.19 and 4.20 – 5.00, verbally described as agree and strongly agree, respectively. Generally, all items had an overall mean, $\bar{x}$ = 4.253 with a standard deviation, S.D. = .3286; verbally described as "strongly agree."

The results implied that defining format is helpful to the students when it comes in understanding concept. Students can also easily define Mathematical terms and describe the word according to the given category.

In addition, definitions are essential to mathematical terms; thus, it seems that focus on the role of definition should be central to education. However, according to Vinner (2013), The role of definition in mathematical thinking is somehow neglected in official contexts. It is not sure whether this is like this or like that, because it is taken for granted or because it is overlooked. It is obligatory to remember that there are some contexts in which referring to the formal definition is critical for a correct performance on a given task.

Moreover, the meaningful learning experience can only be obtained if the students are learning and the teacher gives the chance to define the terms in mathematics and gives students the opportunity to actively participate in the learning. In other words, true mathematical learning will result in a critical individual, open, and integrity, (Doni, 2013).

4.4. Profile

A problem-solving outline provides a strategy for solving problems. The students will answer the questions given and make a story about the answer on a particular topic. Finding and understanding patterns is crucial to mathematical thinking and problem solving, and it is easier for students to understand patterns if they know how to organize their information. Outlining is a way to organize information and to show how different ideas relate to each other. Outlining also helps to improve recall and comprehension of related ideas, and to gather and organize information from more than one source into a coherent whole.

Table 1d Summary of students' responses on language strategies

Constructs of Language Strategies	**N = 49**		
	Mean	SD	VD
D.Profile			
1. I organize information based on my prior knowledge.	4.714	0.5000	SA
2. I use appropriate information to solve the problem.	4.531	0.6158	SA
3. Outlines help me to solve a problem.	4.816	0.4413	SA
4. Organizers help me to keep following a plan.	4.347	0.6308	SA
5. I learned how to select information in each profile.	3.959	0.5759	AG
Overall Mean	4.474	0.3735	SA

Legend: Scale: Verbal Description (VD);4.20 – 5.00: Strongly Agree (SA);3.40 – 4.19: Agree (AG); 2.60 – 3.39: Undecided (UD);1.80 – 2.59: Disagree (DA):1.00 – 1.79: Strongly Disagree (SD)

Table 1d presents the mean responses of selected Grade 11 students on profile as the fourth component of language strategies. Accordingly, item #3 obtained the highest mean (i.e., $\bar{x}$ = 4.816, S.D. = .4413; "strongly agree") such that "they strongly agreed that the use of outlines help them solve a problem" while the lowest mean response was for item #5 (i.e., $\bar{x}$ = 3.959, S.D. = .5759; "agree") such that "they agreed that they learn how to select information in a given profile." The rest of the items that described language strategies got mean responses within the range of 3.40 – 4.19 and 4.20 – 5.00, verbally described as agree and strongly agree, respectively. Generally, all items had an overall mean, $\bar{x}$ = 4.474 with a standard deviation, S.D. = .3735; verbally described as "strongly agree."

The results implied that students' problem-solving in mathematics had been less difficult for them by the help of profile. Among the five statements, item number five shows the lowest mean which the students agree that they learned how to select information in each profile. On the other hand, students agree on the rest of the item. The use of outlines in problem solving really helped them to solve. The students agree that they organize information based on their prior knowledge and use appropriate information to solve problems. An outline is an instructional tool that students can use to organize and structure information and concepts and to promote thinking about relationships between concepts. Furthermore, the spatial arrangement of an outline allows the student, and the teacher, to identify missing information or absent connections in one's strategic thinking (Ellis, 2004).

4.5. Frame

Frames make students concentrate on the mathematical information they need to impart with minimum concern about the beginning, middle, and end of their writing. It also serves as text outlines that provide the students with a pre-established sequence for writing.

Table 1e Summary of students' responses on language strategies

Constructs of Language Strategies	**N = 49**		
	Mean	SD	VD
E.Frame			
1. Text outlines help me answer given problem.	4.000	0.5000	AG
2. I concentrate on the mathematical information from beginning, middle and ending.	3.796	0.5766	AG
3. Step by step strategy really helps me in math class.	4.837	0.3734	SA
4. I develop my explaining, describing and discussing math problem.	4.694	0.5479	SA
5. I practice good writing so that I can explain mathematics and concept appropriately.	4.347	0.8050	SA
Overall Mean	4.335	0.2983	SA

Legend: Scale: Verbal Description (VD);4.20 – 5.00: Strongly Agree (SA);3.40 – 4.19: Agree (AG); 2.60 – 3.39: Undecided (UD);1.80 – 2.59: Disagree (DA):1.00 – 1.79: Strongly Disagree (SD)

Table 1e presents the mean responses of selected Grade 11 students on *frame* as the fifth component of language strategies. Accordingly, item #3 obtained the highest mean (i.e., $\bar{x}$ = 4.837, S.D. = .3734; "strongly agree") such that "they strongly agreed that step by step strategy really helps them in math class" while the lowest mean response was for item #2 (i.e., $\bar{x}$ = 3.796, S.D. = .5766; "agree") such that "they agreed that they concentrate on the mathematical information from beginning, middle, and ending." The rest of the items that described language strategies got mean responses within the range of 3.40 – 4.19 and 4.20 – 5.00, verbally described as agree and strongly agree, respectively. Generally, all items had an overall mean, $\bar{x}$ = 4.474 with a standard deviation, S.D. = .3735; verbally described as "strongly agree."

The results implied that frame is beneficial and helpful to the students. The step-by-step strategy really helped the students. Students can develop their explaining, describing, discussing and practicing good writing so that they can explain mathematics and concepts appropriately.

Results from this study were consistent with Pugalee (2001), there are practice of good writing to mathematics problems exhibit their metacognitive framework and hence give a unique insight into a pupil's understanding of relational knowledge. Sabean and Bavaria (2005) summarized research suggesting that the development of practical meaning for mathematical concepts is enhanced using good practice in writing.

4.6. Students' Mathematical Problem-Solving Skills in Terms of Their Pretest and Posttest Scores.

Students' prior and acquired knowledge about the lessons in the second semester on Statistics and Probability were assessed via 50 multiple choice tests to both groups before and after the integration of the strategy.

Table 2a Mathematical Problem-Solving Skills of the students in pretest and posttest

Score	**Pretest**				**Posttest**				**VD**
	Control Group		Experimental Group		Control Group		Experimental Group		
	f	%	f	%	f	%	f	%	
46-50	0	0	0	0	0	0	4	8.16	O
41-45	0	0	0	0	3	6.67	16	32.65	VS
36-40	0	0	2	4.08	4	8.89	19	38.78	S
31-35	1	2.22	1	2.04	12	26.67	7	14.29	FS
Below 30	44	97.78	46	93.88	26	57.77	3	6.12	DNME
Total	45	100	49	100	45	100	49	100	
Mean	14.56 (DNME)		14.16 (DNME)		27.22 (DNME)		40.88 (VS)		
Std. Dev.	3.799		3.682		4.752		6.122		
HS	31		36		42		48		
LS	10		9		14		28		

Legend: Scale: Verbal Description (VD); 46 – 50: Outstanding (O); 41 – 45: Very satisfactory (VS); 36 – 40: Satisfactory (S); 31 – 35: Satisfactory (FS); Below 30: Did Not Meet Expectation (DNME)

Table 2a presents the Mathematical Problem-Solving Skills of the Students in Pretest and Posttest. As seen in the table, the mean score in pretest of control group is 14.56 and experimental group is 14.16 which is verbally described as "did not meet expectations". Furthermore, the mean score in posttest of control group is 27.22 which is verbally described as "did not meet expectations" while the experimental group is 40.88 which is verbally described as "Very satisfactory". The results show that the mean score of the control group in pretest is greater than the score of the experimental group while in posttest, the mean score of the control group is lower than the experimental group.

The results implied that the experimental group fared better than the control group based on their mean scores in the pretest and posttest. Thus, it can be said that the teaching method for the experimental group (i.e., language strategies) was better than the conventional method for the control group as based on their respective performances in the posttest. With that, language strategies are effective for the students to have better performances in mathematical problem solving. However, students who were exposed to conventional teaching methods also improved, but their performances were lower compared to those who were subjected to new methodologies. In line with these implications, their performance in problem-solving skills was directly affected.

Similarly, based on the study of Cai & Hwang (2002), the students have different learning styles for acquiring knowledge. It is better for teachers to adopt language strategies to promote students performing multiple representations in class, thereby enhancing learning performance.

Moreover, the study of Faucette (2001), stated that although researchers are still not in complete agreement, "language strategies are potentially conscious plans for solving what to an individual presents itself as a problem in reaching a particular communicative goal".

Table 2b Summary of students' pretest and posttest scores

Test Scores		**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Pair CG	Pretest control group	45	14.56	3.799	.566
	Post-test control group		27.22	4.752	.708
Pair EG	Pretest experimental group	49	14.16	3.682	.526
	Post test experimental group		40.88	6.122	.875

Legend: Pair CG – pretest and post-test scores of the control group; Pair EG – pretest and post-test scores of the experimental group

Table 2b shows the comparison among mean scores in the pretest and posttest of the control group (i.e., 11 – GAS C) and the experimental group (i.e., 11 – GAS B). A 50-item test in math was administered to them before and after the *language strategies* intervention. Accordingly, in the pretest and posttest, the control group's score had a mean difference, M.D. = -12.66 while the experimental group's score had a mean difference, M.D. = -26.72. The results showed that in there was a slight difference between the mean scores of both groups (i.e., M.D. = .40), in favor of the control group, in the pretest while there was a notable difference between the mean scores of both groups (i.e., M.D. = -13.66), in favor of the experimental group, in the posttest. Also, the mean posttest scores proved that the intervention of using *language strategies* to the experimental group was helpful in the improvement of their problem-solving skills in Mathematics against the control group that was not exposed to the said treatment.

Thus, in the pretest, the mean score of the control group was 2.74% more than the mean score of the experimental group (i.e., $\bar{x}$CG = 14.56, S.D. = 3.799; $\bar{x}$EG = 14.16, S.D. = 3.682). This implies that there was a slight difference in the performance between groups.

In addition, in the posttest, the mean score of the control group was 50.18% less than the mean score of the experimental group (i.e., $\bar{x}$CG = 40.88, S.D. = 6.122; $\bar{x}$EG = 27.22, S.D. = 4.752). This implies that there was a remarkable difference in the performance between groups in favor of the experimental group. The notable improvement in the experimental group's performance in the posttest can be attributed to the intervention of language strategies in Mathematics problem solving as compared to the control group that was not exposed to the said treatment.

Thus, the results proved that language strategies contributed to the improvement of the experimental group's performance in the posttest. This implies that language strategies have the potential to enhance students' problem-solving skills in Mathematics. Through the different techniques from language strategies, the students were able to understand the lessons easily, resulting in high performance in their posttest.

This is supported by the study of Oxford (1990), that saw the aim of language strategies as being oriented towards the development of communicative competence. Oxford divided language strategies into two main classes, direct and indirect. In Oxford's system, metacognitive strategies help learners to regulate their learning. Affective strategies are concerned with the learner's emotional requirements such as confidence, while social strategies lead to increased interaction with the target language. Cognitive strategies are the mental strategies learners use to make sense of their learning, memory strategies are those used for storage of information, and compensation strategies help learners to overcome knowledge gaps to continue the communication. Language strategies are good indicators of how learners approach tasks or problems encountered during the process of problem solving. Language strategies can help students to face up to mathematical difficulties and to overcome their mathematical anxiety by drawing attention to the potential frustrations or pointing them out as they arise (Stern, 2011).

4.7. Differences Between Groups (Independent Samples T-test)

Table 3 shows the differences between the control and experimental groups with respect to their pretest and posttest scores.

Table 3 Independent samples test of students' test scores (equal variances assumed)

Pretest/Posttest		Descriptives			Levene's test for equality of variances		t-test for Equality of Means		
		N	Mean	Mean Difference	F-value	sig.	t-value	df	p-value
Pair A	Control Expt'l	45 49	14.56 14.16	.392	.118	.732	.508	92	.613
Pair B	Control Expt'l.	45 49	27.22 40.88	-13.655	3.147	.079	-12.003	92	.000**

Legend: ** – highly significant; pair A: pretest control group. vs. pretest experimental group; pair B: post-test control group vs. posttest experimental group

Accordingly, results of the independent samples t-test indicated that there were no significant differences in test scores between pretest of the control group and experimental group (i.e., $t(92) = .508$, $p > .05$) while there was a highly significant difference in test scores between posttest of the control and experimental groups (i.e., $t(92) = -12.003$, $p < 0.001$).

On the other hand, Levene's test for equality of variances among test scores for the control and experimental groups showed that there was no significant variation among the scores in the in the pretest (i.e., $F(2, 92) = .118$, $p > .05$) while there was a highly significant variation among the scores in the posttest (i.e., $F(2, 92) = 3.147$, $p < .001$). This implies that the control and experimental groups were at par with each other with respect to their performance in the pretest while the latter performed a lot better than the former with respect to their posttest scores.

Hence, it can be said that the use of *language strategies* as an intervention had resulted in the improvement of the experimental group's problem-solving skills in Mathematics as based on their performance in the posttest as compared to the control group who was not exposed to the said treatment.

In addition, the integration of language strategies resulted in a significant improvement in the experimental group's problem-solving skills in Mathematics as measured in their posttest scores and brought about a positive experience on the subject as enjoyable and relevant to the students.

For more than a decade, there has been a growing interest in language strategies, including how to integrate strategy training in the language classroom. Language strategies are specific actions, behaviors, and procedures involved in the process of learning (Wenden, 1994).

In addition, language strategies are considered important for the development of strategic competence, it is one of the three competencies of Canale and Swain's famous framework of competence. Strategic competence is defined as "verbal and non-verbal communication strategies that may be called into action to compensate for breakdowns in communication due to problem solving or lack of comprehension" (Canale & Swain, 1980).

Thus, a language strategy is a method that would be able to provide some solution to a problem and give information. Learners make use of language strategies for them to be able to learn effectively. Language strategies were defined by Cruz, (2015) as behaviors or thoughts that a learner goes through during the learning process and that can affect one's encoding storage, organization and retrieval of knowledge.

4.8. Influence of Language Strategies on Mathematical Problem-Solving Skills

Table 4 presents the multiple regression analysis that was used to test if the use of *language strategies* significantly influences the students' *problem-solving skills* in Mathematics.

Table 4 Regression analysis of language strategies on mathematical problem-solving skills

Language strategies		**Problem solving skills**				
	R^2	F	sig.	B	t	p
Metacognition	0.240	3.229	0.021	0.234	2.140	0.031[b]
Profile	0.280	4.982	0.043	0.204	2.286	0.020[b]
Frames	0.246	3.417	0.030	0.368	-3.082	0.043[b]
Composing with keywords	0.125	0.284	0.106	0.306	1.773	0.083[c]
Defining Format	0.162	0.384	0.131	-0.172	-1.109	0.274[c]

Legend: a – highly significant ($p \leq 0.005$); b – significant ($p \leq 0.05$); c – not significant ($p > 0.05$); Predictors: composing with keywords, metacognition, defining format, profiles, frames

4.9. Response variables: problem solving skills

The results of the regression indicated that three out of five predictors, (i.e., metacognition, profile and frame), explained 24.0% and 28.0%, and 24.6% respectively of the variance ($R^2 = .240$, $F(1,47) = 3.229$, $p< .05$), ($R^2 = .280$, $F(2,46) = 4.982$, $p< .05$), and ($R^2 = .246$, $F(3,45) = 3.417$.

Moreover, it was found that *metacognition* as a language strategy in teaching mathematics significantly influenced the *problem solving skills* of the students ($\beta = .234$, $t(92) = 2.140$, $p<.05$); *profile* as a language strategy significantly influenced the *problem solving skills* of the students ($\beta = .204$, $t(92) = 2.286$, $p<.05$); and, *frame* as a language strategy significantly influenced the *problem solving skills* of the students ($\beta = -.368$, $t(92) = -3.802$, $p<.05$). Hence, the β values indicated the relative influence of the independent variables or the predictors (i.e., components of language strategies) on the dependent variable or the response variable (i.e., problem solving skills in Mathematics), that is, *frames* has the greatest influence on *problem solving skills* (i.e., $\beta = -.368$), followed by *metacognition* (i.e., $\beta = .234$), and then *profile* (i.e., $\beta = .204$). On the contrary, the rest of the predictors (i.e., composing with keywords and defining format) did not significantly influence the students' problem-solving skills.

The results implied that metacognition, profile and frames would improve the mathematical problem-solving skills of the students. Students can easily solve mathematical problems with the help of Language Strategies. On the other hand, the last two strategies, namely: composing with keywords and defining format did not significantly affect the students' problem-solving skills, which means that most of the students had not been too interested in the said strategies. Since students consume too much time in composing with keywords and defining format.

Similarly, results of the study of Kotsopoulos (2007), showed key words can cause confusion in differentiating between everyday language and mathematical language. For instance, "The mathematical language that we use (symbols, pictures, words, and numbers) is sometimes unique (only used by mathematicians) or is taken from everyday language and turned into something else". Therefore, the task of comprehending word problems is critical and represents the threshold to successful solutions, (Valentin & Sam 2004).

Based on the results of the study of Alcazaren and Rafanan (2016), learners with more language strategies used have better language proficiency. With this knowledge, a learner should develop more language strategies for further enhancement of one's language proficiency. This could be beneficial in helping the poor learners develop their own language ability.

4.10. Qualitative Analysis

4.10.1. Students' Experiences on the Adaptation of Language Strategies

Grade 11 General Academic Strand students believed that the purpose of Language strategy is to improve problem solving skills, know the lesson in easy ways and to understand mathematics. Their interest in learning towards problem solving significantly increased due to the strategies that the teacher applied in teaching.

Students' responses towards the lessons were very important for the teacher to recognize these where they can think of best language strategy that they can use in every lesson. Their point of view may be affected by what they have perceived in learning the subject.

Repertory Grid 1 Students' Responses on what are the purposes of Language Strategy in Teaching Mathematics.

Table 5 This table presents the repertory grid results summarizing students' responses on the purposes of language strategies in mathematics instruction

Main Theme	Subtheme	Significant Statements
The learners understand the purpose of Language Strategies in Teaching Mathematics.	Learners identify the reasons why Language Strategies has applied.	To improve the problem-solving skills To know the lesson in easy ways To Understand mathematics
	Learners develop mathematical skill in solving problems.	To Develop reasoning and thinking skills To Develop analyzing and explaining skills
	Learners are more engaged in problem solving	To be more connected in problem-solving To Enhance the learning experience of students

Students' responses about the purpose of Language Strategies were mentioned above. Through Language Strategies, they can develop mathematical skills in solving problems and the learners were more engaged in problem solving. Most of the students answer that to be more connected and to enhance the learning in mathematical problem solving is the purpose of Language Strategies.

Hence, it was supported by the study of Wallace (2013). According to him, recent developments within the field of mathematics and math education suggest that the development of mathematical thinking occurs when learning is approached by language strategies rather than as a set of operations to memorize or follow. In addition, the goal of using Language Strategies is to create learning experiences where students understand and thus strive to achieve mathematical skills in problem solving.

Repertory Grid 2. Students like using Language Strategy.

Table 6 Summary of students' preferences in using language strategies in mathematics

Main Theme	Subtheme	Significant Statements
Language Strategies help students understand and solve problems in Mathematics.	Students understand the different ways in solving problems in Mathematics.	Yes, I love to discover new ways to understand the lesson better. Yes, because I can easily get some ideas and contribute knowledge in a particular topic. Yes, because frames help me answer the problems appropriately.
	Students understand Mathematics in such a way that everybody can explain, describe and discuss problem solving.	Yes, it enhances my learning ability. It helps me understand the lesson very well. Yes, it helps me apply and understand different problem solving. Yes, it is easier to understand than other strategies.
	Serves as guide and help develop explaining describing and discussing math problems.	Yes, it helps us develop our explaining, describing and discussing math problems. Yes, because it serves as my guide in solving. Yes, because with that, it captivates me and makes me feel so determined to fill in the questions.

The students liked the Language Strategies as the way of teaching because they found it easier to understand rather than the Traditional Teaching Strategies. Students understand Mathematics in such a way that everybody can explain, describe and discuss it. The Language Strategies captivated the students and made them feel so determined to answer the questions. Students can easily think of some ideas to contribute to the discussion.

It is important for teachers to integrate active learning strategies into the classroom to effectively engage students in the learning process. Dixson (2010) suggested that the use of language strategies can be the forms of communication and interaction between teachers and students and may be connected to higher levels of engagement.

Repertory Grid 3. Students' thoughts when the teacher asks questions during Math class

Table 7 Summary of students' thoughts when teachers ask questions during mathematics class.

Main Theme	Subtheme	Significant Statements
Preparation and awareness of the students when the teacher asks questions.	Preparedness on the oral recitation during Mathematics class	I think it is for the students to be ready on that moment. I think on how I deliver my answer correctly. I'm nervous because sometimes I don't know the answer in the lesson.
	Awareness in the responses for the teacher in asking interrogative statements.	Maybe she wants to know if we understand the lesson. I think that she will ask something that will apply language strategies. My teacher is just assessing us.

The students' responses are about what they were thinking during the discussion. Some students thought that it was for them to be ready in the discussion. Some students thought about how they would deliver their answers correctly if they answered the teacher's questions but some of the students were nervous because they do not know the answer to the questions. The other students thought that the teacher was just assessing them.

This is supported by the study of Willms, et.al, (2012), responding to differences in readiness helps students feel capable and increases their motivation to learn. Addressing student interests and learning preferences provides relevance and autonomy that are the key factors to student engagement.

Repertory Grid 4. Insights of students on what makes Math easy or difficult after adapting Language Strategies.

Table 8 This table presents the repertory grid results summarizing students' insights on what makes mathematics easy or difficult after using language strategies

Main Theme	Subtheme	Significant Statements
Learners identify their experiences during the adaptation of Language Strategies.	List down the reasons why Mathematics become easy or difficult to the students.	It was easier for me because there were exciting strategies that I learned Difficult because some are not good in language. Because of the keywords, it has been easier. Using the new strategies, it has been easier. It's easy because it is categorized into logical way.
	Learners find out their improvements after the adaptation.	I can now easily come up with accurate answer. Because of the language strategies, math became easy. It's easy for me now especially in dealing with math problems.

Repertory Grid 4 shows the answers of the students with regards to the difficulty of the adaptation of Language Strategies. Some of the students responded that the Language Strategies are exciting, and they can easily understand because there were keywords to be found in composing with keywords strategy. The learners found out their fast improvement after the adaptation.

Meanwhile, Kay (2009) showed that in the process of acquiring knowledge, individuals develop and make use simple to complex learning strategies to process information which is an integral part of mental development. For individuals to learn effectively, they use various methods and strategies to process information at a certain time frame. A study strategy or learning strategy is utilized depending on the preference and the way an individual approaches a given problem, (Sternberg, 2013).

Repertory Grid 5. The Bad Experiences with Math during the adaptation of Language Strategies

Table 9 This table presents the repertory grid results summarizing students' bad experiences in mathematics during the use of language strategies

Main Theme	**Subtheme**	**Significant Statements**
Students do not have any bad experiences on the adaptation of Language Strategies.	Learners exactly answered that they don't encounter any bad experiences.	None, I can solve it with the help of my teacher. For now, I have not encountered any bad experience. At first, I still don't know what to do but after that experience and after the lessons she taught, I can now do it correctly.
	The learners mentioned that they are enjoying the experiences	No, because I enjoy adapting it and it seems I know and learn how to solve mathematical problem. Not at all, because I'm enjoying it.

This repertory grid number 5 shows the responses of the students about the bad experiences in Mathematics during the adaptation of Language Strategies. At first, they still did not know what to do but after the experiences and after discussion the students can do it correctly. The students also mentioned that they enjoyed adapting the Language Strategies while learning how to solve mathematical problems.

Hence, it was supported by the study of MacMath et.al, (2009) that language strategies are important way to foster mathematical understanding and increased the learner's interest in problem solving. Mathematics needs to be fun and engaging. A large majority of students find mathematics "boring, mostly irrelevant and unrewarding". This need not be the case, however, as educators should strive to use resources and strategies that capture student interest and spike motivation (Colgan, 2014).

Repertory Grid 6. Teachers need to know about the students to better understand Mathematical Problem Solving

Table 10 This table presents the repertory grid results summarizing students' views on what teachers need to know about learners to better support mathematical problem solving.

Main Theme	Subtheme	Significant Statements
The learners can now apply the language strategies in problem solving in Mathematics.	Language Strategies help the students in solving Mathematics problem.	Yes, I'm not good in memorizing formulas but using the frame it really helped me. There is nothing else because I'm satisfied with language strategies. No, because I actually enjoy how language strategies helps me to develop my critical thinking skills. None, because I can solve math after the adaptation of such strategies.

It shows the answer on what the teacher needs to know about the students to better understand mathematical problem solving. Some students responded "yes", because they were not good in memorizing formulas but most of them responded none because of such reasons: they were satisfied with language strategies; they enjoyed how language strategies helped them develop their critical thinking skills; and the students can solve after adaptation of such strategies.

Furthermore, Stacey (2007) stated in his study that Mathematics learning is oriented towards the enrichment of higher-order thinking ability. The ability to think mathematically and to use mathematical thinking to solve problems is an important goal of schooling. Language Strategies in teaching is an active process in promoting and enhancing students' performance in schools.

Repertory Grid 7. The Most-Liked and Least-Liked Language Strategy of the Students.

Table 11 This table presents the repertory grid results summarizing students' most-liked and least-liked language strategies in mathematics.

Main Theme	Subtheme	Significant Statements
The learners select the strategy that is relevant in learning problem solving in Mathematics.	Learners choose the appropriate strategy that could fit to them.	What I like the most is the frame while metacognition is the least. Metacognition is the most and defining format is the least. Profiles for the most likely and composing with keywords is the least.
	Learners determine the outcome of the strategy that they have chosen.	I really like the frame because it is fun and exciting at the same time. We are learning from it. I like defining format because it's easy to understand and it helps me improve my understanding in a particular mathematical term. I like all Language Strategies since we have different type of mathematical problem solving and we can choose what strategy is applicable.

The table shows the responses to the most-liked and least-liked Language Strategy of the students. Since the students have variety of learning styles, some of the strategies were applicable for them and some were not. Some students chose frame because it is fun and exciting for them. Defining format was the choice of others since they thought it is easy to understand and help them improve understanding in particular term in Mathematics. Metacognition and Profile for some students while others answered all because Language Strategies have different types of mathematical problem solving and they can choose what strategy is applicable. Some chose metacognition, defining format and composing with keywords as their least-like strategy.

Similarly, results of the study of Ishumi (1994), stated that language strategy is a powerful instrument in the formation of concepts, acquisition of perspective abilities, and the transfer or communication of concepts. This implies that the Language Strategies really help improve the problem-solving skills of the students.

Furthermore, Fajardo (2005) stated that frames served as a potent tool in improving the problem-solving skills of the students. The teacher and the use of language strategies with the appropriate level of understanding will play a crucial role in assisting the students improve their performance in problem–solving.

5. Conclusion

Based on the findings of the study, the following conclusions were drawn: There is highly significant difference between the students' pretest and posttest and Mathematical Problem-Solving Skills after being exposed to Language Strategies.

Language Strategies significantly influenced students' Mathematical Problem-Solving Skills. It is therefore concluded that language strategies are effective ways to enhance Mathematical Problem-Solving Skills.

Recommendations

Considering the findings and conclusion of the study, the following recommendations were drawn:

- It is suggested that the Language Strategies be tried out in other subject areas aside from Mathematics;
- Language Strategies may be integrated in the regular classroom, especially for those students who have difficulties in solving Mathematics problems and to further test the validity and reliability as a possible alternative strategy to classroom instruction;
- Teachers are also encouraged to use Language Strategies in the classroom as a useful tool that supports and improves students' explaining, discussing, organizing and solving problems;
- Future researchers are encouraged to explore and enrich the Language Strategies towards enhancing teaching-learning process.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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