Impact of F-A-T Strategies on Level of Problem-Solving Skills among STE and RBEC Students: A Comparative Study

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ABSTRACT

This study aims to determine the Level of Problem-Solving Skills among grade 9 STE and RBEC Students. Specifically, it seeks to provide data on the level of problem-solving skills based on pretest and posttest results with the aid of FAT strategies which were implemented in a span of 3 months.

The respondents of this study were 94 students comprised of 47 from STE Class and 47 from RBEC Class. Statistical inferences like mean, percentage, t-test, and Pearson product-moment correlation coefficient were utilized to check the statistical significance of the data.

The study revealed that the interventions in Mathematics on Word Problem Solving Skills has a significant strong positive correlation to the student's level of achievement in mathematics wherein from only 25% of the students who were able to reach the Outstanding and Very Satisfactory Level of problem-solving skills in mathematics as it was increased to 67%. Moreover, the 41% of students who were on the Fairly Satisfactory and Did not meet Expectations Level went down to 9% respectively.

The percentage average score of 84.00% equivalent to Satisfactory Level increased to 88.00% equivalent to Very Satisfactory Level. The computed r-value of 0.786 indicating a strong positive correlation is higher than the r-tabular value which was 0.205 and 0.05 level of significance while the computed t-value of 5.050 is higher than the t-tabular value which was at 1.984 at 0.05 level of significance.

In the final analysis, the interventions have a positive impact on improving the students' problem-solving skills which are also pivotal in developing their critical thinking skills.

Keywords : *Problem Solving, FAT Strategies*

INTRODUCTION

Mathematics is crucial not only for success in school but in being an informed citizen, being productive in one's chosen career, and personal fulfillment. In today's technology-driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information and complex situations. Raising students' achievement in mathematics has become a matter of increased focus in recent years.

Current technology and scientific advancement being experienced worldwide require that students must be taught to go beyond low-level comprehension and mere memorization of facts and formulae if they are to become problem solvers of the future.

Lack of a student's ability to create or construct the needed knowledge in mathematics and apply it in both familiar and unfamiliar situations will likely lead the student to perform below average in mathematics. Problem-solving in mathematics is one aspect of mathematics that enables learners to apply their skills to both familiar and unfamiliar situations, thereby giving them the ability to use tested theories and create their knowledge before applying them.

In general, when researchers use the term problem-solving in mathematics, they are referring to mathematical tasks that have the potential to provide intellectual challenges that can enhance learners' mathematical development and hence improve their performance in mathematics. Such tasks also promote learners' conceptual understanding, foster their ability to reason and communicate mathematically, capture their interests and curiosity (Dweck, 2014).

Within a classroom setting (Dweck, 2014), the culture that supports a growth mindset allows the teachers to design meaningful learning tasks and present them in a way that fosters students' resilience and long-term achievement. Some teachers make students' progress explicit by giving pre-tests at the beginning of a unit that purposely covers material students do not know. When students compare their inevitably poor performance on these pre-tests with their improved performance on unit or post-tests, they get used to the idea that, with the application, they can become smarter.

There are three approaches to problem-solving instructions: teaching about problem-solving, teaching for problem-solving, and teaching through problem-solving (a problem-solving approach). Teaching about problem-solving involves teaching problem solving as a topic for study (problem-solving as a context) while teaching for problem-solving indicates solving novel or non-routine problems as an aspect of the curriculum requirement (problem-solving as a skill).

CONCEPTUAL FRAMEWORK OF THE STUDY

A problem-solving approach (a learner-centered approach) involves teaching mathematics topics through problem-solving contexts and inquiry-oriented environments that are characterized by the teacher helping learners construct a deeper understanding of mathematical ideas and processes by engaging them in doing mathematics: creating, conjecturing, exploring, testing, and verifying" (Camarista, 2016).

Furthermore, Camarista (2016) explains teaching via problem-solving as a method by which mathematics teachers may provide more meaningful instruction. Advancing his argument, Camarista (2016) further explains that Teaching via problem-solving (teaching through a problem-solving approach) is teaching mathematics content in a problem-solving environment. A problem-solving approach can be used to encourage learners to generalize about rules and concepts, a process that is central to mathematics (Broto, 2010).

It also shows an engagement in learning that may lead to the development of higher-order cognitive skills that are rarely developed by learners in more direct/conventional instruction, drill-and-practice classroom activities. A problem-solving approach to teaching mathematics defines the role of the teacher as a facilitator of learning rather than a transmitter of knowledge and the learner, as a manager and director of their learning.

THEORITICAL FRAMEWORK OF THE STUDY

This study is anchored on the theory of B.F. Skinner (McCann, 2007) based upon the idea that learning is a function of change in overt behavior. Changes in behavior are the result of an individual's response to events (stimuli) that occur in the environment. A response produces a consequence such as defining a word, hitting a ball, or solving a math problem. When a particular Stimulus-Response (S-R) pattern is reinforced (rewarded), the individual is conditioned to respond.

Stimulus-response (S-R) theories are central to the principles of conditioning. They assume that human behavior is learned. In the learning process, changes play an important role because they will serve as a barometer if the strategy is effective and should be continuously applied and used or it must be disregarded. Drill Exercises are being conducted to address such students' needs and weaknesses and with the high hopes that immediate and long-term advantage will be achieved.

The independent variables are the Learner's Level of word problem-solving skills in Mathematics the pre-test, the activities in the form of word problem solving using For, About, and Through Strategies is the innovation or intervention being inserted into the teaching and learning process.

OBJECTIVE OF THE STUDY

The main objective of this research in Mathematics is not to give extra work for the teacher-researcher and the students as well but rather take it as a challenge towards commitment, dedication, and passion in educating and preparing the next generation for their future endeavors. Content of the topics was also the main concern in conducting this research.

These activities were integrated into the normal teaching hours of the subject provided that the required topics to be discussed under Math subject for the third quarter were not compromised. In this way, the students were not just learned new concepts but also get the chance to improve their mastery of solving word problems in mathematics.

The great challenge of the teacher-researcher is not just on admitting that there is a lacking on the students and embracing it but instead on continuously looking for possible solutions that will help them rise from the situation where they are right now even if it will not give a sure positive assurance and outcomes and even if others do not believe that positive change will radiate towards the learners.

RELATED LITERATURE AND STUDIES

In the study of mathematics, students often struggle to comprehend and solve mathematical word problems. Students appeared to understand the mathematics that does not extend much beyond simple problem solving with whole numbers. In recent years, there has been a substantial amount of attention directed to improving academic achievement in mathematics.

Addressing this problem has become an important educational issue. To battle against a student’s inability to solve mathematical word problems, educators have studied students declining math test scores. Although there are external variables that students face, internal variables such as poor instructional approaches, no prior schooling, language barriers, and reading and math difficulties, play important roles in the students’ mathematical learning process while solving word problems (Anhelz, 2009).

In hopes of finding a solution to help students’ mathematical abilities increase, most research educators examine the classroom strategies that can be used to help this problem. Since 1990 there has been an overall gain across all mathematics achievement levels. NAEP‟s 2003 findings show that the percentages of students performing at or above basic, and at or above proficiency level were both higher in 2003 than in all previous assessment years.

Embedded within a theoretical framework of mathematical problem-solving, topics were looked into from a review of the literature: factors that influence students"‟ ability to comprehend and solve math word problems, reading strategies, and math strategies and the need of second language learners and at-risk students. The purpose of this literature review provided research to data on students ' problem-solving skills.

Students lack problem-solving skills because they are not aware of the problem-solving strategies available to assist them in solving word problems (Ruszyk, 2006). Additional factors such as word problem components and instruction designs are also important topics for discussion. For students to acquire learning gains in mathematics, educators need to study the different aspects that impede students from understanding and solving mathematical word problems. Mathematical problem solving is an important attribute of a student's mathematical development (Anhelz, 2009).

In the context of mathematics curriculum, a word problem requires that mathematical skills, concepts, or processes be used to arrive at the intended goal. Disappointingly, most students do not master problem-solving skills (Anhelz, 2009). Research shows that students face numerous factors while problem-solving. According to Anhelz (2009), various studies have documented how difficulties associated with comprehending the problem text are linked with corresponding difficulties in problem-solving. The factors are as follows: influence of general structural features of the problem, semantic structure of the problem, and problem-solving process (Anhelz, 2009).

The influences in general structure features include the average word length, number of arithmetic operations, number of sentences in the problem, average number of words in each sentence, and the frequency of nouns, verbs, and conjunctions (Absin, 2009). A general structure feature is referred to how a word problem is formed. Research shows that while solving word problems, students have difficulties and are not able to comprehend or solve these math problems because problems are too long and or require multiple operations (Absin, 2009). Absin (2009) found combinations of linguistics features and computational demands accounted for nearly 87% of the variability in problem difficulties for a group of learners.

Students have more difficulties while problem-solving as the number of words between the numerical features of the problem increases (Eduafo, 2011). The likelihood of forgetting the first number before reading the second number also increases (Eduafo, 2011). "At the same time, differences in processing load appear to play a role as well. As the size of the chunks that must be maintained in the short-term buffer increases the number of active requests increases solution probabilities generally decrease" (Eduafo, 2011).

Moreover, most mathematical word problems have too many words that the students do not recognize (Eduafo, 2011). Due to the high demand for vocabulary words in a word problem many students will become afraid of reading the word problem. Hence, different structure features will predict problem-solving difficulties and students will not attempt to solve the word problem (Eduafo, 2011). Additionally, the semantic structure of a word problem influences a student's ability to solve word problems (Giroux, 2007).

The semantic structure of a word problem refers to the meaning of the statements in the problem and their relationships. Students have a hard time at problem-solving because the differences in the language (for example the word product in math means to multiply as for in language arts in means an item) with which the problems are presented give them very different meanings to students. An example would be the word product. In math, the word product means the result of the multiplication of two or more quantities. As opposed to language arts the word product could have various meanings such as something that arises as to the consequence of something else, or the goods or services produced by a company. These differences in meaning can influence how the students interpret and represent the word problems.

Furthermore, it influences the student's conceptual understanding of what is being asked as well as what strategies were used to solve the problem. Giroux (2007) avowed, "They also showed that children's strategies for subtraction problems are strongly influenced by the semantic structure underlying them. More specifically, children operating at the material and verbal levels tend to solve each subtraction problem with a strategy that most closely models its semantic structure. Students' decision-making while solving, involves choices.

In all, the semantic structure of word problems, in particular the action implied in the problem and how the problem is presented, has considerable influence on the types of strategies that students use in problem-solving (Giroux, 2007). In support, Malingin (2009) also acknowledged, "Children may develop single strategies for addition and subtraction and use them in all appropriate problems, or they may match their strategies to a given problem's structure by modeling the implied actions or relationships in the problem". Likewise, the problem-solving process also influences the student's ability to solve mathematical word problems (Magno, 2011).

The problem-solving process occurs in four stages: problem translation and problem integration (student's representation of the problem), solution planning, and solution execution (specific strategies used in the problem). How students interpret word problems depends on how well the word problems are presented (Magno, 2011).

Research shows that the order and manner with which the information is presented can make the problem more or less difficult to comprehend. Magno (2011) found, "First, it was shown that subjects are more likely to miscomprehend a problem and therefore commit a reversal error when the problem is presented in an inconsistent language form". The essential problem-solving process requires students to first acquire the meaning of the problem and implications of the text. Next, the student develops an appropriate representation of the problem. Finally, the student links this representation to the best strategy for solving the problem (Eduafo, 2011).

A problem-solving approach used in mathematics textbooks is based on the work of Polya G. (Cherry, 2010). Polya's problem-solving model involves four stages: understand the problem, devise a plan for solving the problem, carry out your plan, and look back. In this teaching approach, learners are expected to learn to apply and adapt a variety of appropriate strategies to solve problems. These strategies include using diagrams, looking for patterns, listing all possibilities, trying special values or cases, working backward, guessing and checking, creating an equivalent problem, and creating a simpler problem.

Problem-solving is crucial in mathematics education because it transcends mathematics. By developing problem-solving skills, we learn not only how to tackle mathematics problems, but also how to logically work our way through problems we may face. The memorizer can only solve problems that he or she has encountered already, but the problem solver can solve problems that he or she has never been encountered before.

According to Cherry (2010), the essence of mathematics resides in "inventing methods, tools, strategies, and concepts for problem-solving". Teaching mathematics through a problem-solving approach provides a learning environment for learners on their own, to explore problems and to invent ways to solve the problems. According to Shuell (2013), proponents of teaching mathematics through problem-solving base their pedagogy on the notion that learners who encounter problematic situations use their existing knowledge to solve those problems, and in the process of solving the problems, they construct new knowledge and new understanding.

Furthermore, Shuell (2013) illustrates how learning mathematics through a problem-solving approach has been put into practice with three examples: using elementary, middle, and secondary school learners (Shuell, 2013). It is worth noting in the study that learners in all three cases had no formal instructions on how to solve the problems; they demonstrated a high sense of mathematical thinking and competency. Each of the examples uses the approach of confronting learners with a real problematic situation to grapple with.

In effect, the outcomes of Shuell’s (2013) study indicate that teaching mathematics through a problem-solving approach offers the promise of fostering students learning (Schroeder cited by Aufmann, 2018). The understanding and skills demonstrated by learners in each case of the study support the claim that problem-solving is a vehicle for developing a deeper understanding of mathematical ideas and processes.

In teaching through a problem-solving approach, the discussion of a problem and its alternative solutions usually takes a longer time than the demonstration of routine classroom activity. In a study, Dweck (2010) found that classrooms with a primary focus on teaching through a problem-solving approach used fewer problems and spent more time on each of them, compared to those classrooms without a primary focus on problem-solving. Moreover, they point out that in a classroom using a problem-solving approach, teachers ask more conceptually oriented questions (example: describe a strategy or explain underlying reasoning for getting an answer) and fewer recall questions than teachers in the classrooms without a primary focus on problem-solving.

The study by Dweck (2010) suggests that judicious use of time requires effective organization of problem-solving activities and class by the teacher. A problem-solving approach, according to Davis (1992), leads to understanding. Although a problem-solving approach is time-consuming, learners who actively engage in it develop, extend, and enrich their understanding (Dweck, 2010). For learners to develop an understanding of mathematics through a problem-solving approach, the teacher’s (facilitator’s) role in ensuring a balance in engaging learners in solving challenging problems, examining increasing better solution methods, and providing information for learners just at the right time is crucial (Dweck, 2010).

The need for learners to have a deep understanding of mathematics calls for a teacher using appropriate instructional approaches and problem-solving related tasks that will arouse and sustain the interest of the learners to develop an understanding of concepts, procedure skills, and the ability to synthesize, analyze skills and evaluate competencies (the higher levels of Bloom’s cognitive domains). Selecting quality and interesting problem-solving tasks is therefore required for the development of understanding in learning mathematics via a problem-solving approach.

In “Selecting Quality Task for Problem Based Teaching”, Book (2018), argue that “designing activities that will keep learners busy throughout the standard class period is relatively easy, but making sure such activities lead to learning important mathematics is much more difficult”. They further argue that “finding and adapting problem tasks that engage learners and lead them to understanding fundamental mathematical concepts and principles and to acquiring skill in the use of basic mathematical techniques is itself a challenging task for teachers”. Studying the mathematics curricula, Dayo (2013) note that international trends in mathematics curriculum development indicate an increased focus on problem-solving and modeling.

Reflecting on curricula development in mathematics, Hake (2007) suggests to mathematics curriculum developers to include problem-solving experiences in the mathematics curriculum. Hake’s convincing reasons are that problem-solving experiences will make learners be able to use and apply mathematical knowledge meaningfully, develop a deeper understanding of mathematical ideas, become more engaged and enthused in lessons, and finally, learners will appreciate the relevance and usefulness of mathematics.

Good use of a problem-solving approach curricula calls for efficiently using problems in the context that make sense to the learner: "if a learner does not have a good sense of what he or she knows, he or she may find it difficult to be an efficient problem solver" (Hake, 2007). A problem-solving skill entails more than drawing on one’s background knowledge; instead, information must be effectively applied to new problem situations (Salamat, 2009).

Mathematics topics are interwoven. For example, knowledge about a procedure for adding common fractions may be needed when it comes to the addition of rational functions. It is therefore important that learners understand the topics in mathematics relationally and not by rote. This view of why learners need to develop an understanding of mathematics topics is supported by Cheng (2011). They explain that understanding a mathematics topic ensures that everything one knows about the topic will be useful. When solving mathematical problems, learners develop a deeper understanding of mathematics because it helps them to conceptualize the mathematics being learned (Cheng, 2011). To sum it up, for a student to develop an understanding of mathematics through a problem-solving approach, the teacher’s role of selecting the quality and interesting problem-solving task is important. Also, the mathematics syllabus, which mostly drives the teaching and learning of mathematics, should contain quality and interesting problem-solving activities.

Abraham Maslow's Hierarchy of Needs as cited by Oco (2012) that the lower need in the hierarchy must be satisfied first before trying to satisfy higher-level needs. Learning mathematics implies that everything should start from the basics before going through the most complex problems. Mastery of the basic concepts is a must so that an individual will have better chances of solving higher or many difficult problems.

According to Almonia as cited by Anhelz (2009), in learning a mathematical concept, students should be actively involved in doing mathematics, for it is through such participation that clear and functioning conceptual understanding are created upon which increasingly abstract constructs may be derived and supported. This supports John Dewey's (Anhelz, 2009) experiential learning which states that experience is the best source of learning. The best way to learn is by experience. Therefore, for the students to learn mathematics, they should do the operations in mathematics.

Dayo (2013) stated that after drill exercises were conducted, the learners' level of performance in mathematics specifically in the four fundamental operations was able to increase and further revealed that drill exercises have significant differences in improving the learner's performance. Haelerman (2012) found out that constant practicing and math drills lead to a substantial and significant increase in math performance growth. On top of that, a positive and significant relation between additional minutes practiced per week and math performance was also revealed.

Moreover, the study of Rautraut (2010) revealed that review and drill exercises play a significant role in the student's higher performance in mathematics. Thus, mastery of the use of the four fundamental operations in mathematics is a must for a learner. However, mastery with the skills in operations will not be that successful without the learner’s ability to comprehend.

Johnson and Schmidt (2006) stressed that word problem activity is essential to the teaching-learning process in mathematics and that improvement in problem-solving skills will lead to higher student achievement. Moreover, giving problem-solving as part of the test to the students develops the ability to read and understand the art of questioning and that students also develop the ability to translate a word. Unfortunately, word problem solving is also facing challenges as the students tend to have difficulty in interpreting the given situation and in selecting the operations to be used to solve the given problem.

True enough, as the study of Aclan (2013) revealed that the learner's low performance in problem-solving is caused by misinterpretation of the meaning of the questions being asked which led to wrong selection mathematical operations. NCTM (2010) stressed that problem-solving must be taught as an integral part of mathematics learning and that it requires a significant commitment in the curriculum at every grade level as well as in every mathematical topic.

Researchers like Trabasso & Bouchard as quoted by Pardo (2004) revealed that there is very strong empirical, scientific evidence that the instruction of more than one strategy in a natural context leads to the acquisition and use of reading comprehension strategies and transfer to standardized comprehension tests. Multiple strategy instruction facilitates comprehension as evidenced by performance on tasks that involve memory, summarizing, and identification of main ideas. No wonder today the teachers are encouraged to use different teaching strategies and approaches so that the teaching and learning process becomes fun, more exciting, and more interesting for the students.

This chapter discussed several reasons why students‟ lack problem-solving skills in mathematics. It has been suggested that problem-solving approaches can help students‟ increase mathematical abilities and increase outcomes to mathematical education. Problem-solving approaches focus on teaching mathematical topics through problem-solving contexts.

To help students‟ increase mathematical abilities, teachers needed to apply different instructional approaches to help reach at-risk students. Hence, teachers needed to interact with students, have mathematical dialogue, guide, coach, and encourage students to make use of strategies and explain their mathematical reasoning (Pardo, 2004). Pardo stated, “helping students construct a deep understanding of mathematical ideas and processes by engaging them in doing mathematics: creating, exploring, testing, and verifying”. In the next chapter the design of the study, school setting, classroom setting, instruments, data collection, procedures, and data analysis will be presented and described.

METHODOLOGY

The study utilized the descriptive design which was appropriate for its objective to determine the students’ level of problem-solving skills in mathematics. The data collected by the study would provide bases of inference on the said skills in the normal daily routine of the school at the time when the research was conducted.

The design involved description, recording, analyses, and interpretations of prevailing conditions as illustrated in the conceptual framework. Furthermore, an interview was also conducted to confirm the consolidated data and for the respondents' opportunity to express their reasons and sentiments on the study conducted.

The set of pre-test and post-test questionnaires each consisting of 50 items were given to the students before and after the conduct of the research study.

The researcher’s questionnaire was adopted from the questionnaires used by the studies of Oco (2011) and Dayo (2013) as well as on the books of Fostanes (2007), Cheng (2011), and Camarista (2016). Pre-test and post-test scores were determined according to their mastery level based on the newly implemented K-12 Curriculum as reflected on the next page:

Table 1: Mastery Level Descriptive Equivalent

Rating Scale	Verbal Interpretation
90% - 100%	Outstanding (O)
85% - 89%	Very Satisfactory (VS)
80% - 84%	Satisfactory (S)
75% - 79%	Fairly Satisfactory (FS)
74% & below	Did not meet Expectations (DE)

The statistical tool used to analyze the data gathered to answer the problems stated for this study were the following:
Mean and Percentage. This was used to describe the mastery level of the respondents in terms of problem-solving exercises.
Percentage – This was used to analyze the data gathered from the respondents.
Pearson product-moment Correlation Coefficient. This test was used to measure the relationship between the two variables.
T-test. This test was used to measure the significant relationship between the two variables.
The quantitative data were tested at a 0.05 level of significance, with the application of the following statistical methods: Mean and percentage for Problems: 1, 2, and 3. Mean, Pearson product-moment coefficient correlation, and t-test for problem 4.

RESULTS AND DISCUSSIONS

...selected STE and RBEC students in Mathematics based on the pretest

Rating Scale	Verbal Interpretation
90% - 100%	Outstanding (O)
85% - 89%	Very Satisfactory (VS)
80% - 84%	Satisfactory (S
75% - 79%	Fairly Satisfact
74% & below	Did not meet E

Level of Skills	Overall Total		STE Students F	%	RBEC Students F	%
O	10	10.64	6	12.77	4	8.51
VS	13	13.83	6	12.77	7	14.89
S	22	23.40	15	31.90	7	14.89
FS	20	21.28	10	21.28	10	21.28
DE	29	30.85	10	21.28	19	40.43
Total	94	100.00	47	100.00	47	100.00

Table 2 presents the pretest comparative results on the level of problem-solving skills of the selected STE and RBEC students. Data shows that overall, 23 out of 94 or 25% of the students' level of problem-solving skills were at an outstanding and very satisfactory level. The satisfactory level registered 22 out of 94 or 23% selected students while 49 out of 94 or 41% of the students were at Fairly Satisfactory and Did not Meet Expectations level respectively.

On the selected STE students, 12 out of 47 or 26% were at an outstanding and very satisfactory level. There were 15 out of 47 or 32% of students who were at a satisfactory level while 20 out of 47 or 42% were at fairly satisfactory and did not meet expectations level respectively.

On the selected RBEC students, 11 out of 47 or 24% of the students were at an outstanding and very satisfactory level. There were 7 out of 47 or 15% of students who were at a satisfactory level while 29 out of 47 or 61% of the students were at fairly satisfactory and did not meet expectations level respectively.

This implies that most of the students' level of problem-solving skills was still at the bottom level specifically fairly satisfactory and did not meet expectations level. When students were asked, most of them revealed that they have difficulty on which operation should be taken first and others have difficulty in identifying the basic facts of the given word problem. This finding is consistent with the study of Aclan (2013) who revealed that the learner's low performance in problem-solving is caused by misinterpretation of the meaning of the questions which leads to wrong selection mathematical operations.

Moreover, this implies that mastery in the use of the basic facts in solving word problems in mathematics must be emphasized so that the students will have much higher chances of answering much higher and more complicated problems. This finding supports the study of Rautraut (2010) who revealed that basic mathematical skills were not mastered by the learners.

Furthermore, this finding aligns with the concept of Abraham Maslow's Hierarchy of Needs that the lower need in the hierarchy must be satisfied first before trying to satisfy higher-level needs (Oco, 2011). Learning mathematics implies that everything should start from the basics before going through the most complex problems. Mastery of the basic concepts is a must so that an individual will have better chances of solving higher or many difficult problems. Thus, an intervention must be given and inserted into the usual teaching and learning process.

Problem 2. What is the Level of word problem-solving skills of the selected STE and RBEC students in Mathematics based on the posttest results?

Table 3 Level of Problem-Solving Skills (Posttest

Level of Skills	Overall Total		STE Students		RBEC Students	
			F	%	F	%
O	24	25.53	16	34.04	8	17.02
VS	39	41.49	19	40.42	20	42.55
S	22	23.41	8	17.02	14	29.79
FS	6	6.38	2	4.26	4	8.51
DE	3	3.19	2	4.26	1	2.13
Total	94	100.00	47	100.00	47	100.00

Table 3 presents the posttest comparative results on the level of problem-solving skills of the selected STE and RBEC students. Data shows that overall, 63 out of 94 or 67% of the students' level of problem-solving skills was at an outstanding and very satisfactory level. The satisfactory level registered 22 out of 94 or 23% selected students while 9 out of 94 or 9% of the students were at Fairly Satisfactory and Did not Meet Expectations level respectively.

On the selected STE students, 35 out of 47 or 74% were at an outstanding and very satisfactory level. There were 8 out of 47 or 17% of students who were at a satisfactory level while 4 out of 47 or 8% were at fairly satisfactory and did not meet expectations level respectively.

On the selected RBEC students, 28 out of 47 or 60% of the students were at an outstanding and very satisfactory level. There were 14 out of 47 or 30% of students who were at a satisfactory level while 5 out of 47 or 11% of the students were at fairly satisfactory and did not meet expectations level respectively.

This implies that the students were able to improve their problem-solving skills in mathematics. Per the interview, the students disclosed that they are now more confident in answering problem-solving than before because they were able to reinforce their knowledge in problem-solving skills due to the series of activities conducted and that they can also apply it to other situations.

Problem 3. What is the comparative result of pre-test and post-test scores on the level of word problem-solving skills of the selected STE and RBEC students after the For-About-Through Strategies (FATS) have been implemented and inserted into the teaching-learning process?

Table 4 Level of Problem-Solving Skills (Pretest and Posttest Comparative Results)

Level of Problem-Solving Skills		Pretest		Posttest	
Verbal Interpretation	Rating Scale	F	%	F	%
Outstanding (O)	90% - 100%	10	10.64	24	25.53
Very Satisfactory (VS)	85% - 89%	13	13.83	39	41.49
Satisfactory (S)	80% - 84%	22	23.40	22	23.41
Fairly Satisfactory (FS)	75% - 79%	20	21.28	6	6.38
Did not meet Expectations (DE)	74% and below	29	30.85	3	3.19
Total		94	100.00	94	100.00

Table 4 shows the level of problem-solving skills of selected grade 9 SPA and RBEC students' pretest and posttest comparative results. data shows that overall, from 23 out of 94 or 25% (pretest results) of the students' level of problem-solving skills were at outstanding and very satisfactory level it went up to 63 out of 94 or 67% (posttest results). The satisfactory level registered 22 out of 94 or 23% (pretest results) were steady at 22 out of 94 or 23% (posttest results) on selected students.

While from pretest results of 49 out of 94 or 41% of the students at Fairly Satisfactory and Did not Meet Expectations level it went down to 9 out of 94 or 9% of the students based on posttest results.

This implies that the implementation of the selected problem-solving strategy was effective as the majority of the selected students were able to improve their problem-solving skills. Students who remained at fairly satisfactory and did not meet the expectation level were those who committed absences during the implementation of the research study.

Furthermore, this data implies that as the interventions were integrated into the teaching and learning process the students' level of problem-solving skills in mathematics increased. Most of the students got higher scores in the posttest compared to their pre-test results. This finding is supported by the study of Haelerman (2012) with the findings that constant practicing and math drills lead to a substantial and significant increase in math performance growth.

On top of that, a positive and significant relation between additional minutes practiced per week and math performance was also revealed. Moreover, the study of Rautraut (2010) revealed that review and drill exercises play a significant role in the student's higher performance in mathematics.

Problem 4. Is there a significant relationship between the students' word problem-solving skills based on pretest and posttest results?

Table 5 Level of Problem Solving (Percent Ave, r-value, and t-value)

Type of Test	Percentage Ave	Level of Skills	r-value	t-value	Interpretation
Pre-Test	84.00	Satisfactory			
Post-Test	88.00	Very Satisfactory	0.786	5.050	Significant

r-value @ 0.05 level of Significance: 0.205 and r-value @ 0.01 level of Significance: 1.984

Table 5 shows the percentage average, level of skills, computed r-value, and t-value for the word problem-solving skills of students in mathematics. Data revealed that the percentage average increased from 84.00% equivalent to Satisfactory Level to 88.00% equivalent to the level of Very Satisfactory. The computed r-value of 0.786 indicating a strong positive correlation is higher than the r-tabular value which was 0.205 and 0.05 level of significance. Likewise, the computed t-value of 5.050 is higher than the t-tabular value which was at 1.984 at 0.05 level of significance.

This implies that a significant relationship on the pre-test and post-test on word problem-solving skills of students in mathematics was established. Thus, the null hypothesis is rejected. Furthermore, this means that the intervention for word problem-solving skills has a significant relationship to their performance in mathematics when problem-solving skills are put into consideration.

During the interview, most of the students admitted that during the exercises for word problem-solving they were able to refresh themselves of the basic facts and steps needed in answering and that they were able to choose strategies at their comfort. This finding aligns with the study of NCTM (2010) which stated that problem-solving must be taught as an integral part of mathematics learning and that it requires a significant commitment in the curriculum at every grade level as well as in every mathematical topic.

Moreover, this finding is supported by the study of Johnson and Schidmt (2006) who stressed that word problem activity is essential to the teaching-learning process in mathematics and that improvement in the problem-solving skills will lead to higher student achievement.

Furthermore, giving problem-solving as part of the test to the students develops the ability to read and understand the art of questioning and that students also develop the ability to translate a word. However, these finding contradicts the study of Ramos (2005) who stated that the use of problem-solving was not found to influence the learner's achievement in mathematics.

FINDINGS

The gathered data disclosed the following results:

Overall, from only 25% of the students who were able to reach the Outstanding and Very Satisfactory Level of problem-solving skills in mathematics, it was increased to 67%.

The satisfactory level registered 22 out of 94 or 23% (pretest results) were steady at 22 out of 94 or 23% (posttest results) on selected students.

The 41% of students who were on the Fairly Satisfactory and Did not meet Expectations Level went down to 9% respectively.

The percentage average score of 84.00% equivalent to Satisfactory Level increased to 88.00% equivalent to Very Satisfactory Level.

The computed r-value of 0.786 indicating a strong positive correlation is higher than the r-tabular value which was 0.205 and 0.05 level of significance.

The computed t-value of 5.050 is higher than the t-tabular value which was at 1.984 at a 0.05 level of significance.

CONCLUSIONS

Based on the findings of the study, the following conclusions are drawn:

The interventions in Mathematics on Word Problem Solving Skills have a significant strong positive correlation to the students' level of problem-solving skills in mathematics. Therefore, the interventions have a positive impact on the students' problem-solving skills which is also pivotal in developing their critical thinking skills. Furthermore, integrating problem solving activity in a lesson helps develop students' critical thinking skills, patience, perseverance, and discipline.

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