Problem-Posing Strategy and Computational Skills in Integers of Grade 7 Students

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ABSTRACT

Computational skill is an integral skill necessary in taking Mathematics education. Integrating problem posing as a strategy in teaching mathematics should improve the computational skills of the students. More so, the use of different situations relative to problem posing strategy is a big help to develop the computational skills of the students. To support this, this study focused on the use of a problem-posing strategy in terms of free structured, semi-structured, and structured situations that aimed to determine its effectiveness in improving the computational skill performance of the learners. The study used a quasi-experimental research design in conducting the study which students answered pretest and posttest instruments and were participated by 66 Grade 7 students in the third grading period of the academic year 2022-2023. The result showed a significant difference between the pretest and post-test scores performance of the student- respondents which implies that the use of problem posing strategy helped students improve their computational skills. This indicates a significant increase in their performance from developing and competent to proficient in calculation, application, comprehension, and problem-solving. The study suggests providing training and seminars relevant to the use of problem posing strategy in Mathematics education not just for Grade 7 but also in all grade levels of junior high school and senior high school.

Keywords: Problem Posing Strategy, Computational Skill, Calculation, Application, Comprehension, Problem-Solving

THE PROBLEM AND ITS BACKGROUND

Introduction

Mathematics is regarded as one of the most challenging disciplines among students in the 21st century. It is because it necessitates critical thinking and analysis (Auzar, 2017).

Mathematics is a subject that is taught from elementary school through college. It is the study of numbers, forms, logic, quantities, and arrangements. It becomes a subject that is taught gradually from tangible to abstract. It must be learned since it plays a critical part in problem-solving in everyday life.

Some students score poorly in mathematics comprehension, which becomes the explanation for the difficulty in solving arithmetic issues (Tata 2013). Many experts presented numerous remedies to this problem, but the problem remained, with many experts claiming that students' lack of basic mathematical understanding is the basis of the problem.

Filipino students struggle with mathematics comprehension at the Elementary and High School levels. It is supported by the recent result provided by the Trends in International Mathematics and Science Study (TIMSS) in 2019 where Filipino students performed below average in all categories of the mathematical achievement exam, with the Philippines scoring 297 in Mathematics and landing on the last rank among 58 countries.

In 2019, Department of Education Secretary Leonor Briones remarked that the performance of Filipino students in large-scale exams, such as the National Achievement Test (NAT), tended to be low in Science, Math, and English. The Department of Education also released the most recent results of the OECD's Programme for

International Student Assessment (PISA), in which Filipino students finished last out of 79 participating countries and near the bottom in science and mathematics. Mathematics is still one of the subjects that young Filipinos struggle with.

Filipino students are being left behind in Mathematics because they lack the basic knowledge of the fundamental operations (TIMSS, 2019). To solve complex equations, several essential processes are required. So at the high school level, students must master the operations on integers to solve complex equations at higher levels.

Understanding the fundamental concept of integers such as its operations are areas that students need extra support and instruction. Students are frequently struggling with the concept of integers, which causes them to encounter difficulties while solving algebraic problems. It is also important for students to learn the unit of integers and picture the actions conducted with these numbers because it serves as a basis for future units (Doan & Iştan, 2018). Learning the unit of integers can help students master other mathematical units that are connected to it. Students who comprehend positive numbers using decimal numbers struggle with problems involving operations with negative numbers since they are encountering negative integers for the first time (Pek & Ünal, 2009).

Understanding integer operations will give students the confidence to go on to more challenging topics of mathematics. Unfortunately, many students and adults struggle with these abilities. Research has shown that integer arithmetic is difficult for many students. In the study conducted by Kahlid & Embong in 2018, misconceptions and inaccuracies can come from a variety of sources, including their underlying causes while working with operations on integers.

Understanding operations in integers is tough since whole-number operations are the most commonly and first encountered kind of computing, and learners must comprehend integers differently in terms of their computational idea. A study conducted by Rubin, et al. in 2014, claimed that discussions of rules in operations on integers alone will not help students grasps the subject thoroughly, increase their comprehension and enhance skills in integers.

Students are lacking in conceptual understanding to solve problems (TIMSS, 2019). Solving problems required critical thinking and other higher-order thinking skills. One method for learning to solve problems is for students to create their own and then solve them. As a result, students may be able to identify the given in the problem, think of a plan, and apply appropriate techniques to acquire the solution. Posing problems and solving them required students to think critically.

Background of the study

It may be difficult for students of this century to gain the requisite abilities if Math is taught using traditional techniques. That is why teachers conduct classes with students by the curriculum guidelines in the Philippines. The curriculum guide incorporates the matching goals of mathematics at the primary and secondary levels, which are problem-solving and critical thinking, and is based on 21st-century abilities. Each subject's contents are also displayed in the curriculum guide. There are four (4) areas of mathematics namely: Numbers and Number Sense, Measurement, Geometry, Patterns & Algebra, and Statistics and Probability. This content is appropriate for grades 1 through 10.

Number and Number Sense is one of the fields in Mathematics that made a distinctive and significant contribution to the students in the variance of mathematics achievement (Jordan, et al. 2010). Additionally, according to Wang (2012), an outstanding earlier curriculum focusing on improving numerical sense is beneficial. Later Math performance is better for students. Specific competencies in this field are performing fundamental operations in integers (K to 10 Mathematics Curriculum Guide, 2013).

Moreover, due to the pandemic, the Department of Education (DepEd) released the Most Essential Learning Skills (MELCs) last June 2020. It aids teachers in focusing on what is most important given the difficulty in learning delivery, having the same aims but fewer or compressed lists of competencies. However, neither the MELC nor the curriculum guide mentions the ability to pose problems for grade 7 to 10 students. It only contains competencies in solving problems. Problem posing is only present at the elementary level, and the only competency that shows posing problems in grade 7 is under Statistics and Probability which states *"poses problems that can be solved using Statistics (**M7SP-IVa-2)**"*. Aside from this, no other competencies state about posing or creating problems.

It was discovered that most research on problem posing focused on the qualities of the presented problems, as well as teachers' and pre-service teachers' attitudes (Akay & Boz, 2010) and problem-posing skills. There has been little research on problem-posing-related activities in the classroom. Studies using classroom activities that involve problem-posing in secondary school are particularly sparse.

Posing a Problem is a key micro-activity that is required for problem solution and always comes before problem-solving (Pintér 2012). Problem posing helps people develop qualities like creativity, reasoning, and conceptual understanding, and it is also used as a technique to assess students' knowledge and mathematical concepts (English, 2020).

Problem posing is a good strategy for addressing these serious scenarios. Problem posing has long been recognized as important in mathematics education (Cai, Jiang, Hwang, Nie, & Hu, 2016; Singer, Ellerton, & Cai, 2015). Much progress has been achieved in problem-posing research during the last two decades (Cai et al., 2015).

Students who pose problems must have inventive abilities, which may be cultivated via the problem-solving process, in order to construct an effective problem (Kilpatrick, 1987). According to Lavy and Bershadsky (2003), while reformulating and developing a new mathematical problem, students must not only think technically but also artistically. Students that participated in problem-solving activities, according to research, were ambitious, creative, and active learners.

Problem-posing strategy can provide teachers the chance to learn more about how to assist students comprehend certain ideas. It can assist them in going beyond what they previously knew in order to increase their mathematical articulacy and involve them in higher-order thinking, which is why it is seen as a tool for critical thinking development (NCTM, 2000).

Posing problems and solving them both have a beneficial link, and posing problems is just as vital as solving problems (Kojima, Miwa, & Matsui, 2015). Posing problems helps students develop qualities like creativity, reasoning, and conceptual understanding. For this reason, teachers also used it as a technique to assess students' knowledge and mathematical concepts (English, 2020).

21st-century learners must poses higher order thinking skills. It is highlighted in the purview of national-level education programs and international-level reform research connected to mathematics education that linking numbers with real-life situations will help students grasp integers better (NCTM, 2000). However, in mathematics education, only problem-solving skills are being exercised, and problem-posing activities are limited. Akay & Boz, (2010), show how some guidelines on problem posing can expand problem-posing skills for particular definite types of problems.

There has been no major study that discusses problem posing as an object of instruction. One of the few studies in this area has focused on teaching pre-service teachers effective question-asking.

Based on the information above, the researcher will prove that the application of problem posing strategy in the learning process would have an effect on students' computational skills.

Theoretical Framework

This study is anchored on **Cognitive Learning Theory**. Cognitive Learning Theory (CLT) is concerned with thought. It is the idea that is concerned with comprehending the human mind and how the brain responds as individuals learn. The CLT is also concerned about the way the brain processes information and whether learning happens as a result of that internal processing of information. (Andre, 2019).

Another theory is **Constructivism Learning Theory.** This theory is founded on the notion that learners build their own learning based on prior experience. Students use what they acquire and combine it with what they have already learned and experienced to create a distinctive reality that is unique to them. This learning approach emphasizes learning as a personal and unique process for each student. McLeod (2019).

Teachers as moderators may use constructivism to assist students comprehend that they will be bringing their own history to the classroom on a daily basis. Teachers in constructivist classrooms serve as guides to assist learners in generating their own learning and knowledge.

Teachers support learners in developing their own approach and reality based on their personal observations. This is critical for assisting many different types of students in incorporating their personal experiences into their learning. (2013) (Jennings, Surgenor, & McMahon).

Conceptual Framework

For a clearer view of the research problem, the conceptual framework is presented in paradigm form.

Problem presenting (PP) is the process through which learners generate a new problem or question based on a given circumstance (Mishra & Iyer 2013).

Stoyanova and Ellerton (1996) presented a new three-tiered classification scheme.

• In free structure, students are asked to create a problem based on anything they have seen in nature.

• In semi-structured, students are presented with an open situation and asked to solve it. You are urged to look into or finish the structure. Using graphics or mathematics to convey issues is an example of this type.

• Structured - the problem is presented in a well-structured manner. A problem is presented, and the goal is to generate more.

Millans (2011) defines computational skills as the ability to choose and use arithmetic techniques to solve mathematical problems.

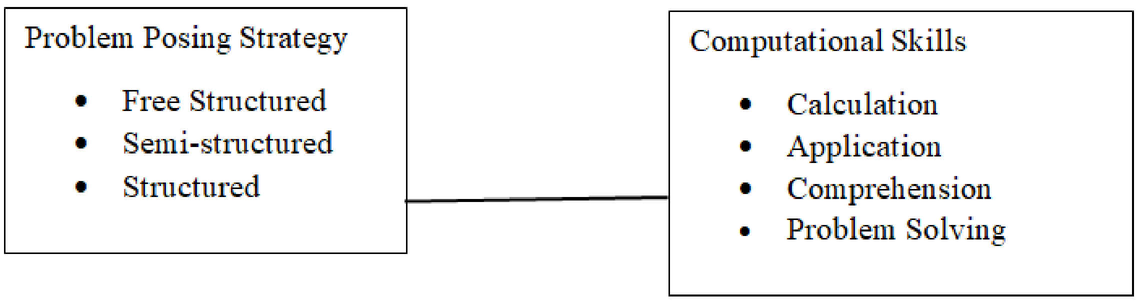

Figure 1. The Research Paradigm

Statement of the Problem

Specifically, this study sought to find out:

1. What are the students' pretest level of computational skills in integers as to:

    1.1. Calculation;

    1.2. Application;

    1.3. Comprehension; and

   1.4. Problem Solving?

2. What are the student's posttest level of computational skills in integers as to:

   2.1. Calculation;

   2.2. Application;

   2.3. Comprehension; and

   2.4. Problem Solving?

3. Is there a significant difference between the pretest and posttest scores on the computational skills of the student-respondents?

4. What emerging themes can be derived from the challenges of the student respondents being exposed to problem-posing strategy?

Hypothesis

There is no significant difference between the pretest and posttest scores on the computational skills of the student-respondents.

Significance of the Study

Through this study, the researcher was able to determine if the problem-posing strategy could be helpful in enhancing computational skills. Individuals, groups, and institutions in one way or another can benefit from this study.

Students. Students were aware that there are some effective strategies on how they can easily solve integers arithmetically. This study is more meaningful because it serves as a tool for developing critical thinking skills and computational skills.

Mathematics Teachers. Teachers are considered one of the best influences in the development of children or student's academic life. It helped them to improve the skills of the students in computing. It is beneficial for them because it adds context to how they will teach a certain topic of mathematics with the concept of problem-posing strategy.

Administrators. The result of this study is used to open the door to using problem posing strategy to produce Mathematics learners who are holistically developed with 21st-century skills.

Future Researchers. They may gain insights and learn what strategies are effective in improving students' computational skills. They may also come up with other strategies that would help students improve their learning difficulties aside from their computational skills. The findings of this research may also be used as the basis for other inquiries regarding the same field of specialization.

Scope and Limitation of the Study

This study focused on the computational skills of students. This displayed the benefits of problem posing strategy to the computational skills of Grade 7 students in San Antonio de Padua College. This study took place for a specific quarter of a school year and topics would be about the operations on integers.

The researcher used instruments such as pre and post-test that are used as tools for gathering the data. Instructional plans are also compiled which reflect the use of problem posing strategy.

It is hoped that the use of problem posing strategy helped the students to develop computational skills in mathematics that helped them in using appropriate learning strategies and make them become lifelong and self-directed learners.

Definition of Terms

The following terms were defined according to how they will be used in the study:

Application. Applying the correct concept/principle is necessary to solve the problem.

Calculation. Steps and strategies a student presents as her work.

Comprehension. Recognizing whether the answer is reasonable for the given problem.

Computational Skills. The selection and implementation of arithmetic procedures to solve mathematical problems.

Free structured – create a problem based on anything students have seen in nature.

Integers. It covers negative and positive numbers, including zero, and has no decimal or fractional amount.

Problem. A situation that has to be solved.

Problem Posing Strategy. An instructional strategy that allows students to pose problems.

Problem Solving. The process of solving problems with the use is operations on integers

Semi-structured – presented with an open situation and asked to solve it.

Structured – the problem is presented in a well-structured manner.

REVIEW OF RELATED LITERATURE

The researcher gathered a number of publications and research studies that are pertinent to the current investigation. It is on this premise that the researcher would like to give a general picture of the research topic. These studies have similarities to the present study in terms of conceptual framework, methodology as well as in their findings. Through these studies, the researcher has gathered some insights that are relevant to the problem discussed. As a result, this chapter provides the many literature and research that were read in order to acquire ideas for the study. This also contains research that is being examined to reinforce the concepts.

Problem Posing as Strategy

Drew (2022) defines problem-posing education as an active learning technique in which a teacher or student raises a problem and the class collaborates to develop solutions. It has been utilized as an effective teaching approach to provide learning opportunities for all students as well as to evaluate students' thinking. (Cai & Hwang, 2019)

Problem posing has positive effects on teachers’ mathematics self-efficacy beliefs and attitude toward mathematics as studied by Akay, H., & Boz, N. in 2010. However, teachers are more familiar with problem-solving and students still have a limited capacity for posing mathematical problems (Zakariah 2011).

The importance of problem posing strategy in mathematics instruction has lately grown in terms of its benefits to both the teacher and the student (Sahal, 2016). According to research conducted by Cai and Jiang in 2017, both teachers and learners are capable of generating mathematical problems depending on specific circumstances. Additionally, successful problem-posing in mathematics has been established, for example, through research that investigates the link between mathematical subject knowledge and problem-posing skill. (Leavy and Hourigan, 2020)

As mentioned by Kapur (2018), posing problems together with finding solutions is a better warm-up exercise than posing problems without finding solutions. In-depth thinking is required because students must generate unique ideas, make sense of them, and evaluate the plausibility of the situation being presented. How problems are created, particularly how they are written, reveals how effectively students learn math by posing problems (Patac, A., Patac, L., & Crispo, N. 2022),

Bakar and Jahanshahloo (2013) claimed that problem-posing activities might improve students' higher-order thinking abilities since they place an emphasis on considering the connections between mathematical concepts. K. Georgius (2014) also argues that tasks with various degrees of difficulty are likely to lead to various types of thinking. As a result, it's crucial to examine students' thought processes when presenting them with various problem-solving activities.

Separating problem posing and problem solving is considered equivalent to disregarding most of the elements of problem posing. According to Baki (2015), a problem is any circumstance that upsets an individual or for which the individual cannot foresee a solution. When a problem bothers us and we don't know how to solve it, we refer to it as a problem. According to Kontorovicha, et.al (2012), a problem that needs to be presented is also a problem that needs to be addressed, and they underline that problem posing is a subset of problem-solving.

Based on the study conducted by R. Tan (2018), posing problems helps to increase the performance of students. The students recognized that posing problems is an effective way to teach math as it had a favorable impact on their achievements. In order to inspire the teachers to use this exercise in their classes, Tan also urges the school principals and supervisors to promote the introduction of problem posing in mathematics classes. Additionally, she suggests that comparable studies be carried out in the Philippines to broaden the study's scope and to promote the conclusions' generalizability.

In schools, specifically in mathematics education, problem-solving has been more prominent as compared to problem-posing. There are a lot of competencies that cover problem solving but posing problem activities make up a very uncertain percentage of the mathematics education. Despite the fact that problem posing provides significant advantages and has large mean effects on ability-, skill-, and attitude-based learning outcomes (Rosli et al., 2014), it has gotten less attention than the other research strands.

Problem-posing activities should stretch students' abilities to think critically and should enable them to reach their full learning potential, as Leikin and Elgrably (2019) emphasize.

Problem Posing as a Skill

There is a positive relationship between problem-posing skills and problem-solving skills. People who can approach challenges from a new perspective might come up with more unique and varied solutions. As a result, the problem-solving process is an essential component of mathematics classrooms, and putting problem-solving at the heart of the curriculum might encourage educators to place a premium on this process (Berisha, 2015).

Despite the research that has been done so far, teachers and students still find problem posing to be a challenging aspect of learning since it is underrepresented. Problem posing is still a rare occurrence in mathematics classrooms, and there is no general problem-posing equivalent to well-established problem-solving frameworks (Cai, J., Koichu, et. al, 2022)

As studied by Daz & Patac (2021), students admitted that they struggle the most with their problem-posing tasks because they lacked prior experience, which was not present in their early schooling. They are more familiar with concepts and operations on whole numbers. As a result, they propose to formally include it in the curriculum with utmost care and importance. There is a need to incorporate problem-posing in the learning process,

Koichu (2019) expands on the potential for improving students' problem-posing skills by arguing that problem-posing might be an implicit goal of another activity, such as problem-solving (or investigations). To solve a problem, you must first pose your own problem. It is worthwhile to consider taking an a-didactical approach to problem posing in order to integrate it into the fundamental teaching methods. Though it is not commonly used for grades 7 through 10, teachers may nonetheless consider using this strategy during class discussions. Additionally, as an alternative to testing and assessment activity, teachers might employ problem-posing.

According to Işk and Kar (2015), the difficulties that are faced by students and the points which they have difficulty understanding can be used to develop the ability to pose mathematical problems. Identifying students' difficulties and misconceptions will aid students in their learning and help teachers improve the level of instruction they provide. (Arkan & Dede, 2020).

Research conducted by Karnain et al. (2014) identified that problem-posing activities can include understanding the problem, extracting the information provided, recognizing the aim, looking for any examples previously utilized, and mapping a solution discovered. In this case, it is very likely that problem-posing contributes significantly to aiding students in solving problems.

Integers

Number and Number Sense is one of the fields of mathematics that has provided a distinctive and important contribution to students' math accomplishment variance (Jordan, Glutting, and Ramineni, 2010). Furthermore, an early curriculum with a strong emphasis on number sense development helps students do better in mathematics in the future. Individuals who master these abilities will be able to deal with numerical challenges in their daily lives (Cheng and Wang, 2012).

In the Philippines, the notion of integers is introduced to learners in Grade 7 (between twelve to thirteen years old). Students who have finished secondary school should ideally have a solid knowledge and grasp of the whole real number system, including negative values. However, some students fail to attain this because they accept processes such as the rule of signs without knowing the right reason for them. A study conducted by Kloosterman in 2012 revealed that a quarter of 13-year-old students were unable to accurately add positive and negative numbers, while half of them were unable to divide integers.

Research has shown that operations on integers are difficult for many students. In the study conducted by Kahlid & Embong (2018), misconceptions and inaccuracies can come from a variety of sources, including their underlying causes while working with operations on integers. According to them, most learners who struggled with problems in integers lacked information, were unable to internalize the notion of Integers, had a shallow comprehension, and were puzzled by the rules, resulting in learners confusing them. They urge that in order to create relevant exercises for their mathematics lessons, teachers must integrate the following elements: 1) Active learning, 2) Cooperative learning, 3) Multiple representations, and 4) Creative lessons that will make students think critically.

Active learning is supported by the constructivist learning theory. Most students desire to participate in the learning process. A study conducted by Rubin et al (2014), claimed that discussions of rules in operations on integers alone will not help students grasps the subject thoroughly, increase their comprehension and enhance their skills in integers.

Integer arithmetic is typically taught as four distinct operations (addition, subtraction, multiplication, and division). Disciplined notions of arithmetic, on the other hand, involve two groups of operations (i.e., addition and multiplication). That is, addition and subtraction, for example, may be thought of as "strands" of the same dimension (i.e., subtraction is the same as addition of the opposite of a value). As a result, any instrument meant to test aptitude with integer arithmetic may have a multidimensional structure, which should be demonstrated before doing any analysis in the following research or employing the instrument in the classroom.

When it comes to integers, the most common issue is when students are unsure of what it means to have a number smaller than zero. They frequently wonder why negating negative numbers results in a positive quantity (Shanty, 2016). Furthermore, students typically struggle with comprehending numbers smaller than zero, representing negative numbers as mathematical objects, and formalizing rules for operations on integers (Stephan & Akyuz, 2012).

As studied by Aziz et. al (2016), integers are the key capital for junior high school students to learn mathematical principles. In truth, many students still struggle to grasp the notion of integers, particularly negative numbers, due to cognitive conflicts. One possible explanation for the variation in students' integer comprehension is their perception of integer notation. Many pupils still struggle to grasp negative integers since the sign "-" has three meanings: unary (negative), binary (subtraction), and symmetric (opposite).

Understanding integers and solving problems requiring integer operations are tough and demanding for students (Fuadiah et al., 2017). Students struggle to understand the subtraction process, especially when the quantity is negative. Many students struggle to grasp the concept of subtracting a negative number yielding the same result as adding the reverse of negative numbers. When students have a weak comprehension of subtracting negative integers, they may follow the rules mindlessly.

Textbooks are organized in a way that teaches students about integers and integer operations. There are no tangible instructional objects in this procedure, as there are when teaching natural numbers. Number line and neutralization models are common pedagogical models for integers, and teaching with each paradigm has both benefits and drawbacks (Vig et al., 2014).

According to Rubin, et. al (2014), executing operations on integers includes the signs of the numbers as well as the operation of the needed sign. When asked to do operations on numbers, students become perplexed and struggle. When the integer subject is not fully grasped, it leads to misunderstandings regarding the precise meaning of the ideas in exponential and root numbers. Because Mathematics subjects are taught progressively, teaching integers before moving on to exponential and root numbers (Kutluca, 2012).

Many studies show a relationship between the improvement of using strategy in teaching operations on integers. Mutodi (2015) evaluated the influence of interchangeable numbers, debts, and assets, as well as the chips model, on grade 8 learners' ability to do integer addition, subtraction, multiplication, and division. He employed a pre-and-post-testing strategy. The study included forty students. The study's findings are described as "a statistically significant boost in student performance" with the adoption of the three models (Mutodi, p.434).

According to Embong (2020), although basic integer operations appear straightforward, students frequently become confused and struggle when asked to answer simple mathematical problems. It is tough for the students since they have been taught to follow rules and processes in a highly abstract manner without using models to improve conceptual comprehension. As a result, it is preferable for students to understand the principles of mathematics so that they may readily master higher mathematical procedures. Furthermore, having strong mathematics abilities will save students time during exams and lessen the need for tutoring or remediation. Furthermore, because each process relies on earlier knowledge and effective application of these abilities, it is critical that the basics are sound for every school student.

In lower secondary education, integer operation is an important idea to understand. Nonetheless, many students continue to have misunderstandings about doing integer operations. Some students perceive integer operations to be a simple or trivial subject. In reality, when it comes to solving this problem, students continue to make mistakes. (Fadillah, 2019).

Computational Skills

Calculation. The primary objective of most countries across the world is to improve their calculating skills (Quinn in Mumpuniarti., 2017). Teachers must be able to count in order to improve the instruction they provide to their students. Calculating is under the category of cognitive ability. Cognitive behaviors include comprehension, attention, information processing, problem-solving, and methods of thinking.

According to the study conducted by Aprianti in 2014, the smoothness of students' calculations in determining operational materials in fractions in junior high school showed none of the students, or 0% had a smooth mathematical procedure that was included in the present category. Moreover, some students have difficulty with systematic procedures and precise calculations.

When math problems are answered using simply pencil and paper without any reasoning, pupils can solve the problem in a regular standard way (like they have done previously) without grasping the logic of the rule or the formulae. To solve such a mathematical activity or problem, it is important to visually evaluate the problem and execute a number of calculation processes before reaching a judgment and picking a suitable solution (Vansteensel et al., 2014).

Application. Modeling and application are critical in the development of mathematical comprehension and abilities. It is critical that students apply their mathematical problem-solving and reasoning abilities to a wide range of challenges, including real-world problems (Akinmola, 2014). According to Linto 2012, when students can connect one topic to another, they develop their mathematical connection ability. Because they have mastered the prerequisite topics relating to daily life, students can convey the concepts that they study. If students can make connections between the content they study in past disciplines and other topics, mathematics learning becomes more relevant.

The problem-solving process necessitates an attempt to build a link between the stages of problem-solving (Tasni & Susanti, 2017). The process of solving mathematical problems is the activity of students who can construct mathematical connections; this occurs because in order to solve mathematical problems, students must be able to identify the linkage of concepts or theorems utilized to answer a problem (Siregar & Surya, 2017).

Problem-solving is critical to be taught in schools so that it may become a skill needed in modern society (Oktaviyanthi & Agus, 2019). Students are required to grasp mathematical ideas, explain the interrelationships between concepts, and use these concepts flexibly, correctly, effectively, and precisely in activities to solve mathematical problems every time they follow the process of studying mathematics in school.

Comprehension. In school mathematics, the judgment of reasonableness generally refers to an evaluation of a computational result based on a critical judgment of whether it may qualify as a rational and acceptable response to a mathematical task. We only have a limited understanding of which factors or task characteristics impede or facilitate one's ability to provide reasonable answers to mathematical tasks. The reasonableness of mathematical calculation results is frequently addressed in connection to either the effect of operations and number relationships (Yang, 2017) or their practicality.

A study conducted by Desli in 2022 revealed that students frequently failed to get findings that made sense in light of real-life situations or the numbers and processes involved. Instead, they accepted algorithms and rules uncritically, even when their application was incorrect or insufficient. According to the findings, mathematics classrooms should focus on the development of number sense and stimulate the search for links between school mathematics and real life in order to assist students refine their capacity to discern reasonableness.

When students build meaning from their own means of addressing issues, this is a crucial component of justification. Once students can defend their own work, they may begin to justify the rationale or methodology of others. Using reasons provides a better comprehension of mathematical ideas; teachers that encourage students to justify their thinking improve student achievement in arithmetic. It is supported by the study conducted by Moore in 2012. Based on her study, students were able to have correct justification if they are asked low-level type of questions. However, they find it hard to justify questions that are a high-order type of questions. She concluded that teachers must support students to develop their way of justifying answers in terms of exposing them to different types of questioning and making it part of the class discussion.

Problem Posing, Problem-Solving, and Integers

According to Sahal (2018), one of the subjects that cover the link between problem-posing and problem-solving is integers. It accounts for a significant component of the instructional program. Natural numbers and the positive line of rational numbers are introduced to elementary school students. Many students struggle with the introduction of integers in high school.

In the high school mathematics curriculum, integers are regarded as a critical topic. Previous research on problem-posing has clearly focused on conceptual errors and student challenges (Turhan & Guven, 2014). The breadth and depth of study should be broadened to include areas that students find challenging.

Teachers and researchers have used a variety of instructional strategies or resources to overcome students' misconceptions about sin integers. Fuadiah (2017), Suryadi (2017), and Turmudi (2017). Performing problem-solving activities by relating knowledge about integers with daily life can be used as one of the teaching approaches that will help students learn integers more readily (Berkant & Yaren, 2020). It is considered that by employing numerous scenarios in which we may use integers, conducting problem-posing activities connected to integers would be more successful in learning integers.

Mathematical problem-posing may be viewed as a subject-specific component of a broader educational philosophy and teaching style. Problem posing improves academic accomplishment in the teaching of integers (Zdemir & Ahal, 2018) and helps students to employ integers in context (Wessman-Enzinger & Tobias, 2020).

The main distinction between problem-posing and problem-solving is that problem-solving is a thorough process that includes reasoning abilities (ldr & Sezen, 2011). According to Guezel and Biber (2019), issue situations have a favorable influence on emotional processes such as motivation and attitude. Teachers must know appropriate approaches and strategies based on their student's abilities in order for pupils to comprehend the problem and have problem-solving skills. It is critical that students learn that operations on negative integers (after natural numbers) may be interpreted using mathematical reasoning. The greatest technique to link integers is to associate negative numbers with daily life and include them in the process (Akyaz & Kaplan, 2018).

There are numerous sources of errors and fundamental reasons that lead to misunderstandings and errors while dealing with integer operations. It is preferable for students to understand the principles of mathematics so that they may easily master higher mathematical concepts. Furthermore, having strong mathematics skills will save students time on exams and lessen the need for tutoring or remediation. The value of teaching is critical for student comprehension (Ellerton 2013).

RESEARCH METHODOLOGY

The many approaches that are used before, during, and after the research are highlighted in this chapter. This also reveals research designs that are, in some ways, coherent with how the current study was carried out. There is also a detailed description of the respondents and the sampling procedure, as well as techniques for data gathering and statistical analysis.

Research Design

This study engaged a mixed method approach with quantitative and qualitative phases. Experimental research was employed to test the effectiveness of the strategy and a descriptive qualitative was implemented to depict the emerging themes of challenges encountered being exposed to a problem-posing strategy. This research design involved the manipulation of a certain variable or the use of a teaching strategy to identify significant differences in terms of skills development.

This research focused mainly on the development of students' Computational Skills in Integers through the application of the Problem Posing Strategy. Their statistical tests for significant differences within and among groups were used after scores in the pre and post-test are gathered.

Respondents of the Study

The respondents in this study were Grade 7 students of San Antonio de Padua College, Pila, Laguna during the school year 2022 – 2023. All grade 7 students were included in the study.

Table 1. Respondents of the study

Grade and Section	No. of Students
Grade 7 – Integrity	33

Grade 7 – Love	33
Total	66

Sampling Technique

The respondents in this study were chosen using the cluster sampling technique. Respondents were only consisting of the seventh-grade students of San Antonio de Padua College. They were treated as a single group.

Cluster sampling (also known as one-stage cluster sampling) is a technique that identifies and includes groups of individuals that reflect the population in the sample. It entails identifying a cluster of people who reflect the population and including them in the sample group. Jackson (2011). The cluster of the researcher in terms of data gathering and administering the researcher will be taken into consideration. As stated in the Theory and Practice in Language Studies (2012), cluster sampling is the most common type of sampling technique as it gives low and high sets of groups which then make them comparable with all other variables remaining the same.

Research Instrument

The instruments of this research were tests.

The researcher prepared a test that includes the operations on integers. It was divided into two parts: pre-test and post-test. The two (2) tests focused on Problem Posing strategy and students' computational skills in integers. Each test was composed of four (4) problems with four (4) questions each. Each problem was composed of questions to assess students' computational skills as to calculation, application, comprehension, and problem-solving. A rubric was provided to check for students' level of computational skills.

Research Procedure

The principal, an English teacher, a statistician, a topic specialist, and a technical editor all confirmed the researcher's pre-and post-tests. Following the preparation of the research instruments, the researcher sought advice and comments from her adviser, statistician, subject specialist, and technical editor in order to review the given instrument to be used. After the instrument had been validated, the researcher requested permission to conduct the study. It was obtained from the various offices involved in the study's execution. With San Antonio de Padua College as the target school, a formal request was sent to the school principal to formally begin the research. The researcher began conducting the study after obtaining the necessary approval from the appropriate offices.

The researcher administered the pre-test to the student respondents. It is followed by the conduct of the study or instructional delivery. After the study was conducted, the researcher checked the pre-test and recorded the students’ results. The researcher then administered the post-test and checked it once the students were done answering.

In order to gather data for the qualitative aspect of the study, the researcher interviewed some of the respondents and asked them about the challenges they encountered while being exposed to problem-posing strategies. After that, the researcher recorded their answers and categorized them based on common themes. Once all the data needed for the study was available, the researcher submitted the results for data analysis.

Statistical Treatment of Data

There are several statistical measures used in the study and that depends on the statement of the problem declared in Chapter I.

To interpret the raw data that were gathered, descriptive and inferential statistics were used to give significant meaning to the set of data.

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In response to the presentation of the descriptive data on the pretest and posttest scores performance of the student-respondents on computational skills assessment, frequency and percentages are to be used.

To analyze the result of the data gathered in response to the inferential question of pre-test and post-test comparison within groups, paired t-tests were used.

Presentation, Analysis, And Interpretation Of Data

This chapter contains the tabulated data and research outcomes, as well as the accompanying analysis and data interpretation as a result of the statistical treatment applied.

Table 1. Students' Pretest Level of Computational Skills in Integers

Scores	Calculation		Application		Comprehension		Problem-Solving		Interpretation
	F	%	F	%	F	%	F	%	
13-16	42	63.6%	65	98.5%	29	43.9%	21	31.8%	Proficient
9-12	21	31.8%	1	1.5%	27	40.9%	32	48.5%	Competent
5-8	3	4.5%	-	-	10	15.2%	12	18.2%	Developing
0-4	-	-	-	-	-	-	1	1.5%	Beginning
Total	66	100.0%	66	100.0%	66	100.0%	66	100.0%	

Table 1 clearly shows the computational skills of the students before being exposed to problem posing strategy in terms of calculation, application, comprehension, and problem-solving.

In terms of calculation, it is found that prior to being exposed to the problem-posing strategy, 63.6% of the students were proficient. It suggests that, while the majority of students can demonstrate their work in a logical manner with proper stages and calculations, some of them make mistakes and forget parts of the steps and calculations in the provided problem. According to the researcher's observations, most students on pretest examination in calculation find it difficult to answer problems with negative signs and to express the given on a problem when encountering uncertain words that must be associated with negative signs.

According to (Blair et al, 2012), negative numbers, unlike positive numbers, do not have a clear perception reference, thus students need to work harder to learn about them. Many of them are excellent representations of positive and negative numbers, but they provide problems when used to demonstrate the operations of addition, subtraction, multiplication, and division.

Figure 1 depicts the student's computation on one of the pretest questions. Despite the fact that student 28 correctly identified the proper operation to employ in one of the problems, she represented the given in mathematical language without incorporating the negative sign. As a result, she displays inaccurate steps or computations for the given problem.

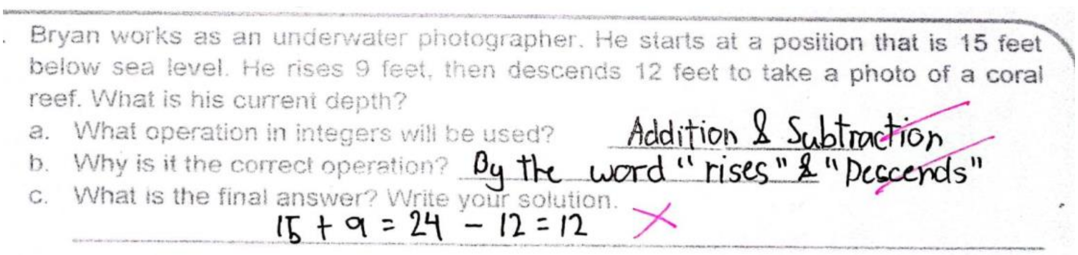

Figure 1. Sample Pretest Output of Student no. 28 as to Calculation with incorrect calculation

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However, Figure 2 shows that student 28 was able to identify the correct operation and show the correct mathematical sentence that best represented the given in one of the problems, displaying the correct steps or calculations that worked well in the problem since there are no confusing terms or terms associated to negative signed numbers.

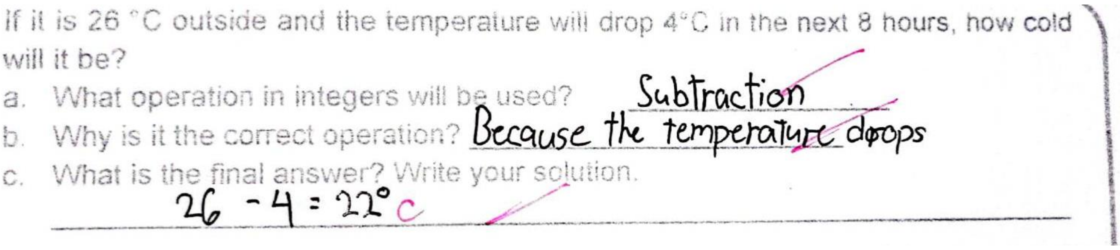
If it is 26 °C outside and the temperature will drop 4°C in the next 8 hours, how cold will it be?
a. What operation in integers will be used? Subtraction
b. Why is it the correct operation? Because the temperature drops
c. What is the final answer? Write your solution.
26 - 4 = 22°C

Figure 2. Sample Pretest Output of Student no. 28 as to Calculation with correct calculation

In terms of application, it is observed that before being exposed to problem posing strategy, 98.5% of the students were proficient and only 1.5% were competent. It indicates that most of the students were able to apply all concepts and principles necessary to solve the problem, and only a few students had missing concepts and principles. This is because of the researcher's observation that students have already encountered problem-solving when they were in elementary where they are tasked to write what is asked and identify the correct operation to be used. They can recognize the correct concept by looking at the keywords related to the correct operation to be used in order to solve the problem. Referring to figures 1 and 2, student 28 is also able to identify the correct operation for two problems in the given pretest because of the keywords that will lead to the right concept or principle.

The table also shows that only 43.9% of students are proficient in comprehension, with 40.9% and 15.2% at the competent and developing levels, respectively. It is stated that the majority of students justify their answers arbitrarily, or erroneously, or do not attempt to justify their answers at all. The researcher discovered that students can only identify the correct operation in solving a problem based on the keywords in the problem, but they do not always know how to construct a sentence that explains or justifies why that operation or concept is the best one to use to solve the problem.

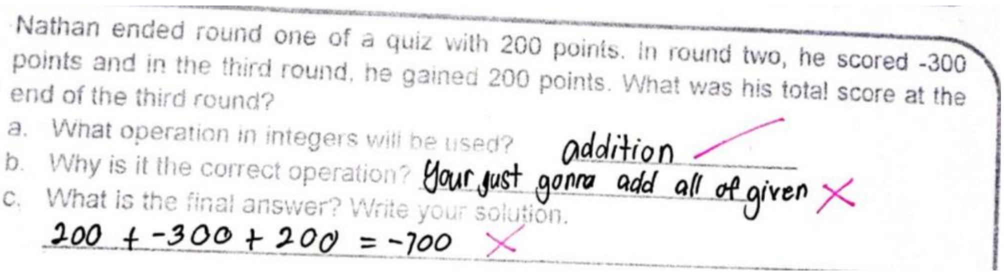
Nathan ended round one of a quiz with 200 points. In round two, he scored -300 points and in the third round, he gained 200 points. What was his total score at the end of the third round?
a. What operation in integers will be used? addition
b. Why is it the correct operation? Your just gonna add all of given
c. What is the final answer? Write your solution.
200 + -300 + 200 = -700

Figure 3. Sample Pretest Output of Student No. 21 as to Comprehension

Figure 3 illustrates that student 21 was able to identify the proper operation or concept to employ but was unable to articulate why it was the best option for solving the problem. She may understand the problem and that addition was required to solve it, but she could not put it into words, in a sentence, or even a phrase.

Additionally, before being exposed to problem-posing strategy, 48.5% of the students were at the competent level, while 18.2% and 1.5% were at the developing and beginning levels, respectively, according to the pretest results in terms of problem-solving skills. This indicates that some students do not fully comprehend or they misinterpret the problem, resulting in an inaccurate result. The researcher discovered that, while they can identify the operation or concept to be applied, some of them are unable to demonstrate the right computation and explain their results.

Figure 4 illustrates that student 56 was unable to explain his findings because he misunderstood the problem and the information provided in the problem, particularly if negative signed integers are included. It is true that he got the words associated with addition and subtraction correct but he cannot comprehend what the term "below sea level" means. He displayed the mathematical language inaccurately in the presented problem, resulting in an erroneous explanation of his answer.

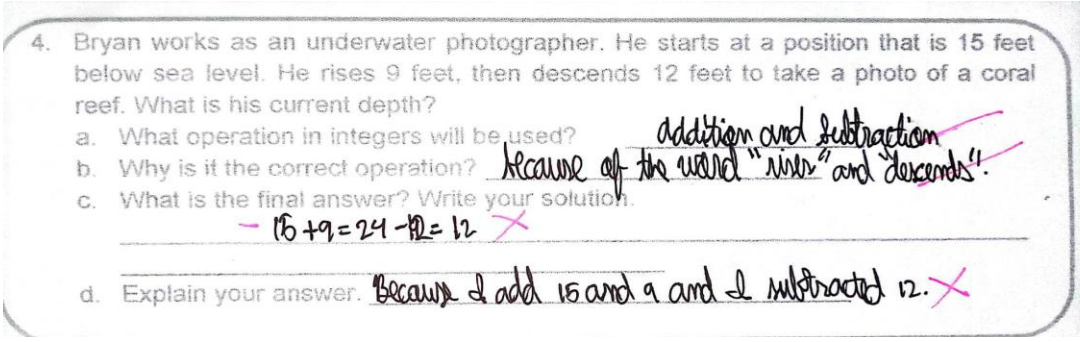
4. Bryan works as an underwater photographer. He starts at a position that is 15 feet below sea level. He rises 9 feet, then descends 12 feet to take a photo of a coral reef. What is his current depth?
a. What operation in integers will be used? Addition and subtraction
b. Why is it the correct operation? because of the word "rises" and "descends".
c. What is the final answer? Write your solution.
- 15 + 9 = 24 - 12 = 12
d. Explain your answer. Because I add 15 and 9 and I subtracted 12.

Figure 4. Sample Pretest Output of Student No. 56 as to Problem-Solving

Table 2. Students' Posttest Level of Computational Skills in Integers

Scores	Calculation		Application		Comprehension		Problem-Solving		Interpretation
	F	%	F	%	F	%	F	%	
13-16	60	90.9%	66	100.0%	42	63.6%	32	48.5%	Proficient
9-12	5	7.6%	-	-	12	18.2%	27	40.9%	Competent
5-8	1	1.5%	-	-	6	9.1%	5	7.6%	Developing
0-4	-	-	-	-	6	9.1%	2	3.0%	Beginning
Total	66	100.0%	66	100.0%	66	100.0%	66	100.0%	

Table 2 clearly shows the computational skills of the students after being exposed to problem-posing strategy in terms of calculation, application, comprehension, and problem-solving.

In terms of calculation, it is found that after being exposed to problem posing strategy, 90.9% of the students were proficient. It suggests that most of the students improved their calculation skills. They can demonstrate their work in a logical manner with proper stages and calculations, to solve the given problem. According to the researcher's observations, most students on posttest examination in calculation can construct the correct mathematical sentence using also the correct operation to solve the problem.

Figure 5 shows the student's calculation on one of the post-test questions. It shows that student 28 identified the proper operation to employ in one of the problems and she represented the given in a mathematical language with correct calculation. As a result, she displays accurate steps or computations for the given problem.

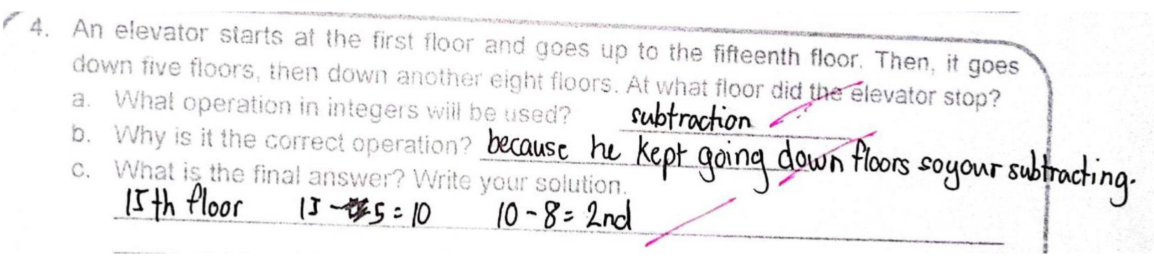
4. An elevator starts at the first floor and goes up to the fifteenth floor. Then, it goes down five floors, then down another eight floors. At what floor did the elevator stop?
a. What operation in integers will be used? subtraction
b. Why is it the correct operation? because he kept going down floors so your subtracting.
c. What is the final answer? Write your solution.
15th floor 15 - 5 = 10 10 - 8 = 2nd

Figure 5. Sample Posttest Output of Student No. 28 as to Calculation

In application skills, it is observed that after being exposed to problem posing strategy, 100% or all of the students were proficient. It indicates that all of the students were able to apply all concepts and principles necessary to

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solve the problem. The researcher observed that students can easily identify the correct concept by looking at the keywords related to the correct operation to be used in order to solve the problem without confusion about whether or not it is related to positive or negative signed numbers because it becomes part of the discussion wherein the researcher taught the students to be critical in finding terms related to the right operation to be used.

Moreover, 63.6% of students are proficient in terms of comprehension after being exposed to the problem-posing strategy. This suggests that the majority of students offer a reasonable justification for their answers. Though there are students who struggled to comprehend the problem and explain the use of the correct principle, the researcher discovered that most students can identify the proper operation to employ to solve a problem based on the keywords provided, and they also know how to build a statement that explains or justifies why that operation or concept is the best one to use to solve the problem.

Figure 6 shows the student's comprehension of one of the problems in the posttest. It shows that student 21 was able to identify the correct operation or concept, could associate terms related to the correct operation, and could explain why it was the appropriate operation/principle to solve the problem.

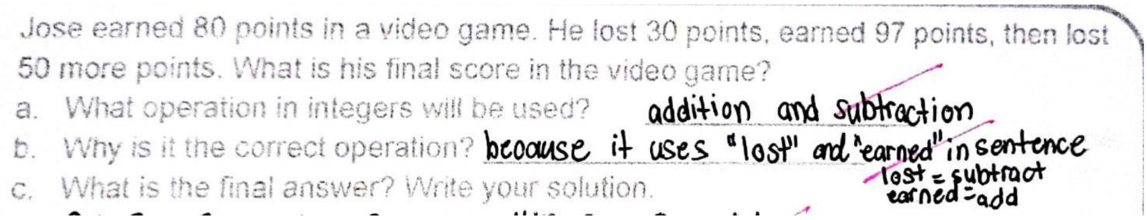

Figure 6. Sample Posttest Output of Student No. 21 as to Comprehension

Furthermore, the table demonstrates that after being exposed to problem posing strategy, 48.5% of the students were proficient in problem-solving skills. This indicates that the majority of students comprehend the problem, which leads to the proper result. The researcher discovered that they can identify the operation or concept to be employed and that the majority of them can demonstrate the right calculation and can explain or justify their results.

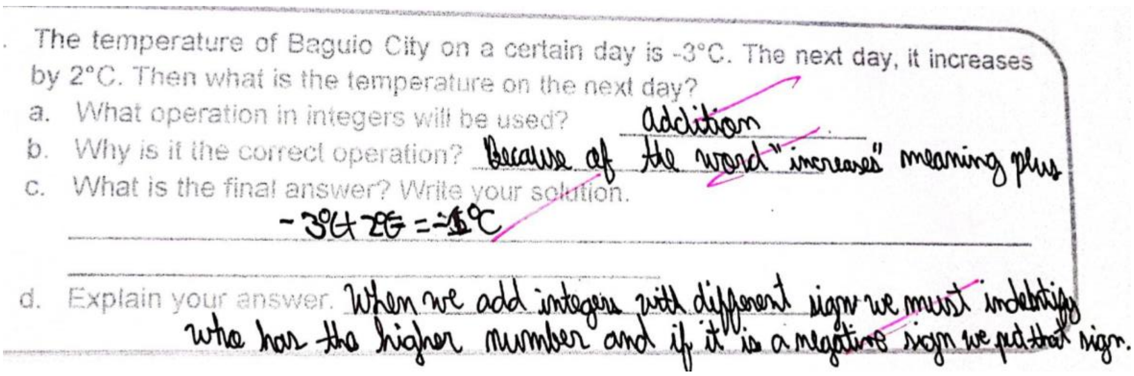

Figure 7. Sample Posttest Output of Student No. 56 as to Problem Solving

Figure 7 illustrates that student 56 was able to describe his findings because he comprehended the problem and the information presented in the problem, despite the inclusion of negative signed numbers. He properly demonstrated mathematical terminology in the given problem, leading up to the right description of his answer. He could also identify the proper idea, explain why it is the correct concept, put the provided in a mathematical language, and use integer concepts or rules to explain his conclusions

Table 3. Test of Difference between the Pretest and Posttest Scores Computational Skills

Skills	Test	Mean	SD	t	Df	Sig.
Calculation	Pretest	12.70	2.00	11.889	65	0.000

	Posttest	14.85	1.72			
Application	Pretest	15.41	0.66	5.590	65	0.000
	Posttest	15.86	0.63			
Comprehension	Pretest	11.52	2.51	2.995	65	0.004
	Posttest	12.29	3.72			
Problem-Solving	Pretest	10.59	2.73	8.373	65	0.000
	Posttest	12.11	2.90			

Legend: p<0.05 – Significant, p>0.05 Not Significant

Table 3 demonstrates the difference in performance between the pretest and posttest scores of students who were exposed to problem posing strategy on computational skill assessment as to calculation, application, understanding, and problem-solving. There is a significant difference between the student's pretest and posttest scores in terms of calculation (p-value=0.000), application (p-value=0.000), comprehension (p-value=0.004), and problem-solving (p-value=0.000) after the students were exposed to the use of problem posing strategy. It shows that the students' pretest and posttest scores have increased significantly. According to Tables 1 and 2, the pretests and posttests show that the majority of the students in the group obtained **competence** and some are **developing** before being exposed to problem posing to **proficient** after applying it. It means that when the learners were exposed to the problem-posing approach, their evaluation scores improved significantly.

Furthermore, using a problem-posing strategy can improve learning. Tan (2018) stressed that presenting problems helps students perform better. The students acknowledged that posing problems is an excellent strategy to teach mathematics since it improved their performance.

Table 4. What emerging themes can be derived from the challenges of the student respondents being exposed to problem-posing strategy?

Statements	Codes	Themes
S#43 Ma'am yung gagawa po ng sariling sentence.	Sentence	Crafting own Mathematical Problems
S#58 Ma'am yung gagawa po ng sariling given.	Given	
S#36 Yung creating your own problem po.	Creating	
S#25 Yung paggawa po ng sariling sentence		
S#18 Yung paggawa po ng sariling problem at sentence po		
S#47 Paggawa po ng sariling problem kasi po kailangan pa pong mag isip ng tamang words na gagamitjn dun sa operation.	Word Association	Appropriate Words in Math Sentence
S#58 mahirap pong isipin yung mga numbers and words na gagamitin po		
S#43 Mahirap pong pagsama samahin yung mga words sa isang sentence.	Combining Words	
S#57 mahirap pong mag isip ng sentence o grammar po, kapag mali po yung grammar po.	Grammar	Technical Properties
S#32 mahirap pong mag isip ng grammar magtugma tugma ng sentence		

Table 4 depicts some of the difficulties that students encountered after being introduced to the problem-posing strategy. One is that students struggle to create their own mathematical problems, implying that the free-structured type is their failure among the three (3) problem-posing situations. Students were invited to create their own mathematical problems using their own language in this setting.

The researcher discovered that even when students know what they want to say, they struggle to build a phrase. In connection with this, students struggled to write a whole statement that was grammatically acceptable and free of spelling problems. It is also evident that students were having difficulty using appropriate words in constructing a sentence. Though they have an idea of what they want to construct, they find it hard to put it into words to make a sentence. They have difficulty in word association and combining words. This is also evident in their pretest responses, in which students struggled in constructing a correct sentence explaining why they arrived at their final answer.

As students grow into more complex mathematics, they benefit from consistent mathematical language. Students should be able to speak mathematically using mathematical language and become excellent at problem-solving.

It is supported by the study of Koichu (2019) who explain that one of the challenges in problem posing is how problem posing may be assisted inside a standard mathematics curriculum, a-didactical approach to problem posing. Because there are only a few competencies in the mathematics curriculum that entail problem posing, practice, exercise, and exposure to this type of method are required. Koichu's recommendation for integrating problem posing within core teaching techniques, that is, using an a-didactical approach to problem posing, is worth investigating further. He broadens the chances for improving students' problem-posing abilities by stating that problem-posing might be an implicit goal of another activity, such as problem-solving (or investigations, for example). Problem posing should be more than simply a method; it should be a skill that every learner should have.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter summarizes the conclusions acquired after presenting, analyzing, and interpreting the data of the study. The findings are used to make conclusions, and recommendations for further study are made.

The following are the significant findings of this study;

Summary

The main goal of this study was to impose Problem Posing Strategy in assessing the computational skills of Grade 7 students.

The study utilized a quasi-experimental research method.

The study made use of a teacher-made pretest and posttest instrument and was administered to assess the student's computational skills in terms of application, computation, comprehension, and problem-solving.

The study used learning plans where the use problem posing strategy was incorporated. To measure the performance of the students in solving problems, a pretest and posttest were administered to sixty (66) Grade 8 students of San Antonio de Padua College during the school year 2022-2023.

The study sought to answer the following questions; What are the student's pretest level of computational skills in integers in terms of calculation, application, comprehension, and problem-solving? What are the students' post-test levels of computational skills in integers in terms of calculation, application, comprehension, and problem-solving? Is there a significant difference between the pretest and posttest scores on the computational skills of the student-respondents? and, What emerging themes can be derived from the challenges of the student respondents being exposed to problem-posing strategy?

Likewise, frequency and percentage were used in knowing the mean pretest and posttest scores performance of the student-respondents on computational skill assessment. The paired t-test was used to determine the significant difference in the mean pretest and posttest scores performance of each group of respondents.

Summary of Findings

1. The level of computational skills of the students-respondents during the pretest assessment in terms of calculation and application were mostly at the proficient level with a score of 4 and in comprehension and problem-solving were in competent and developing level with a score of 3 and 2. Moreover, after being exposed to the use of problem posing strategy, the posttest results show that the computational skills assessment of the respondents in terms of calculation, application, comprehension, and problems solving were mostly proficient.

2. The results show that there is a significant difference between the pretest and posttest scores performance of the students-respondents exposed to the use of problem-posing strategy with a p-value of 0.000 in calculation, application, and problem solving respectively, and a p-value of 0.004 in comprehension which are less than 0.05.

3. The results suggest that students struggle the most in free structured situations because they must design their own problem that is grammatically accurate with no errors and must have suitable usage of words connected to the right operation/concept to be used to solve their problem.

CONCLUSIONS

The findings of the study led to the formulation of the following conclusions:

1. There is a significant difference between the pretest and post-test scores performance of the respondents exposed to the use of problem posing strategy. Therefore, there is enough statistical evidence to support the claim.

2. Students may be familiar with the keywords in a given problem to be investigated so that they perform the right operation, but they find it difficult to express their results since some of them have limited vocabulary and struggle to compose grammatically sound sentences.

RECOMMENDATIONS

In light of the findings and conclusions of the study, the following recommendations are offered:

1. Since the study found that using a problem-posing strategy improves students' computational skills, Mathematics teachers are urged to incorporate the strategy into their training. This method can be used by teachers not just in Grade 7, but also in other grade levels.

2. Because word problems are usually engaged in Mathematics, Mathematics teachers may provide feedback to English teachers on the student's level of oral and written communication. They may also carry out lesson alignment. They may work together to provide assignments (particularly performance tasks) to students, creating a single activity with two separate rubrics. The Mathematics teacher will be responsible for the subject, while the English teacher will be responsible for English-related components such as grammar and spelling.

3. Because the study was confined to incorporating the problem-posing strategy components into a single examination, the researcher encouraged future researchers to investigate the usage of this strategy in each of its three (3) situations independently and test for differences in students' before and post-test results. This aims to determine which of the free-structured, semi-structured, and structured situations is most effective in developing computational abilities in students. They may also find this useful in their studies. They are encouraged to perform comparable research not just in the field of mathematics or in integers, but also in other fields of mathematics and other sciences.

REFERENCES

1. Patac, A., Patac, L., & Crispo, N. (2022). Students' understanding of a geometric theorem: A case of grade 9 problem posing. JRAMathEdu (Journal of Research and Advances in Mathematics Education), 7(2), 105-115. https://doi.org/10.23917/jramathedu.v7i2.16394
2. Leavy, A., & Hourigan, M. (2020). Posing mathematically worthwhile problems: developing the problem-posing skills of prospective teachers. Journal of Mathematics Teacher Education, 23(4), 341-361. https://doi.org/10.1007/s10857-018-09425-w
3. K to 12 Mathematics Curriculum Guide. (2016). Retrieved from Learning Resources Management and Development System: https://lrmds.deped.gov.ph/search?query=curriculum+guide
4. Rosli, R., Capraro, M. M., & Capraro, R. M. (2014). The Effects of Problem Posing on Student Mathematical Learning: A Meta-Analysis. International Education Studies, 7(13). https://doi.org/10.5539/ies.v7n13p227.
5. Van Harpen, X. Y., & Presmeg, N. C. (2013). An investigation of relationships between students' mathematical problem-posing abilities and their mathematical content knowledge. Educational Studies in Mathematics, 83(1), 117-132. https://doi.org/10.1007/s10649-012-9456-0 Van Harpen, X. Y., & Sriraman, B. (2012). Creativity and mathematical problem posing: an analysis of high school students' mathematical problem posing in China and the USA. Educational Studies in Mathematics, 82(2), 201–221. https://doi.org/10.1007/s10649-012-9419-5
6. Roxanne Mae Grefiel Daz, & Adriano V. Patac, Jr. (2021). EXPLORING RELATIONSHIP OF INSTRUCTIONAL SCAFFOLD IN PROBLEM POSING PERFORMANCE UNDER DIFFERENT SITUATIONS. European Journal of Humanities and Educational Advancements, 2(11), 177-189. Retrieved from https://scholarzest.com/index.php/ejhea/article/view/1500
7. Brown, S. I., & Walter, M. I. (2014). Problem posing: Reflections and applications. Psychology Press.
8. Baumanns, L., & Rott, B. (2021). Rethinking problem-posing situations: A review. Investigations in Mathematics Learning, 13(2), 59-76.
9. Lukas Baumanns & Benjamin Rott (2022) Developing a framework for characterising problem-posing activities: a review, Research in Mathematics Education, 24:1, 28-50, DOI: 10.1080/14794802.2021.1897036
10. Baumanns, L., & Rott, B. (2021). METACOGNITIVE BEHAVIOUR IN PROBLEM POSING–A CASE STUDY. Khon Kaen, Thailand 19-22 July 2021.
11. Cai, J., Koichu, B., Rott, B., Zazkis, R., & Jiang, C. (2022). Mathematical problem posing: task variables, processes, and products.
12. Rubin, R. J., Marcelino, J., Mortel, R., & Lapinid, M. R. C. (2014, March). Activity-based teaching of integer concepts and its operations. In DLSU Research Congress (pp. 6-8).
13. R. J. Rubin, J. Marcelino, R. Mortel, and M. R. C. Lapinid, "Activity-Based Teaching of Integer Concepts and its Operations", 1–16, 2014.
14. Sipayung, T. N., & Anzelina, D. (2019, April). An analysis of students problem solving skills using a realistic mathematics approach on integers materials. In Journal of Physics: Conference Series (Vol. 1211, No. 1, p. 012083). IOP Publishing.
15. Panagiotakopoulos, C. T. (2011). Applying a Conceptual Mini Game for Supporting Simple Mathematical Calculation Skills: Students' Perceptions and Considerations. World Journal of Education, 1(1), 3-14.
16. Yilmaz, A., Akyuz, D., & Stephan, M. (2019). Middle grade students‟ evoked concept images of number line models and their calculation strategies with integers using these models. International Journal of Education in Mathematics, Science and Technology (IJEMST), 7(1), 93-115. DOI:10.18404/ijemst.509292
17. D. Akyüz, M. Stephan, and J. K. Dixon, "The role of the teacher in supporting imagery in understanding integers", Egitim ve Bilim, vol. 37, no. 163, pp. 268–282, 2013
18. K. J. Lester Frank, "Thoughts About Research On Mathematical Problem- Solving Instruction", The Mathematics Enthusiast, vol. 10, no. 1/2, pp. 245–278, 2013
19. Fuad, Y., & Ekawati, R. (2018, July). Problem Solving Behaviors of Grade Seven Students Focusing on Negative Integers. In MISEIC 2018.

20. Inayah, Sarah, Ari Septian, and Ramdhan Fazrianto Suwarman. "Student procedural fluency in numerical method subjects." Desimal: Jurnal Matematika 3.1 (2020): 53-64.
21. Nurnberger-Haag, J., Kratky, J., & Karpinski, A. C. (2022). The Integer Test of Primary Operations: A Practical and Validated Assessment of Middle School Students' Calculations with Negative Numbers. International Electronic Journal of Mathematics Education, 17(1), em0667. https://doi.org/10.29333/iejme/11471
22. Ellerton, N.F. Engaging pre-service middle-school teacher-education students in mathematical problem posing: development of an active learning framework. Educ Stud Math **83**, 87–101 (2013). https://doi.org/10.1007/s10649-012-9449-z
23. Cankoy, O. INTERLOCKED PROBLEM POSING AND CHILDREN'S PROBLEM POSING PERFORMANCE IN FREE STRUCTURED SITUATIONS. Int J of Sci and Math Educ **12**, 219–238 (2014). https://doi.org/10.1007/s10763-013-9433-9
24. Fadillah, S., & Susiaty, U. D. (2019). Developing refutation text to resolve students' misconceptions in addition and subtraction of integers. Beta: Jurnal Tadris Matematika, 12(1), 14–25. https://doi.org/10.20414/betajtm.v12i1.160