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Exploratory Investigation on the Problem Solving Skills of the Students who are Exposed to Cooperative Learning

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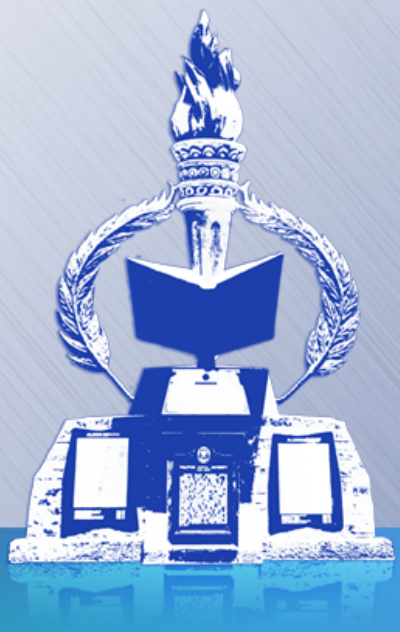

EXPLORATORY INVESTIGATION ON THE PROBLEM SOLVING SKILLS OF THE STUDENTS WHO ARE EXPOSED TO COOPERATIVE LEARNING

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APPROVAL SHEET

This seminar paper entitled **EXPLORATORY INVESTIGATION ON THE PROBLEM SOLVING SKILLS OF THE STUDENTS WHO ARE EXPOSED TO COOPERATIVE LEARNING** prepared and submitted by Annalyn O. Canaleta in partial fulfillment of the requirements for the Degree of Master of Arts in Teaching Mathematics has been examined and recommended for acceptance.

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A C K N O W L E D G M E N T

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a.o.c.

D E D I C A T I O N

I dedicate my work to my family
and many friends who have supported
me throughout the process. I will always
appreciate all what you've done.

a.o.c.

ABSTRACT

Researcher:	**ANNALYN O. CANALETA**
TITLE:	**EXPLORATORY INVESTIGATION ON THE PROBLEM SOLVING SKILLS OF THE STUDENTS WHO ARE EXPOSED TO COOPERATIVE LEARNING**
Key Concepts:	**Problem solving skills, Cooperative learning**
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The purpose of this study was to explore on the problem solving skills of the students who were exposed to cooperative learning. Specifically, this study was essential to answer the students' perception of using cooperative learning in problem solving activities, the students' attitude toward problem solving, the relationship between the attitudes of the students and their perception on using cooperative learning in problem solving activities, the level of performance of the students in problem solving that was exposed to cooperative learning, and the relationship between the perception on using

cooperative learning in problem solving activities and performance in problems solving test of the students. The participants of this study were Grade 7 students of Bacoor National High School – Villa Maria Annex in the Division of Bacoor.

The researcher used two survey questionnaires: (1) Perception on the Use of Cooperative Learning, and (2) Attitude Toward Problem Solving. A problem solving test concentrated on the Operations of Rational Numbers was also administered after the students had been exposed to cooperative learning. The study was descriptive because it described the students' perception on the use of cooperative learning and attitude towards problem solving. On the other hand, it was correlational because it aimed to answer whether there was an existence of relationship between the students' perception on cooperative learning in problem solving and attitude toward problem solving and relationship between perception on using cooperative learning in problem solving activities and performance in problem solving test of the students. The researcher used weighted mean to measure the perception of students on cooperative learning and attitudes toward problem solving and Pearson r correlational test to measure the significant relationship between perception of students on cooperative learning and attitudes toward problem solving and relationship between perception of students on cooperative learning and performance on problem solving test of the students.

The results showed that students had a moderately acceptable perception on the use of cooperative learning; students had a moderately positive attitude towards problem solving; there was a significant moderately positive relationship between perception of using cooperative learning and attitude toward problem solving; students showed a slightly satisfactory level of performance in problem solving; and there was no significant relationship between perception of using cooperative learning in problem solving activities and performance in problem solving test of the students. With this regard, the teacher must always provide cooperative learning strategies or new methods in Mathematics to enhance problem solving skills of the students.

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CHAPTER I

THE PROBLEM AND ITS SETTING

This chapter presents the introduction, statement, and significance of the problem. It also presents the definition of terms and the theoretical and conceptual framework of the study.

Introduction

Life is full of mysteries of problems, which are considered as difficulties, challenges or any kinds of situations that need solutions. It is like an examination paper which has set of problems. Everyday, we face different types of problems that are unique so we have to find an extraordinary solution for each. Problems could turn out of the necessity of every person. No matter how hard or crucial the problems are, these could easily be solved if one has developed critical thinking that can be developed only, if one has fully improved problem solving skills. The success of a person could be determined by how well he or she finds solutions to problems and how efficient he or she is in solving problems.

The National Council of Teachers in Mathematics (NCTM 23, 24) has strongly endorsed the inclusion of problem solving in Mathematics. There are many reasons for doing this. First, problem solving is a major part of Mathematics. It is the sum and the substance of our discipline which can be reduced to a set of exercises and skills devoid of problem solving is

misrepresenting Mathematics as a discipline and shortchanging the students. Second, Mathematics has many applications and often those applications represent important problems in it. Our subject is used in the work, understanding, and communication within other disciplines. Third, there is an intrinsic motivation embedded in solving Mathematics problems. We include problem solving in Mathematics because it can stimulate the interest and enthusiasm of the students. Fourth, problem solving can be fun. Many of us do mathematical problems for recreation. Finally, problem solving must be in the Mathematics Curriculum to allow students to develop the art of problem solving. This art is so essential for understanding and appreciating Mathematics to attain the instructional goal.

Problem solving has been recognized as one of the trademarks of Mathematics. One of the principal goals of Mathematics Education is for the students to become good problem solver. Problem solving is considered as a substantial life skill involving a range of processes like analyzing, interpreting, reasoning, predicting, evaluating and reflecting. It is an essential element of the Mathematics Curriculum in many countries especially in the Philippines.

Problem solving is a fundamental means of developing mathematical knowledge at any level. For this reason, it is one of the most important aspects of doing Mathematics. According to NCTM, problem solving means engaging in a task for which the solution method is not known in advance. In order to find a solution, students must draw on their knowledge, and through this

process, they will often develop new mathematical understandings. Solving problems is not only a goal of learning Mathematics, but also a major means of doing so (NCTM, 2000, p. 52). Problem solving gives students a context to help them make sense out of the Mathematics they are learning. Problems can be used to introduce new concepts and extend previously learned knowledge.

In today's classroom, problem solving is recognized as the central focus of mathematics teaching. The supreme target of Mathematics is the ability to solve problems. That is why Mathematics teachers are teaching the four fundamental operations (addition, subtraction, multiplication and division), integers, fractions, and decimals. Our objective is not for students to perform separate computations, but rather to be able to apply their varied mathematical skills to each problem. But problem solving is more than just a goal of learning Mathematics; it is also a critical process, woven across the entire Mathematics Curriculum, through which students are able to explore and understand this subject (NCTM 2000, 52). Students develop an understanding of mathematical content and eventually use that understanding to find solutions to problems through problem solving tasks. Problem solving is both the process by which students explore Mathematics and attain goal of learning it.

The fundamental goal of any problem solving activity is to enhance students' performance at solving problems. The solving of problems is at the

heart of doing Mathematics. Students must have experiences with a wide variety of problem solving methods and opportunities for solving an extensive range of problems. The capacity to relate the problem solving methods learned in Mathematics with knowledge of concepts from other academic areas is a fundamental survival skill for life.

Problem solving is an acquired skill. The ability to solve problems is the core of Mathematics. Developing problem solving skills is a long – standing aim in Mathematics because it increases, enhances and expands higher order thinking skills. It plays a vital role in the development of high mental processes. It calls on all of students' mental capacities including logical thinking and reasoning. However, developing successful problem solvers is a complex task requiring of skills and character (Stacey, 2005). Students must have deep mathematical knowledge and reasoning ability for solving problems. It is also necessary to have helpful beliefs, interest and attitudes for solving problems. Coupled with this, students require the ability to work in cooperative groups to improve their problem solving skills.

The study of Mathematics is often viewed as an isolated, individualistic, or competitive matter. One works alone and struggles to understand the material or to solve the assigned problems. Perhaps it is not surprising that many students and adults are afraid in this subject and develop mathematics avoidance or anxiety. They often believe that only few talented individuals can function successfully in the mathematical realm. Small-group cooperative

learning addresses these problems in several ways. (National Council of Teachers of Mathematics [NCTM], 1989, p. 79).

Many would agree on the axiom that, “two heads are better than one.” A first – rate teaching strategy in the 90’s is based on this, called Cooperative Learning. Proponents of cooperative learning confirmed that cooperative learning improved the mathematical skills and attitude of the students. According to Slavin (1991), this strategy has been recognized to promote critical thinking, higher level of learning and to improve solving ability.

Cooperative Learning is a strategy that involves a small group of learners working together to solve a problem. Other benefits of this strategy are student participation, teacher encouragement and student to student interaction which positively relate to improve critical thinking. This confirms that cooperative learning is superior to other strategies in improving thinking and problem solving.

Problem solving is the essence of mathematical discovery and plays a key role in the processes of teaching and learning. On the other hand, there is a confirmation that students experience troubles when trying to solve problems. Likewise, they often lack of interest. Therefore, the obligation of finding ways to improve students’ interest in doing Mathematics comes as significant. Students develop mathematical understanding as they formulate and scrutinize methods for solving mathematical problems.

Every teacher is entrusted with great responsibility on the formation of students skills. Thus, he or she must hold the necessary knowledge and effective technique in dealing and teaching his or her students. K to 12 Basic Education Curriculum is mandated to educate Filipino learners to filter information critically. Teachers today are facing the challenge to update their knowledge and skills.

There is a need to determine whether cooperative learning offers the effective approaches that can enhance students' problem solving skills.

The concept of a group centered learning environment is to direct student energy by actively engaging them in the learning process. This is of course, assumes that peer group interactions are constructive forces that enhance academic learning. In trying to apply this idea in Mathematics, it is expected that the group would provide both social and technical support to its members, in solving problems collaboratively and promoting a substance of achievement. It would diminish the problem with students sitting alone, being stuck on a problem, and give all the members of the group the possibility to share in the accomplishment of solving the problem. It is thought that the group connections help all members realize the concepts and problem solving strategies. When students are connecting together, students in a group environment can talk numerous strategies for solving problems.

Mathematics problems are well matched for cooperative learning when considering the values of group discussions. Most mathematical problems can

be solved in a reasonable length of time. In addition, logical arguments can be used to reveal how to find the solution. When the students are capable of communicating concepts to others, learning takes place. The bottom line here is to find a way for motivating students to learn mathematical skills and concepts and to encourage and help each other achieve mastery. The challenge then, is to create a community of learners who actively work together in small groups, to enhance each member's mathematical knowledge, proficiency and problem solving skills in a positive and enjoyable working environment.

The researcher has been teaching Mathematics for quite sometime. She has noticed that with series of tests reveal, the students have much difficulty in problem solving. She feels that there is a need to teach students to apply mathematical knowledge to problems. Problem solving is regarded as higher order thinking process. With the observation of the researcher, problem solving is a complex learning activity that can be improved through group discussions.

Special attention is placed on the development of group work, because of their interaction with their group mates. Students develop many of their problem solving skills. They must be encouraged to perform these activities which are helpful to enhance their skills. One of the best opportunities for promoting students to learn is during group tasks where students are expected to work and learn together. Problem solving skills must be addressed by all

Mathematics teachers to develop or attain higher order thinking skills. This observation led the researcher to work on this study.

Statement of the Problem

Generally, the aim of this study was to explore on the problem solving skills of the students who are exposed to cooperative learning.

Specifically, this study sought to answer the following questions.

1. What is the students' perception of using cooperative learning in problem solving activities?
2. What is the students' attitude toward problem solving?
3. Is there a relationship between the attitudes of the students and their perception on using cooperative learning in problem solving activities?
4. What is the level of performance of the students in problem solving that is exposed to cooperative learning?
5. Is there a relationship between the perception on using cooperative learning in problem solving activities and performance in problem solving test of the students?

Theoretical Framework

Behaviorists' understanding of learning was based on cause and effect. In this conceptualization, a behavior was followed by reinforcement. If the behavior was followed by positive reinforcement, then it was more likely to be repeated; if there was negative reinforcement, the behavior was less likely to be repeated.

One of the problem solving methodologies explains that the problem solving process within the framework of behaviorists learning theory is the trial and error method. This involves attacking the problem by various methods until a solution is found. Young children solving a jigsaw puzzle exhibit this type of problem – solving behavior. The children try fitting different pieces into the same spot until eventually the pieces fit.

As a cognitive psychology progressed as a discipline, more interest and effort was directed toward the mental processes of learning and problem solving. An early cognitive approach to problem solving was to identify the mental stages through which problem solving proceeded. Two noted cognitive psychologists, Wallas (1926) and Polya (1957), developed a four – stage model of problem solving. The four stages of problem solving identified by Wallas are (1) preparation – defining the problem and gathering information relevant to it; (2) incubation – thinking about the problem at a subconscious level; (3) inspiration – having a sudden insight into the solution of the problem; and (4) verification – checking to be certain that the solution was correct.

This theory is also anchored on Associate Learning Theory, Social Learning and Collaborative Problem Solving. This theory focuses on developing content knowledge in complex domain, problem solving and critical thinking skills, and collaborative skills. The theory offers a comprehensive set of instructional methods and guidelines for problem solving and collaborative learning. Specifically, the theory addresses four types of collaborative environment guidelines including instructor – implemented, learner – implemented, instructor – and – learner implemented, and interactive methods.

Conceptual Framework

Mathematics is a dynamic science which empowers individuals to become successful members of society. It provides a framework for the analysis of problems and the development of appropriate solutions, from the most basic to those which are quite complex.

Problem solving is one of the primary tools of Mathematics instruction. The ultimate goal of learning Mathematics is to be able to solve problems in actual life situations.

The public perception of students' attitudes toward problem solving, sad to say is quite upsetting. When students merely hear the word mathematics, a feeling of anxiety is already triggered in the minds of these students. The interests of the students in the subject from this point are already blocked.

Esra (2006) asserts that the development of positive attitude is desirable because of its association with achievement. It further explains that there is a general belief that students learn more effectively when they are interested in what they learn so they will achieve better in Mathematics if they like the subject.

Attitude plays a very significant role in learning Mathematics. According to Neale (1969), there is a remarkably stable correlation between the attitude toward mathematics and the standardized mathematics achievement test scores. Furthermore, he affirmed that the relationship between attitudes and achievement is the result of a reciprocal influence; those attitudes affect achievement and achievement affects attitudes.

The observations of Neale (1969) are linked to the study because in this regard, Neale's findings verify the idea that favorable attitudes of students toward problem solving in Mathematics promote learning and foster the kind of feeling which intensifies better performances.

Students need both the right attitude and the necessary skills to become a successful problem solver. Problem solving is a complicated process and is often met with a variety of affective responses. These beliefs, attitudes and emotions are significant because they influence how a student will attempt to find the solution.

Successful problem solvers persist that teachers need to be especially alert of their students' attitudes and how they can affect their problem solving skills.

How students interact with each other is also another issue to be addressed by the teachers. Training is devoted to helping teachers arrange appropriate interactions between students and materials (curriculum and textbooks). Little time is spent on how teachers should interact with students, but how students should interact with one another is relatively ignored. How teachers structured student to student interaction patterns has a lot to say about how well students learn, how they feel about school and the teacher, how they feel about each other, and how much self – esteem they have in solving problem in Mathematics.

Cooperative learning which is hailed as the "most important and most successful teaching method reform in the last decade" (Ellis and Fouts, 1997) and as one of the teaching methods that the new curriculum advocates, is increasingly winning favor in most secondary schools. The prime focus of cooperative learning is on the students' own thinking processes. Cooperative learning created an atmosphere that would encourage students to think creatively when solving problems. Cooperative problem solving is implemented because it has been shown to be effective techniques for helping students learn complex skills. Each member can observe others perform

varied thinking strategies that he or she must perform independently and silently on individual problem assignments.

Cooperative learning is now an accepted and often the preferred instructional procedure at all levels of education. Cooperation is working together to accomplish shared goals. Within cooperative situations, individuals seek outcomes that are beneficial to themselves and to all other group members. Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. Using the cooperative learning in solving problems students might be able to improve their skills and achievement in mathematics.

The effects of cooperative learning on student achievement are very remarkable. Students achieve necessary skills in a cooperative learning setting for many reasons. In those settings, students see a variety of other students in various level of mastery of cognitive tasks, and peers provide support and assistance to one another. When students interact cooperatively, they like to rationalize their strategies to one another in their own word (Stevens, Slavin, and Farnish 1991). The students who are explaining can then understand the ideas more clearly. When students are required to expand, elaborate, and defend their positions to others, they may be obliged to think more deeply about their ideas. However, students who are listening to the explanations of others are exposed to, and must think about, other methods to a given task. Observing others and practicing in such settings help

learners internalize the concepts that they are attempting to master or understand (Stevens, Slavin and Farnish 1991).

Cooperative learning has a positive effect on students' achievement and attitudes toward Mathematics if properly implemented. Cooperative learning has been shown to be effective in elevating academic achievement, self – esteem, and in improving students' attitudes toward the subject and problem solving skills.

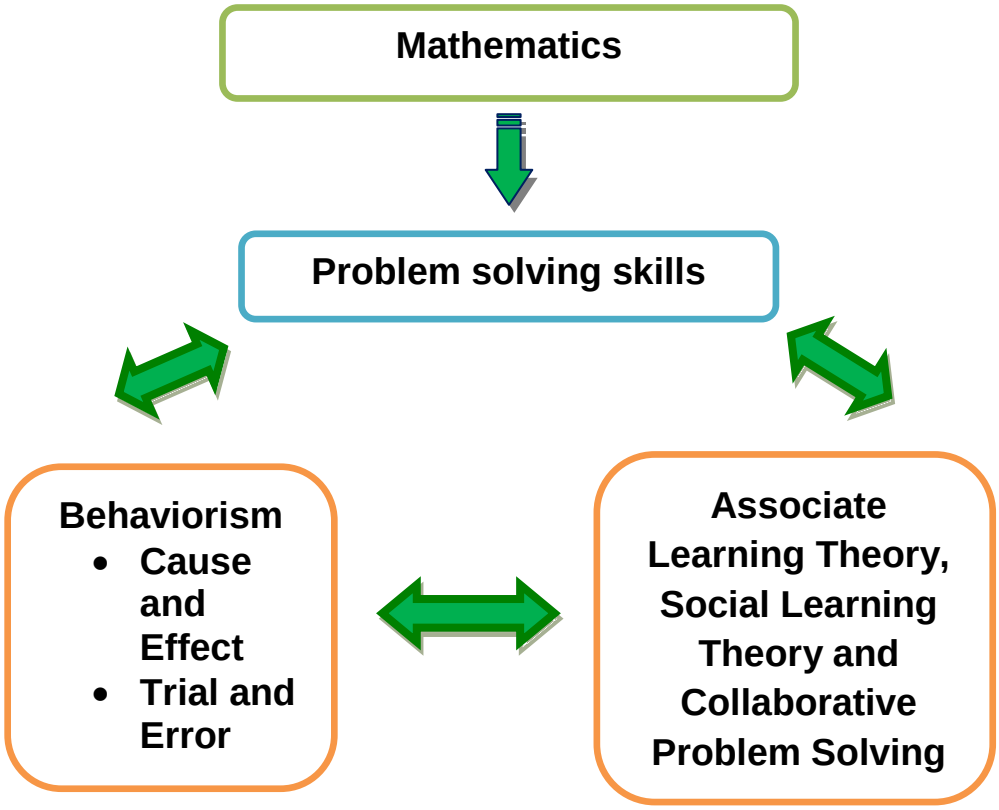

Figure 1

Conceptual Paradigm

Significance of the Study

This study is believed to be significant to the Math teachers, students, school administrators and textbook writers.

***Math Teachers*.** Teachers will be able to design the appropriate cooperative learning strategies given to their students to assess their problem solving in Mathematics. They will be able to improve their skills in teaching the subject. They will also help their students to improve their problem solving skills.

***Students*.** The students will also profit from this study. The integration of cooperative learning in problem solving will provide them enjoyable experience in learning the subject. The activities will help develop their sense of involvement and achievement in problem solving in Mathematics. Students will also improve their problem solving skills through the different activities.

***School Administrators*.** The school administrators will also gain from this study because it will help them to improve their curriculum. They will be directed in helping the Mathematics teachers in bringing better results by adopting cooperative strategies in teaching problem solving and enhancing the problems solving skills of the students.

***Textbook Writers*.** Authors will enrich their work by providing more cooperative learning strategies in their book that will encourage students to engage in learning problem solving in Mathematics. In addition, they will be able to deepen problem solving activities.

Scope and Delimitation

This study is focused on the exploratory investigation on the problem solving skills of the students exposed to cooperative learning. The participants of this study are Grade 7 students of Bacoor National High School – Villa Maria Annex in the Division of Bacoor during the school year 2013 – 2014. The researcher used two survey questionnaires; one is the perception on the cooperative learning of the students and another on the attitude of the students toward problem solving. A problem solving test which is concentrated on the Operations of Rational Numbers was also administered. These objectives are taken from the First Quarter Budget of Work of the School Year 2013 – 2014.

Definition of Terms

For clearer understanding of the study and to put the reader in the right perspective, the researcher defined the following terms:

Attitude – According to business dictionary an attitude can be defined as a positive or negative evaluation of people, objects, event, activities or ideas. In this study the term refers to the score of the students in the attitude scale toward problem solving in Mathematics.

Cooperative Learning – Cooperative learning is a method of instruction wherein students work together in pairs or in groups, usually with the goal of completing a specific task. In this study the term refers to the method that can

help students to develop their problem solving skills in Mathematics. In this study the researcher used different cooperative learning strategy such as Think Pair Share, All Write Round Robin and Rally Table.

Perception – According to Oxford Dictionary perception is a belief or opinion, often held by many people and based on how things seem. In this study the term refers to the score of the students in the perception scale about cooperative learning.

Problem Solving Skills – It refers to the process of working through details of a problem to reach a solution. It is the ability to consider the probable factors that can influence the outcome of each of various solutions to a problem, and to select the most advantageous solution. In this study, these include solving the problems that involve the four fundamental operations on Rational Numbers (Addition, Subtraction, Multiplication and Division). The level of problem solving skills is determined through their scores in a problem solving test

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents the review of related foreign and local literature and studies that have significance in the conduct of research. Expressed opinions of some of leading figures in the subject at hand were also considered. Relevance of each reviewed material to the present study were briefly discussed to give insights and foresights to the reader.

On Problem Solving

Problem solving as defined by Webster (New Collegiate Dictionary, 1970) is the determination of the nature or relations involved in a challenging quantitative situation and consequent activity that unifies properly chosen reaction into a satisfactory result. It is a process of arriving at an answer to word problems applying different skills or steps. The basic steps in word problem solving in Mathematics are: (1) silent reading of the problem; (2) identifying what is given; (3) analyzing what is asked for; (4) determining what fundamental operations of Mathematics to use in getting the right answer; and (5) checking of the answer.

Problem solving, as used in Mathematics, Education and Literature, refers to the process wherein students encounter a problem – a question for which they have no immediately apparent resolution, nor an algorithm that they can directly apply to get an answer (Schoenfeld, 1992).

Reitman (1965) defined problem as when you have been given the description of something but do not yet have anything that satisfies that description. Reitman's discussion described a problem solver as a person perceiving and accepting a goal without an immediate means of reaching the goal.

Van Gundy (1998) holds that a problem is a gap between "what is" and "what should be". In order for a problem to exist, there must be an identifiable gap, awareness of its existence, motivation to decrease it, ability to measure it and resources to close it. Problems can be classified as well – structured, semi - structured or ill – structured. Well – structured problems can be solved using algorithmic procedure ("recipes"), semi – structured problems can be best dealt with using heuristics ("rule of thumb") and ill – structured problems will require the use of creative problem procedures.

Krulik and Rudnick (1980), describe problem solving as a process by which an individual uses previously acquired knowledge, skills and understanding to satisfy the demands of an unfamiliar situation.

Heddens and Speer (1992) define problem solving as the process that an individual uses to respond and to overcome obstacles or barriers when a solution or method of solution is not immediately obvious.

According to Weimer (2008) problem solving is "what you do when you don't know what to do". It is one of those skills that all teachers aspire to have their students develop.

Polya (1962) describes mathematical problem solving as finding a way around a difficulty and an obstacle, and finding a solution to a problem that is unknown. To Polya, problem solving is a major theme of doing Mathematics and teaching students to think is of primary importance. “How to think” is a theme that underlies much of a genuine inquiry and problem solving in mathematics.

According to Wilson (1993) problem solving has a special importance in the study of Mathematics. A primary goal of Mathematics teaching and learning is to develop the ability to solve a wide variety of complex Mathematics problems. Problem solving as a method of teaching may be used to accomplish the instructional goals of learning basic facts, concepts and procedures as well as goals for problem solving within problem contexts.

Hiebert (1997) suggests that problem solving inherently has some form of conceptual understanding involved. Specifically, he states that tasks that promote understanding are the ones for which students have no memorized rules, nor for which they perceive that there is one right solution method.

Schroeder and Lester (1989) contended that in mathematics, problem solving was not a content strand but a pedagogical stance. Students must be exposed to a variety of problem solving tasks that require them to collate and analyze previous knowledge and yet offer a challenge. Problem solving was thus seen as a means of developing student’s reasoning skills.

Lester and Kehle (2003) typify problem solving as an activity that involves the students “engagement in a variety of cognitive actions including accessing and using previous knowledge and experience: Successful problem solving involves coordinating previous experiences, knowledge, familiar representatives and patterns of inference and intuition in an effort to generate new representations and related patterns of inference that resolve the tension or ambiguity that prompted the original problem – solving activity”.

Mayer (1987) explained problem – solving processes as using different forms of knowledge leading to the goal of solving the problem. According to him, the types of knowledge applied in problem solving consisted of: linguistic and factual knowledge – about how to encode statements; schema knowledge – about relations among problem types; algorithmic knowledge – about how to present distinct procedures and strategic knowledge – about how to approach problems.

According to Resnick (1987) a problem-solving approach contributes to the practical use of Mathematics by helping people to develop the facility to be adaptable when, for instance, technology breaks down. It can thus also help people to transfer into new work environments at this time when most are likely to be faced with several career changes during a working lifetime (NCTM, 1989). Resnick expressed the belief that “school should focus its efforts on preparing people to be good adaptive learners, so that they can

perform effectively when situations are unpredictable and task demands change."

According to Weber (2005) a mathematical problem solving may require a longer period of time for success than a simple mathematical exercise will. In addition, for tasks to be considered mathematical problem solving, they must be developmentally appropriate for students (Lesh & Zawojewski, 2007; Piaget & Inhelder, 1975).

Lesh and Zawojewski (2007) further advocate that most definitions of mathematical problem solving are confined to the utilization of problem solving in a school context. They call for a more pragmatic, real-life or authentic version of a definition that is consistent with concept development. As a starting point, they suggest that, "a task, or goal-directed activity, becomes a problem (or problematic) when the problem-solver, which may be a collaborating group of specialists, needs to develop a more productive way of thinking about the given situation" (Lesh & Zawojewski, 2007).

Cockcroft (1982) also advocated problem solving as a means of developing mathematical thinking as a tool for daily living. It means that saying that problem-solving ability lies "at the heart of Mathematics" because it is the means by which Mathematics can be applied to a variety of unfamiliar situations.

Problem solving is, however, more than a vehicle for teaching and reinforcing mathematical knowledge and helping to meet everyday challenges.

It is also a skill which can enhance logical reasoning. Individuals can no longer function optimally in society by just knowing the rules to follow in order to obtain a correct answer. They also need to be able to decide through a process of logical deduction what algorithm, if any, a situation requires, and sometimes need to be able to develop their own rules in a situation where an algorithm cannot be directly applied. For these reasons problem solving can be developed as a valuable skill in itself, a way of thinking (NCTM, 1989), rather than just as the means to an end of finding the correct answer.

The Principles and Standards for School Mathematics (NCTM, 2000) describes problem solving based teaching as using “interesting and well – selected problems to launch mathematical lessons and engage students.” The National Council of Teachers of Mathematics (NCTM, 1980) recommended that problem solving be the focus of mathematics teaching because, they say, it encompasses skills and functions which are the important part of everyday life. Furthermore, it can help people to adapt to changes and unexpected problems in their careers and other aspects of their lives. More recently, the Council endorsed this recommendation (NCTM, 1989) with the statement that problem solving should underlie all aspects of Mathematics teaching in order to give students experience of the power of Mathematics in the world around them. They see it as a vehicle for students to construct, evaluate and refine their own theories about Mathematics and the theories of others. The NCTM has strongly endorsed the inclusion of problem solving in Mathematics. First,

problem solving is a major part of Mathematics. It is the sum and substance of our discipline and to reduce the discipline to a set of exercises and skills devoid of problem solving is misrepresenting Mathematics as a discipline and shortchanging the students. Second, Mathematics has many applications and often those applications represent important problems in Mathematics. Our subject is used in the work, understanding, and communication within other disciplines. Third, there is an intrinsic motivation embedded in solving Mathematics problems. We include problem solving in Mathematics because it can stimulate the interest and enthusiasm of the students. Fourth, problem solving can be fun. Many of us do Mathematics problems for recreation. Finally, problem solving must be in the mathematics curriculum to allow students to develop the art of problem solving. This art is so essential for understanding and appreciating Mathematics that it must be an instructional goal.

Francisco and Maher state that our perspective of problem solving recognizes the power of children's construction of their own personal knowledge under research conditions that emphasis minimal interventions in the students' mathematical activity and an invitation to students to explore patterns, make conjectures, test hypotheses, reflect on extensions and applications of learnt concepts, explain and justify their reasoning, and work collaboratively. Such a view regards mathematical learning and reasoning as integral parts of the process of problem solving.

Glipo (1996) enumerated the rationale for problem solving in Mathematics teaching as: 1) Learning how to solve problems is the primary reason for studying Mathematics; 2) Problem solving provides the context in which concepts and skills are not only applied but also learned; 3) It provides opportunities for students to relate Mathematics to the real world and thus, appreciate its usefulness; 4) It provides opportunities for the students to use the interconnection among mathematical ideas; 5) It provides opportunities for students to develop critical and analytical thinking by using different problem solving strategies; and 6) It develops a positive attitude towards mathematics and problem solving.

On Cooperative Learning

Johnson and Johnson (1999) proclaim that working together to achieve a common goal procedures higher achievement and greater productivity than does working alone. Cooperative learning is a powerful tool for learning. Research shows that students learn and understand more when they discuss and collaborate on mathematics. Educational research reveals that cooperative learning can benefit students' learning. The more information available, the more prepared we are as educators, and as result the more our students will learn.

Cooperative learning groups promote higher academic performances from all students. Johnson and Johnson (1999) define cooperative learning by

saying, “Students work together to accomplish shared goals. Students seek outcomes that are beneficial to all. Students discuss material with each other, help one another understand it, and encourage each other to work hard.

The most researched and anticipated benefit of cooperative learning is higher academic achievement and social skills development (Johnson and Johnson, 1999). Tied to increased academic achievement is the development and growth of his/her level thinking skills, more frequent transfer of learned concepts to new situations and more time on task. In addition to learning social skills, cooperative learning has a positive impact on classroom climate, content communication, students’ self – esteem, attendance, students’ attitudes towards education and students’ psychological health. Cooperative learning has also been shown to decrease special education placements, classroom/content anxiety and disciplinary referrals (Slavin 1999).

Kagan (1994) defines cooperative learning through four basic principles: a) Positive Interdependence; (b) Individual Accountability; (c) Equal Participation; and (d) Simultaneous Interaction. Kagan explains, “Established and effective cooperative learning structures incorporate all four of the PIES (Positive Interdependence, Individual Accountability, Equal Participation and Simultaneous Interaction) principles.”

Cooperative learning that might enhance problem solving skill

One of the structures that foster the development of students' reasoning skills is small group cooperative work (Charles, 2003).

According to Weimer (2010) to improve students' problem solving skills add group work to the equation. We can improve student problem solving by having students work cooperatively in groups. If students are working cooperatively there is a "higher percentage of students adopted more successful strategies." Collaborative groups are effective in promoting the further development of problem – solving abilities.

In common with every other discipline, people learn to think mathematically by being in the presence of others who are thinking the same way, whether through attending live lectures and participating in support groups. Working in groups allows students to develop their skills at collaboration and generate new ideas faster. Majority of the students are happy to work with their peers, and in doing so learn something about the collaborative nature of Mathematics.

Cooperative group problem solving has several advantages: (1) The structured problem-solving strategy seems too long and complex to most students. Cooperative-group problem solving gives students a chance to practice the strategy until it becomes more natural; (2) Groups can solve more complex problems than individuals, so students see the advantage of a logical problem-solving strategy early in the course; (3) Each individual can practice

the planning and monitoring skills they need to become good individual problem solvers; (4) Students get practice developing and using the language of Mathematics "talking Mathematics"; (5) In their discussion with each other, students must deal with and resolve their misconceptions; and (6) In subsequent, whole-class discussions of the problems, students are less intimidated because they are not answering as an individual, but as a group.

Currently, most Mathematics classrooms are engaged in the traditional approach of whole class expository instruction followed by numerous individual drill and practice activities (Chang, Kaur, Koay, & Lee, 2001). Hence, there is a need to explore other instructional strategies that encourage active student interaction in the classroom, and provide opportunities for students to express their Cooperative Learning to enhance problem solving mathematical skills during problem solving. Davidson (1990) believed that small - group cooperative learning could be used to foster effective mathematical communication, problem solving, logical reasoning and making of mathematical connections. By putting the students into cooperating groups, they knew that they were not handling the problems alone and they would be helping one another cope with the unfamiliar problem situations.

According to Ho Geok Lan (2007) the use of cooperative learning environment had a positive effect on the acquisition of problem – solving strategies. The students engaged in a cooperative problem-solving process improved in their mathematical problem - solving performance. Besides

acquiring more effective problem-solving strategies, the students exhibited metacognitive behaviors that help them to be become more effective problem solvers.

In the study of Barham (2002) it demonstrates that cooperative learning strategies enhance the teaching and learning process by transferring focus from a teacher-centered situation into a student- centered learning context. This enriches the cognitive, competitive and social interaction and, hence, develops outcomes in the cognitive, affective, motivational and social domains. The study proved the positive impact of applying such strategies in enhancing mathematical achievement and promoting problem solving skills compared with the impact made by traditional teaching strategies. Cooperative learning strategies could offer all students with different abilities the opportunities to cooperate, interact and participate in the Mathematics lesson. This gave them a chance to do Mathematics by themselves, speak their thoughts, offer and receive explanations, introduce several procedures for solving problems and, hence, profit from the mathematical knowledge available in the group as a whole. The new learning approach encouraged students to challenge problems and provided them with the opportunities to speak mathematically, to understand the mathematical concepts and rules and to use them. Results from the study also demonstrated that cooperative learning developed other skills. It improved student interaction, communication

and social skills and built more positive attitudes towards learning compared with the traditional methods.

Ingleton et al. (2005) describe the impact of collaborative learning on students' learning using different tasks namely: designing group work, evaluating group work, organizing learning groups and setting up study teams.

Gokhale (2005) mentioned that collaborative learning practice teachers as facilitators and they guides students towards the attainment of such skills. He also defined that it served as an instructional method for both students and teachers at various performance levels who work together in small groups towards a common academic goal.

Campione et al. (1998) also discuss a method to help monitor and evaluate the progress of a small cooperative group during a problem solving session. A learning leader (sometimes a teacher, or a student) guides the group in solving problem through the use of three boards; (1) a Planning Board, which important information and ideas about the problem are recorded, (2) a Representation Board, where diagrams illustrating the problems are drawn, and (3) a Doing Board, where appropriate equations are developed and the problem is solved. By using this method, the students are able to discuss and reflect on their approaches by usually tracing their joint works. Campione and his colleagues indicated that increased student engagement and enthusiasm in problem solving as well as increased performance resulted in the use of this method for solving problems.

Bololoy (1996) said that group problem – solving has many advantages. Members of the group engage in brainstorming, an activity that enables all members of the group to participate in the free flow of everyone to make a contribution. The student who is poor at problem solving has the opportunity to engage in this process along with peers who are more able.

Synthesis

The findings of the research studies mentioned above show the importance of cooperative learning strategy in problem solving skills of the students. The cooperative learning plays a significant role on how the students will perform in the problem solving test.

The views and opinions of Polya (1962), Reitman (1965), Krulik and Rudnick (1980), Schroeder and Lester (1989), Heddens and Speer (1992), Schoenfeld (1992) (1992) Van Gundy (1998), Weber (2005), Lesh and Zawojewski (2007) and Weimer (2008) are very useful in the study because of the ideas given by these leading persons gave a clear understanding of problem solving.

The analysis of Mayer (1987), Resnick (1987), Cockcroft (1982), NCTM (1989), Wilson (1993), Glipo (1996) And Lester and Kehle (2003) are very valuable in this study because they discuss the rationale, importance, goals, perspective and contribution of problem solving in Mathematics.

On the other hand, the present study is similar to the studies conducted by Kagan (1994), Johnson and Johnson (1999), Slavin (1999) and Charles (2003) because it describes the achievement of using cooperative learning in Mathematics. Their studies also presented the advantages of group learning especially in problem solving in Mathematics.

Likewise, the present study is similar to the studies conducted by Davidson (1990), Bololoy (1996), Campione (1998), Barham (2002), Gokhale (2005) and Ho Geok Lan (2007). It is also focused on the use of cooperative learning to have a positive effect on the attainment of the problem solving strategies of the students in Mathematics.

In view of the stated studies, this paper investigates on the problem solving skills of the students who are exposed to cooperative learning.

CHAPTER III

METHODOLOGY

This chapter discusses the research design, the respondents, the instrument used, and the data gathering procedures followed and the statistical tools applied in the data gathered.

Research Design

The study used the descriptive research design. One of the types of descriptive studies is correlational studies. These studies are designed to determine to the extent to which different variables are related to each other in the population of interest. (Sevilla, 1992).

The study is descriptive because it described the students' perception on the use of cooperative learning and attitude towards problem solving. On the other hand, it is correlational because it aimed to answer whether there is an existence in a relationship between the students' perception on cooperative learning in problem solving and attitude toward it and relationship between the perception on cooperative learning in problem solving and performance on problem solving test.

Participants of the Study

The respondents of this study are eighty – seven (87) Grade 7 students that are purposively chosen because of their fixed schedule (9:30 – 10:30

Monday - Thursday) of Bacoor National High School – Villa Maria Annex in the Division of Bacoor under the K to 12 Basic Education Curriculum, for the school year 2013 – 2014. There are forty – four boys and forty – three girls.

Research Instruments

The researcher made used of several tools in gathering the data for this study.

A. Students' Perception on Cooperative Learning

A validated instrument which was adopted from Delaon (2000) was disseminated to the students (see Appendix C). The instrument consists of ten questions covering the perception of the students on cooperative learning. The questionnaire that was used is the Likert Type response scale where each student was asked to respond to questions with any of the following responses:

4 Strongly Agree

3 Agree

2 Disagree

1 Strongly Disagree

The overall mean of the students' responses to the questionnaire have the following numerical values and the corresponding interpretation.

Scale	Interpretation
3.50 – 4.00	**Highly Acceptable**
2.50 – 3.49	**Moderately Acceptable**
1.50 – 2.49	**Slightly Acceptable**
1.00 – 1.49	**Not at All Acceptable**

B. Attitude of the Students toward Problem Solving

Another tool was the questionnaire – checklist that uses Likert scale (see Appendix D) to identify the attitudes of Grade 7 students toward problem solving in Mathematics. The tool consists of thirty items covering the attitude of the students on problem solving. It was adopted from the work of Mrs. Carmela R. Carabbacan (2003), which was primarily done by Dr. Milagros D. Ibe. The students were asked to respond to questions with any of the following responses:

4 Very true to me

3 Generally true to me

2 Slightly true to me

1 Not at all true to me

The following scale and interpretation were used to get the overall attitude of the students and the corresponding interpretation.

Scale	Interpretation
3.50 – 4.00	**Very Positive**
2.50 – 3.49	**Moderately Positive**
1.50 – 2.49	**Slightly Positive**
1.00 – 1.49	**Not at All Positive**

C. Problem Solving Test

A test on problem solving was used to identify the problem solving skills in Mathematics. The problem solving is composed of fifteen items covering the first quarter topics for Mathematics Grade 7 which includes Operations on Rational Numbers (see Appendix F). The problem solving test was face validated by a mathematics teacher, the department head and the adviser of the researcher. The rubric rating scale, which was adopted from the National Center for Research on Evaluation, Standards, and Student Testing (CRESST, 2004) Schreyer Institute for Teaching Excellence was used to get the score of each student per item on the fifteen item problem solving test. (see Appendix G).

Statistical Treatment

The researcher used the following statistical tools to interpret the data gathered;

1. Frequency count was used to determine the number of responses in each item.
2. Percent was used to compare the frequency of the responses and the total number of respondents.

   Formula: $P = \frac{F}{N}\ x\ 100$

   Where: P = percent

   F = frequency

   N = number of case
3. Weighted mean was used to measure the perception of students on cooperative learning and attitudes toward problem solving.

   Formula: $\overline{X} = \frac{\sum x}{N}$

   Where: $\overline{X}$ is the mean

   x is the score

   N is the number of cases
4. Pearson r correlational test was used to measure significant relationship between perception of students on cooperative learning and attitudes toward problem solving and relationship between perception of students on cooperative learning and performance on problem solving test of the students

Implementation of Cooperative Learning Approach in Class

Initial Phase: With the permission of the Officer in Charge of Bacoor National High School the study was participated by eighty – seven students (87) of Grade 7 – Silver consisting of forty – three females and forty – four males.

Second Phase: The researcher distributed the questionnaire on perception of students' on cooperative learning and attitudes toward problem solving. Students were requested by the researcher to answer the questionnaires honestly. Retrieval of the questionnaires was done after the respondents answered them.

Third Phase: Implementation of Cooperative Learning in the class through pair or group activities. Topics are discussed by the teacher and then students were grouped to answer the given exercises. Students discussed the problems with their group mates. The four lesson plans are found in Appendix K.

For Lesson 1: Addition of Rational Numbers. Cooperative learning is applied during the application phase of the plan. Think Pair Share is the cooperative learning strategy used. Students think through questions using three distinct stages. In the Think Stage, the students think independently about the question forming ideas on their own. It is followed by the Pair Stage where students are grouped in pairs to discuss their thoughts. This step allows students to articulate their ideas

and to consider those of others. In the last Stage called Share, student pairs share their ideas with a larger group, such as the whole class.

For Lesson 2: Subtraction of Rational Numbers. Cooperative learning is applied during the application phase of the lesson plan. The All Write Round Robin was used in this lesson. In this strategy each group member record his/her own answer on paper, then students take turns, reading their answers to the group.

For Lesson 3: Multiplication of Rational Numbers. Cooperative learning is applied during the application phase of the lesson plan. The teacher will group the students with five members each. The group will apply the “All Write Round Robin” strategy to answer the given problems. Each group will submit one paper as their solution to the problems. They will be given 25 minutes to form their solutions. After the given time the students will be called to show their solutions on the board and explain it to the class.

For Lesson 4: Division of Rational Numbers. Cooperative learning is applied during the application phase of the lesson. Students will be grouped into ten. They will choose a leader and a secretary to guide the group. They are going to apply the rally table strategy to answer the given problems. Each group will submit one paper as their solution to the problems. They will be given 25 minutes to form their solutions.

After the given time the students will be called to show their solutions on the board and explain it to the class.

Final Phase: After three weeks of implementing the Cooperative Learning in class, the problem solving test was given.

CHAPTER IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter deals with the presentation, analysis and interpretation of data. Results of the perception on cooperative learning, attitudes toward problem solving, problem solving test of the students and their relationships are discussed. Conclusions gathered from the evaluation are also presented.

1. On students' perception of using cooperative learning in problem solving

Table 1

Students' Perception on Cooperative Learning

Overall Mean	Frequency	Percentage	Interpretation
3.50 – 4.00	10	11%	Highly Acceptable
2.50 – 3.49	77	89%	Moderately Acceptable
1.50 – 2.49	0	0%	Slightly Acceptable
1.00 – 1.49	0	0%	Not at All Acceptable

It can be inferred from Table 1 that majority of the students which is 89% have a moderately acceptable perception on the use of cooperative learning in problem solving, while the remaining 11% of the students have highly acceptable perception on the use of cooperative learning in problem solving.

It only illustrates that cooperative learning is an accepted strategy used in Mathematics. With the complexity of the subject, student's assessment on

the use of cooperative learning is very useful in learning and developing their skills in problem solving.

This gives clarification on the definition given by Johnson and Johnson (1999) about cooperative learning that students work together to accomplish shared goals; students seek outcomes that are beneficial to all, discuss material with each other, help one another understand it, and encourage each other to work hard.

None of the students developed a “not at all acceptable” perception on cooperative learning. This probably means that all students agree that cooperative learning is very useful in Mathematics especially on problem solving. Students learn more when they interact with their classmates.

The result further suggests that students agree that cooperative learning makes Mathematics more fun and interesting. It shows that students are encouraged to work on mathematics problems if they are working with groups. It only denotes that majority of the students are favorable to work with their classmates.

2. On students’ attitude toward problem solving

Table 2

Students’ Attitude toward Problem Solving

Overall Mean	Frequency	Percentage	Interpretation
3.50 – 4.00	0	0%	Very Positive
2.50 – 3.49	61	70%	Moderately Positive
1.50 – 2.49	26	30%	Slightly Positive
1.00 – 1.49	0%	0%	Not at All Positive

Results in Table 2 reveal that majority of the students which is 70% have a moderately positive attitude toward problem solving, while the remaining 30% have slightly positive attitude toward problem solving. None of the students were found to have a “very positive” attitude and “not at all positive” attitude toward problem solving.

This most likely means that all students agree that problem solving is useful in their lives. They certainly believed that through problem solving their thinking and reasoning is enhanced. In this case, we can imply that teachers are successful in making the students recognize how problem solving is significant in their lives.

These inferences are enlightenment on the part of NCTM (1989), who believed that problem solving is the process by which students experience the power and usefulness of Mathematics in the world around them.

The highest obtained mean from the 30 statements is question number 5, “I always want to get high grades in problem solving in mathematics” (see Appendix I). We can clearly say that students have a positive attitude towards problem solving. Despite the difficulty of the subject, they are still interested in getting high grades especially about problem solving. They find problem solving a very challenging task as their means of developing one’s skills.

None of the students developed a “not at all positive” attitude towards problem solving. This perhaps tells us that students are highly motivated and

optimistic when it comes to problem solving. Students demonstrated an affirmative attitude toward mathematics.

With this result, it emphasized the study of Esra (2006), that the development of positive attitude is desirable because of its association with achievement. It further explains that there is a general belief that students learn effectively when they are interested in what they learn so they will achieve better in Mathematics if they like this subject.

3. On the relationship between the perception of using cooperative learning and attitude in problem solving

Table 3

Correlation between the Perception of using Cooperative Learning and Attitude toward Problem Solving

$\overline{X}$ Perception on cooperative learning	$\overline{Y}$ Attitude toward Problem Solving	N	r	Critical value at δ = 0.05	Interpretation
3.02	2.64	87	0.2579	0.1765	Significant moderately positive correlation

Based on the table, the obtained Pearson r is 0.2579 with an interpretation of significant moderately positive correlation. The computed r value of 0.2579 is greater than the tabular r value of 0.1765 at 0.05. It only

shows that there is a significant correlation between the perception of cooperative learning and attitude toward problem solving.

4. The performance level of the students in problem solving that are exposed to cooperative learning

The performance level of the Grade 7 students in problem solving is shown on the table below.

Table 4

Students' Level of Performance in Problem Solving

Scores	Frequency	Percentage	Interpretation
46 – 60	7	8%	Outstanding
31 – 45	34	39%	Very Satisfactory
16 – 30	43	50%	Slightly Satisfactory
1 – 15	3	3%	Poor
TOTAL	87	100%	

Based on the table majority (50%) of the students have a slightly satisfactory performance in problem solving, 39% of them are very satisfactory performance and very few (8% and 3%) for outstanding and poor performance in problem solving.

Although majority of the students showed a moderately acceptable perception on cooperative learning and moderately positive attitude toward problem solving still only minority of the students showed a high level of performance in problem solving.

It discredits Ho Geok Lan (2007) that the use of cooperative learning environment had a positive effect on the acquisition of problem – solving

strategies. The students who are engaged in a cooperative problem solving process still were not able to get the anticipated benefit of cooperative learning which is higher academic achievement.

5. On the relationship between the perception of using cooperative learning in problem solving activities and the performance in problem solving test of the students

Table 5

Correlation between the Perception of using Cooperative Learning and the Performance in Problem Solving test of the students

N	r	Critical value at δ = 0.05	Interpretation
87	0.008	0.942	No significant correlation

Based on the table, the obtained Pearson r is 0.008 with an interpretation of no significant relationship. The computed r value of 0.008 is less than the tabular r value of 0.942 at 0.05. It only shows that there is no significant relationship between the perception of using cooperative learning and the performance in problem solving test of the students.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter deals with the three important components of the study namely: (1) summary of findings, (2) conclusions and (3) recommendations. The summary reflects the brief discussions of the findings of the study. Conclusions were formed from the said findings. Using the conclusion, recommendations were formulated.

Summary of Findings

Below is the summary of findings of the study wherein the following specific problems were answered.

1. **On students' perception of using cooperative learning in problem solving**

   Majority of the students which is 77 out of 87 (89%) have a moderately acceptable perception on the use of cooperative learning in problem solving, while 10 or 11% have highly perception on the use of cooperative learning in problem solving. No students were found to have a slightly acceptable or not at all acceptable perception on the use of cooperative learning in problem solving.

2. **On students' attitude toward problem solving**

   Majority of the students which is 61 out of 87 (70%) have a moderately positive attitude toward problem solving, while 26 or 30% of

the students have slightly positive attitude toward problem solving. None of the students were found to have a very positive attitude and not at all positive attitude toward problem solving.

3. **On the relationship between the respondents' perception on cooperative learning and their attitude towards problem solving**

The computed r value of 0.2579 is greater than the tabular r value 0.1765 at 0.05. Hence perception on cooperative learning and attitude in problem solving has a significant positive correlation.

4. **The performance level of the students in problem solving that are exposed to cooperative learning**

Forty – three (43) students out of 87 (50%) obtained a slightly satisfactory rating (a score falling in the interval of 16 – 30 points); thirty – four students (34) or 39% obtained very satisfactory rating (a score falling in the interval of 31 – 45 points); seven (7) students out of 87 or (8%) obtained a rating of outstanding (a score falling in the interval of 46 – 60 points)and three (3) or 3% obtained a poor rating (a score falling in the interval of 1 – 12). The students showed a slightly satisfactory level of performance in problem solving.

5. **On the relationship between the perception of using cooperative learning in problem solving activities and the performance in problem solving test of the students**

   The computed r value of 0.008 is less than the tabular r value 0.942 at 0.05. Hence perception on cooperative learning in problem solving activities and performance in problem solving test of the students has no significant relationship.

Conclusions

From the findings of the study, the following conclusions were drawn.

1. The students have a moderately acceptable perception on the use of cooperative learning in problem solving.
2. The students have a moderately positive attitude toward problem solving.
3. There is a significant moderately positive relationship between perception of using cooperative learning and attitude toward problem solving.
4. The students showed a slightly satisfactory level of performance in problem solving.
5. There is no significant relationship between perception of using cooperative learning in problem solving activities and performance in problem solving test of the students.

Recommendations

Based from the findings and conclusions of the study, the following are recommended.

1. The teacher must always provide cooperative learning strategies or new methods in teaching mathematics to enhance problem solving skills of the students.
2. The teacher should inculcate to the minds of the student positive attitudes toward mathematics. The teacher must motivate the students to solve problem in mathematics.
3. The teacher must not only provide effective cooperative learning strategy to encourage positive attitudes towards the subject but also activities that will enhance the problem solving skills of the students.
4. The school administrators may conduct trainings and seminars for teachers regarding cooperative learning and developing problem skills of the students in mathematics.
5. Encourage other researchers to undertake similar studies correlating the problem solving skills of the students and the cooperative learning strategy.

References

Barairo, F. (2000). *Enhancing problem solving skills through the use of activities appropriate to the dominant intelligences among second year high school students*. (Special Project). Philippine Normal University, Taft Avenue, Manila.

Barham (2002). *An assessment of the effectiveness of cooperative learning strategies in promoting problem solving skills and achievement in mathematics*. Retrieved from http://ethos.bl.uk/OrderDetails.do?uin=uk.bl. ethos.515957.

Belding, J. *Goals and philosophies for teaching mathematics*. Retrieved from www.math.harvard.edu/jbelding/umd-site/teachingstmt-new.pdf.

Bernero, J. (2000). *Motivating students in math using cooperative learning*. (Master's Thesis) Saint Xavier University, Chicago.

Bololoy, H. (1996). *Cooperative learning a strategy in problem solving*. Legaspi City.

Bungayong, A. (2012).*Students' conceptual understanding, learning approaches and problem solving strategies in solutions*. (Master's Thesis)Technological University of the Philippines, Taft Avenue, Manila.

Camilo, M. (2004). *The use of cooperative strategies as a tool in developing students' social skills in learning mathematics*. (Special Project), Philippine Normal University, Taft Avenue, Manila.

Campione, J. (1998). *Metacognition:on the importance of understanding what you are doing.* Reston, VA: Laurence Erlbaum, NCTM.

Carabbacan, C. (2003). *Attitudes of grade VI pupils of Isabel towards word problem solving in mathematics*. (Master's Thesis), Philippine Normal University, Taft Avenue, Manila.

Chang, A., Kaur, B., Koay, P.L. & Lee, N.H. (2001). *The NIE Researcher An exploratory analysis of current pedagogical practices in primary mathematics classrooms*., , 1(2), 7 - 8.

Charles, R. (2003). *The teaching and assessing of mathematical problem solving*. Research agenda project. Reston, VA: NCTM.

Cockcroft, W. (1982). *Mathematics counts*. Report of the committee of inquiry into the teaching of mathematics in schools, London: Her Majesty's Stationery Office.

Dale, E. (1969). *Management and theory and practice*. N.Y. Mac Graw Hill.

Davidson, N. (1990). *Cooperative learning in mathematics*. A handbook for teachers. Reading mass: Addison – Wesley Publishing Co.

Delaon, R. (2000). *Developing students' mathematical skills through cooperative learning*. (Master's Thesis), De La Salle University, Taft Avenue, Manila.

Derraco, N. (2012). *Problem solving performance, self – concept and meta cognitive strategies of first year high school students in math*. (Special Project), Philippine Normal University, Taft Avenue, Manila.

Ellis, A. K. & Fouts, J. T. (1997). *Research on Educational Innovations* (2nd ed.). Larchmont, NY: Eye on Education.

Esra, O. (2006). *An investigation on the effects of project – based learning on students achievement in and attitude towards geometr*y. Retrieved from http://etd.lib.mety. edu.trupload/3126071666/index.pdf.

Glipo, Z. (1996). *Strategies in problem solving*. Lectured delivered from seminar workshop for mathematics educators, Bicol University.

Gokhale. A. (2005). *Collaborative learning enhances critical thinking.*Journal of Technology education, Vol. 7.

Heddens, J and Speer W. (1992). *Today's mathematics 7th edition*. New York: Macmillan Publishing Company.

Hiebert, J. (1997). A proposal for improving classroom teaching: The elementary school journal.

Hoffman, M.(n.d.) *Collective learning in everyday mathematics classrooms*. Retrieved from www.gphillymath.org.

Ibanez, J.(2011). *Promoting the development of problem solving skills through collaborative problem solving approach*.(Master's Thesis), Technological University of the Philippines, Taft Avenue, Manila.

Ingleton, C. (2005). *Collaborative learning*. The University of Adelaide, Australia.

Johnson, D. and Johnson R. (1999). *Cooperative learning in the classroom*. Alexandra Va. Associates for Supervision and Curriculum Development.

Kagan, S. (1994). *Cooperative learning*. San Clemente, California.

Kennedy, L., & Tipps, S. (1994). *Guiding children's of mathematics*. Belmont, CA: Wadsworth.

Klebosits, P., & Perrone, B. (1998). *Increasing student academic achievement through the use of single and mixed gender cooperative grouping patterns.*(Master's Thesis), Saint Xavier University, Chicago. Retrieved from the ERIC database.(ED436358)

Krulik, S and Rudnick J. (1980). *Problem solving: A handbook for teachers*. Boston: Allyn and Bacon.

Lan, H. (2007). *A cooperative learning programme to enhance mathematical problem solving performance among secondary three students*. Retrieved from http://repository.nie.edu.sg/jspui/bitstream/10497/100/1/ME-10-1-59.pdf.

Lesh, R., & Zawojewski, J. (2007). *Problem-solving and modeling*. In F. Lester *(Ed.), Second handbook of research on mathematics teaching and learning (pp. 763-804). Reston, VA: NCTM.*

Lester, F and Kehle M. (2003). *Learning how to teach via problem solving*. Reston, Virginia: NCTM.

Mago, A.(2004) *The performance and attitudes of grade 6 pupils at Villamor Air Base elementary school toward problem solving*. (Special Project), Philippine Normal University, Taft Avenue, Manila.

Marks, J., Purdy, R., Renney, L. (1965). *Teaching elementary school math for understanding*. Mc Graw Hill Book Cop., NY.

Mayer, D. (1987). *Thinking, problem solving, cognition 2nd edition*. New York: Freeman.

Miranda, R. (1996). *Attitudes and mathematics skills as factors for problem solving ability of freshmen secondary students*. (Dissertation), Philippine Normal University, Taft Avenue, Manila.

Neale, D. (1969). *The role of attitude in learning mathematics*. The arithmetic teacher XVI.

Nebesniak, A. (2007). *Using cooperative learning to promote a problem – solving classroom.* Retrieved from http://scimath.unl.edu/ MIM/files/research/ NebesniakA.pdf.

Piaget, J., & Inhelder, B. (1975). *The origin of the idea of chance in children.* London: Routledgate & Kegan Paul.

Pinzker, V. (2001*). Increasing the engagement and understanding of concepts in mathematics.(*Master's Thesis*)*, Saint Xavier University, Chicago. Retrieved from the ERIC database. (ED455117)

Polya, G. (1957). *Mathematical discovery on understanding learning and teaching problem solving*. New York: Wiley.

Polya, G. (1962).. Mathematical Discovery, vol 1. New York: Wiley.

Reisnick, L. (1987). *Education and learning to think*. Washington: National Academy Press.

Reitman, W. (1969). *Cognition and thought*. New York: Wiley.

Robles, L.(2010). *Problem solving performance, metacognitive strategies and self – esteem of engineering students*. (Special Project), Philippine Normal University, Taft Avenue, Manila.

Sangcap, P.(2004). *Aspects of mathematical problem solving as perceived by the college of education students and teachers of the University of Santo Tomas*. (Seminar Paper), Philippine Normal University, Taft Avenue, Manila.

Schoenfeld, A. (1992). *Learning to link mathematically: Problem solving, metacognition and sense making in mathematics*. In A. D. Grouws (Ed.), Handbook of research on mathematics learning and teaching (pp. 334-370). New York: Macmillan.

Schroeder, T. and Lester L. (1989). *Developing understanding in mathematics via problem solving*. Reston. VA: NCTM.

Sevilla. (1992). *Introduction to research methods*. Rex Bookstore, Manila.

Slavin, R. (1999). *Blueprints for thinking in the cooperative classroom*. Arlington Heights, VA: IRI/Skylight Training and Publishing.

Stacey, Kaye (2005). *The place of problem solving in contemporary mathematics curriculum documents*. Journal of Mathematical Behavior 24, pp 341 – 350.

Stevens, R., Slavin, R., & Farnish, A. (1991). *The effects of cooperative learning and directed instruction in reading comprehension strategies on main idea identification*. Journal of Educational Psychology, 83, 8-16.

Taplin, M. (n.d) *Mathematics through problem solving.* Retrieved from http://www.math goodies.com/ articles/ problem_solving.html.

Tripathi, P. *Problem solving in mathematics: A tool for cognitive development*. Retrieved from http://www.businessdictionary .com/ definition/attitude. html#ixzz2ZjVvH0kz

Van Gundy, A. (1998). *Techniques of structured problem solving*. New york, USA: Van Nostrand Reinhold Company, Inc.

Wallas, G. (1926). *The art of thought*. New York: Franklin Watts.

Walmsley, A., Muniz J.(n.d). *Connecting research to teaching: Cooperative learning and its effects in a high school geometry classroom*. Retrieved from jwilson.coe.uga.edu.

Weber, K. (2005). *Problem-solving, proving, and learning*: The relationship between problem-solving processes and learning opportunities in the activity of proof construction. Journal of Mathematical Behavior, 24, 351-360.

Weimer, M. (2008). *To improve students' problem solving skills: Add group work to the equation. The teaching professor.* Retrieved from http://library.thinkquest. org/ 25459/learning/problem.

Wilson, J.,Fernandez, M., Hadaway, N.(1993). *Mathematical problem solving*.Retrieved from http://jwilson.coe.uga.edu/ emt725/PSsyn.html.

Yau, H., Cheng, A. (n.d). Perceptual influence of cooperative goal to problem solving approach.IMECS,Honglong. Retrieved from www.iiaeng.org /publication/ IMECS2013/IMECS2013_pp985 - 987.pdf.

Yeo, J. (2009). *National institute of education*. Retrieved from http://www .cimt.plymouth.ac.uk/journal/yeo.pdf.

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APPENDIX A

Permission to Conduct a Study

PHILIPPINE NORMAL UNIVERSITY
Taft Avenue, Manila

July 9, 2013

PONCIANO G. GARRIDO
OIC – BNHS (Villa Maria Annex)
Molino III, City of Bacoor, Cavite

Sir:

Warm Greetings!

I am a graduating student of Philippine Normal University, who is presently conducting a research study entitled "EXPLORATORY INVESTIGATION ON THE PROBLEM SOLVING SKILLS OF THE STUDENTS WHO ARE EXPOSED TO COOPERATIVE LEARNING" in partial fulfillment of the requirements for the Master's Degree in Teaching.

In connection with this, I am respectfully asking permission from your good office to allow me to float my two sets of questionnaires to selected students of Grade 7. The first set is about the student's perception on cooperative learning and the second set is the attitude of the students toward problem solving. The said questionnaires will be given on July 15 – 16, 2013.

My sincerest gratitude for your favorable consideration to this request.

Very truly yours,

Annalyn O. Canaleta
Researcher

APPROVED BY: (sgd)
PONCIANO G. GARRIDO
OIC – BNHS (Villa Maria Annex)

APPENDIX B

Permission to Use the Instrument

PHILIPPINE NORMAL UNIVERSITY
Taft Avenue, Manila

July 5, 2013

DR. MILAGROS D. IBE
UNIVESITY OF THE PHILIPPINES
DILIMAN CAMPUS, QUEZON CITY

Ma'am:

Warm Greetings!

I am a graduating student of Philippine Normal University, who is presently conducting a research study entitled "EXPLORATORY INVESTIGATION ON THE PROBLEM SOLVING SKILLS OF THE STUDENTS WHO ARE EXPOSED TO COOPERATIVE LEARNING" in partial fulfillment of the requirements for the Master's Degree in Teaching.

In connection with this, I am respectfully asking permission from your good office to allow me to use your questionnaires on "Attitude of the Students toward Problem Solving. The said questionnaires will be very useful in my study.

My sincerest gratitude for your favorable consideration to this matter.

Very truly yours,

Annalyn O. Canaleta
Researcher

DR. MILAGROS D. IBE
UNIVERSITY OF THE PHILIPPINES

APPENDIX C

Students' Perception on Cooperative Learning

Name:_____Date:_____

THIS IS NOT A TEST. There is no RIGHT or WRONG answers. Your answer to this questionnaire will not affect your grade in the subject.

Direction: Read each statement carefully and shade the circle that corresponds to your honest opinion about cooperative learning.

4 Strongly Agree

3 Agree

2 Disagree

1 Strongly Disagree

4	3	2	1	
0	0	0	0	1. It increases my knowledge because I have learn more from other in social situations.
0	0	0	0	2. It makes mathematics more fun and interesting.
0	0	0	0	3. It increases the number of ideas and problem solving techniques that I can use.
0	0	0	0	4. It makes mathematics more student directed.

0	0	0	0	5. It helps me develop my cooperation skills.
0	0	0	0	6. It makes other dominate the lessons and allow others to just follow.
0	0	0	0	7. It makes the other students noisy and off – task.
0	0	0	0	8. It takes away covering important mathematics content.
0	0	0	0	9.It makes smaller classes of students learn more.
0	0	0	0	10.It makes students share their ideas.

APPENDIX D

Attitude of the Students toward Problem Solving

Name:_____Date:_____

THIS IS NOT A TEST. There is no RIGHT or WRONG answers. Your answer to this questionnaire will not affect your grade in the subject.

Direction: Below are statements often made by students about their problem solving in mathematics subject. Read each statement carefully and indicate how truly it applies to you. Shade the letter that corresponds to you answer.

4 Very true to me

3 Generally true to me

2 Slightly true to me

1 Not at all true to me

4	3	2	1	
0	0	0	0	1. I am sure that word problem solving in mathematics is useful in daily life.
0	0	0	0	2. I am interested to develop my skills in problem solving in mathematics.
0	0	0	0	3. My parents are very interested in problem solving in mathematics.
0	0	0	0	4. I want solving word problems in mathematics beyond what is expected of me.

0	0	0	0	5. I always want to get high grades in problem solving in mathematics.
0	0	0	0	6. My mind is working better when doing problem solving in mathematics.
0	0	0	0	7. I enjoy solving my problem tasks in mathematics.
0	0	0	0	8. I would like to exchange my problem solving mathematics for an easier subject in school.
0	0	0	0	9. Solving mathematical word problem confuses me.
0	0	0	0	10. The chance of succeeding in higher years is more probable if it does not require problem solving in mathematics.
0	0	0	0	11. Problem solving is a task in mathematics that I always enjoy.
0	0	0	0	12. My most difficult activity in mathematics is word problem solving.
0	0	0	0	13. Problem solving in mathematics is my favorite.
0	0	0	0	14. I have an adequate foundation in problem solving in mathematics.

0	0	0	0	15. Of all my teachers, it is my math teacher that I like best.
0	0	0	0	16. I do not like to take problem solving in mathematics in higher years.
0	0	0	0	17. My thinking and reasoning are sharpened when I work with problem solving in mathematics.
0	0	0	0	18. My mind does not work well when doing problem solving in mathematics.
0	0	0	0	19. Becoming successful depends on my achievement in problem solving in mathematics.
0	0	0	0	20. It would be better if problem solving in mathematics were to be taken out of the curriculum.
0	0	0	0	21. Problem solving in mathematics is a scary activity.
0	0	0	0	22. I usually get the lowest grades in problem solving in mathematics.
0	0	0	0	23. When I cannot solve a problem in mathematics, I give up easily.

0	0	0	0	24. In problem solving in mathematics I feel like I am lost in a jungle of numbers and I cannot find my way out.
0	0	0	0	25. I like problem solving in mathematics class than any other classes.
0	0	0	0	26. Problem solving in mathematics makes me nervous.
0	0	0	0	27. I am uncomfortable when solving problems in mathematics.
0	0	0	0	28. Problem solving in mathematics makes me more curious about daily life problems that I usually encounter.
0	0	0	0	29. Solving problems in mathematics satisfies me.
0	0	0	0	30. I like going with friends who are good in word problem solving in mathematics.

APPENDIX E

Problem Solving Test

Name:_____Date:_____

Direction: Answer each of the following application questions. Be sure to read the question, interpret the problem mathematically, solve the problem, and then answer the question. Show your solution and box your final answer.

1. Subtract from $15\frac{1}{2}$ from the sum of $2\frac{1}{3}$ and $4\frac{2}{5}$. What is the result?

2. Glenda said, “I’m thinking of a number N”. If I subtract 10.34 from N, the difference is 1.34. What is Glenda’s number?

3. Hazel had P 7, 500.00 for shopping money. When she got home, she had P 132.75 in her pocket. How much did she spend for shopping?

4. Anna needs $10\frac{1}{4}$ kg of meat to serve to 55 guests. If she has $3\frac{1}{2}$ kg of chicken, $2\frac{3}{4}$ kg of pork and $4\frac{1}{4}$ kg of beef. Is there enough meat for 55 guests?

5. Laarni ran the 120 – meter race in 135.46 seconds. Donna ran faster by 15.7 seconds. What is Donna’s time for the 120 – meter dash?

6. Josephine and Jenney are comparing heights. If Josephine’s height is $120\frac{3}{4}$ cm and Jenney’s height is $96\frac{1}{3}$ cm. What is their combine height?

7. Abigail is preparing for their final exam. She study $\frac{3}{2}$ hours on Friday, $\frac{6}{4}$ hours on Saturday and $\frac{2}{3}$ hours on Sunday. How many hours did she study over the weekend?

8. Shiela lives $\frac{3}{8}$ miles from the Museum of Science. Charry lives $\frac{1}{4}$ mile from the Museum of Science. How much closer is Charry from the museum?

9. If a 10 – foot piece of electrical tape has 0.037 feet cut from it, and then what is the new length of the tape?

10. A father weighed $2\frac{1}{4}$ times more than his son. If the son weighs $60\frac{1}{2}$ pounds, about how much does the father weigh?

11. What is the average speed in miles per hour of a car that travels 956.4 miles in 15.9 hours?

12. How many thirds are there in six fifths?

13. The enrolment for this school year is 2 340. If $\frac{1}{6}$ are sophomores and $\frac{1}{4}$ are seniors, how many are freshmen or juniors?

14. An Italian sausage is 8 inches long. How many pieces of sausage can be cut from the 8-inch piece of sausage if each piece is to be two-thirds of an inch?

15. A student earns P 12.75 per hour for gardening. If she worked 21 hours this month, then how much did she earn?

END OF EXAM

Numbers rule the universe.

APPENDIX F

Table of Specifications

Topics	No. of Items	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Placement of Items
1. Addition	5	1		6,7	2		4	1,2,4,6,7
2.Subtraction	4			3,8	5,9			3,5,8,9
3.Multiplication	3			15	10		13	10,13,15
4.Division	3	12		11	14			11,12,14
Total	15	2	0	6	5	0	2	15

APPENDIX G

Problem Solving Rubric

This scale evaluates the process employed in response to a problem-solving task. It takes into consideration the level of student knowledge and understanding with respect to the given problem solving task; the selection and implementation of appropriate procedures and/or strategies; and the accuracy of the solution obtained.

	Indicators				
Criteria	**4**	**3**	**2**	**1**	**0**
	Response is characterized by all of the following:	The student selects appropriate procedures/ strategies to solve this problem; however, the response/ solution is not entirely correct because one of the following is apparent:	The student selects appropriate procedures/ strategies to solve this problem; however, the response/ solution is not correct because one or more of the following are:	An incomplete and/or incorrect response/ solution is provided evidencing an attempt to solve the problem. In addition, one or more of the following are apparent:	Response is characterized by the following:
	The student selects and implements relevant concepts and procedures/strategies needed to solve this problem.	There is evidence the student has a misconception or has failed to consider a relevant concept needed to solve the problem correctly.	There is evidence that the student has several misconceptions or has failed to consider several concepts needed to solve the problem	The student did consider a constraint or variable of the problem situation.	It is blank.

			correctly.		
	The student considers all constraints of the problem situation.	The student fails to consider a constraint of the problem situation.	The student fails to consider several constraints of the problem situation.	The student understands some concepts relevant to the problem task.	The student response only repeats information in the problem task.
	The solution and all relevant work is correct.	The student has considered an irrelevant variable or failed to consider a relevant variable.	The student has also considered several irrelevant variables or failed to consider several relevant variables.	The student selected a totally inappropriate procedure /strategy.	An incorrect solution/response is given and no other information is shown.
		The response/ solution is generally correct; however, from the information provided it is not completely clear how the student arrived at this solution.	The student did not carry the procedures/ strategies far enough to reach a solution.		The solution/response and supportive information is totally irrelevant to the problem task.
		.	The response/ solution is generally correct; however, there is no information showing how the student arrived at this response/ solution.		

Level of Performance in Problem Solving

Scores in Problem Solving Test	Scoring Level Interpretation
45 – 60	Outstanding
31 – 44	Very Satisfactory
16 – 30	Slightly Satisfactory
1 – 15	Poor

APPENDIX H

Students' Perception on the use Cooperative Learning in Problem Solving

MEAN SCORES PER ITEM

Item Number	Weighted Mean	Interpretation
1. It increases my knowledge because I have learn more from other in social situations.	**3.40**	Moderately Acceptable
2. It makes mathematics more fun and interesting.	**3.64**	Highly Acceptable
3. It increases the number of ideas and problem solving techniques that I can use.	**3.23**	Moderately Acceptable
4. It makes mathematics more student – directed.	**3.53**	Highly Acceptable
5. It helps me develop my cooperation skills.	**3.47**	Moderately Acceptable
6. It makes other dominate the lessons and allow others to just follow.	**2.21**	Slightly Acceptable
7. It makes the other students noisy and off – task.	**1.51**	Slightly Acceptable
8. It takes away covering important mathematics content.	**2.47**	Slightly Acceptable

9. It makes smaller classes of students learn more.	**3.07**	Moderately Acceptable
10. It makes students share their ideas.	**3.63**	Highly Acceptable
Overall Weighted Mean	**3.02**	**Moderately Acceptable**

APPENDIX I

Students' Attitude toward Problem Solving

MEAN SCORES PER ITEM

Item Number	Weighted Mean	Interpretation
1. I am sure that word problem solving in mathematics is useful in daily life.	**3.37**	Moderately Positive
2. I am interested to develop my skills in problem solving in mathematics.	**3.48**	Moderately Positive
3. My parents are very interested in problem solving in mathematics.	**2.98**	Moderately Positive
4. I want solving word problems in mathematics beyond what is expected of me.	**3.24**	Moderately Positive
5. I always want to get high grades in problem solving in mathematics.	**3.72**	Very Positive
6. My mind is working better when doing problem solving in mathematics.	**3.41**	Moderately Positive
7. I enjoy solving my problem tasks in mathematics.	**3.15**	Moderately Positive
8. I would like to exchange my mathematics for an easier subject in school.	**2.25**	Slightly Positive
9. Solving mathematical word problem confuses me.	**2.36**	Slightly Positive

10. The chance of succeeding in higher years is more probable if it does not require problem solving in mathematics.	**1.95**	Slightly Positive
11. Problem solving is a task in mathematics that I always enjoy.	**2.90**	Moderately Positive
12. My most difficult activity in mathematics is word problem solving.	**2.33**	Slightly Positive
13. Problem solving in mathematics is my favorite.	**2.71**	Moderately Positive
14. I have an adequate foundation in problem solving in mathematics.	**3.11**	Moderately Positive
15. Of all my teachers, it is my math teacher that I like best.	**3.21**	Moderately Positive
16. I do not like to take problem solving in mathematics in higher years.	**1.90**	Slightly Positive
17. My thinking and reasoning are sharpened when I work with problem solving in mathematics.	**3.02**	Moderately Positive
18. My mind does not work well when doing problem solving in mathematics.	**1.67**	Slightly Positive
19. Becoming successful depends on my achievement in problem solving in mathematics.	**2.83**	Moderately Positive
20. It would be better if problem solving in mathematics were to be taken out of the curriculum.	**1.66**	Slightly Positive
21. Problem solving in mathematics is a scary activity.	**1.84**	Slightly Positive

22. I usually get the lowest grades in problem solving in mathematics.	**2.37**	Slightly Positive
23. When I cannot solve a problem in mathematics, I give up easily.	**1.99**	Slightly Positive
24. In problem solving in mathematics, I feel like I am lost in a jungle of numbers and I cannot find my way out.	**2.00**	Slightly Positive
25. I like problem solving in mathematics class than any other classes.	**2.63**	Moderately Positive
26. Problem solving in mathematics makes me nervous.	**2.25**	Slightly Positive
27. I am uncomfortable when solving problems in mathematics.	**2.01**	Slightly Positive
28. Problem solving in mathematics makes me more curious about daily life problems that I usually encounter.	**2.68**	Moderately Positive
29. Solving problems in mathematics satisfies me.	**2.92**	Moderately Positive
30. I like going with friends who are good in word problem solving in mathematics.	**3.21**	Moderately Positive
Overall Mean	**2.64**	**Moderately Positive**

APPENDIX J

Relationship between Students' Perception on Cooperative Learning and Attitudes toward Problem Solving

Students	Scores on Perception on Cooperative Learning (x)	Scores on Attitude toward Problem Solving (y)	x^2	y^2	xy
1	29	73	841	5329	2117
2	25	81	625	6561	2025
3	29	79	841	6241	2291
4	32	87	1024	7569	2784
5	31	77	961	5929	2387
6	30	74	900	5476	2220
7	35	83	1225	6889	2905
8	26	65	676	4225	1690
9	29	69	841	4761	2001
10	32	79	1024	6241	2528
11	30	87	900	7569	2610
12	29	79	841	6241	2291
13	32	78	1024	6084	2496
14	35	82	1225	6724	2870
15	34	90	1156	8100	3060
16	29	70	841	4900	2030
17	32	82	1024	6724	2624
18	29	77	841	5929	2233
19	27	97	729	9409	2619
20	35	93	1225	8649	3255
21	27	81	729	6561	2187
22	28	79	784	6241	2212
23	33	92	1089	8464	3036
24	30	80	900	6400	2400
25	31	77	961	5929	2387
26	27	86	729	7396	2322
27	29	83	841	6889	2407

28	30	77	900	5929	2310
29	34	85	1156	7225	2890
30	31	79	961	6241	2449
31	29	80	841	6400	2320
32	28	81	784	6561	2268
33	36	90	1296	8100	3240
34	30	86	900	7396	2580
35	30	84	900	7056	2520
36	31	75	961	5625	2325
37	26	78	676	6084	2028
38	33	82	1089	6724	2706
39	30	84	900	7056	2520
40	28	60	784	3600	1680
41	32	83	1024	6889	2656
42	35	77	1225	5929	2695
43	29	78	841	6084	2262
44	27	65	729	4225	1755
45	27	76	729	5776	2052
46	25	77	625	5929	1925
47	27	69	729	4761	1863
48	30	87	900	7569	2610
49	31	72	961	5184	2232
50	28	78	784	6084	2184
51	31	78	961	6084	2418
52	33	69	1089	4761	2277
53	31	77	961	5929	2387
54	32	93	1024	8649	2976
55	29	73	841	5329	2117
56	30	75	900	5625	2250
57	38	96	1444	9216	3648
58	30	74	900	5476	2220
59	30	83	900	6889	2490
60	30	70	900	4900	2100
61	27	85	729	7225	2295
62	29	83	841	6889	2407
63	30	72	900	5184	2160
64	32	89	1024	7921	2848
65	34	71	1156	5041	2414
66	35	71	1225	5041	2485
67	32	72	1024	5184	2304
68	28	81	784	6561	2268
69	34	71	1156	5041	2414
70	29	66	841	4356	1914

71	30	85	900	7225	2550
72	33	81	1089	6561	2673
73	31	64	961	4096	1984
74	36	71	1296	5041	2556
75	28	75	784	5625	2100
76	32	73	1024	5329	2336
77	30	87	900	7569	2610
78	32	76	1024	5776	2432
79	27	77	729	5929	2079
80	34	90	1156	8100	3060
81	38	75	1444	5625	2850
82	28	65	784	4225	1820
83	30	74	900	5476	2220
84	28	68	784	4624	1904
85	29	82	841	6724	2378
86	32	87	1024	7569	2784
87	29	74	841	5476	2146
	$\sum x = 2\,653$	$\sum y = 6\,836$	$\sum x^2 = 81\,573$	$\sum y^2 = 542\,128$	$\sum xy = 208\,931$

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{[N\sum x^2 - (\sum x)^2][N\sum x^2 - (\sum y)]^2}}$$

$$r = \frac{(87)(208{,}931) - (2\,653)(6\,836)}{\sqrt{87\,(81\,573) - (2\,653)^2][87\,(542\,128) - (6\,836)^2]}}$$

$$r = \frac{41\,089}{\sqrt{(58\,442)(434\,240)}}$$

$$r = 0.2579$$

APPENDIX K
Lesson Plan

Lesson 1: Addition of Rational Numbers

Time Allotment: 1 hour

Level: Grade 7

Content: Operations on Rational Numbers

Content Standard: The learner demonstrates understanding of key concepts of rational numbers.

Performance Standard: The learner is able to formulate real – life problems involving rational numbers.

Cooperative Learning Strategy: Think Pair Share

The think, pair, share strategy is a cooperative learning technique that encourages individual participation and is applicable across all grade levels and class sizes. Students think through questions using three distinct steps:

Think: Students think independently about the question that has been posed, forming ideas of their own.

Pair: Students are grouped in pairs to discuss their thoughts. This step allows students to articulate their ideas and to consider those of others.

Share: Student pairs share their ideas with a larger group, such as the whole class. Often, students are more comfortable presenting ideas to a group with the support of a partner. In addition, students' ideas have become more refined through this three-step process.

Learning Competencies

I. Content: Operations on Rational Numbers

II. Sub – Content: Addition of Rational Numbers

III. Objectives: At the end of the lesson, students should have been able to:

- Apply concepts and rules in adding rational numbers
- Solve problems involving addition of rational numbers
- Show patience and cooperation in solving problems

Materials

flashcards

flaglets (face/sad face)happy

visual aids

worksheet

- **Routinary Activities**
- **Prayer**
- **Greetings**
- **Checking of Attendance**

Primary Activities

Activity 1: Motivation

Individual work: In 5 minutes copy and complete the magic square. The sum in each row, column and diagonal must be two (2). Answers may be expressed in fractions or decimals.

a	**0.5**	**b**
$\frac{7}{5}$	$\frac{1}{3}$	**c**
d	**e**	**0.4**

Analysis:

The teacher will flash the questions one by one and call a volunteer to discuss his/her answer. The students will be raising their happy face flags if they agree with the answer of their classmate and a sad face flag if they do not agree with the answer.

Questions:

- How do we add similar fractions?

  (In adding similar fractions, we just add their numerators and copy the denominator)

- How do we add dissimilar fractions?

(In adding dissimilar fractions we must change first dissimilar fractions to similar fraction by finding their equivalent fractions using the same denominator. If they are already similar fractions then we can add their numerators and copy the denominator.

- How do we change dissimilar to similar fractions?

(We change dissimilar fractions to similar fractions by getting first the smallest multiple (LCM) of both numbers. Rewrite the fractions as equivalent fractions with LCM as the denominator.

- When do we say that fractions are already expressed in lowest terms?

(Fractions are said to be in lowest term if the numerator and denominator are already relatively prime. They do not have any factor greater than 1.)

- How do we simplify fractions?

(We simplify fractions by finding the greatest common factor (GCF) of the numerator and the denominator. Then we divide the Numerator and the denominator by their GCF. The obtained fraction is said to be in lowest term.))

- How do we add decimals?

(In adding decimals, we line up the decimal points (align the decimals according to their place values). Add from right to left column by column. Place the decimal point in the answer in line with the other decimal points in the problem.)

- Why is it necessary to align the decimals according to their place value?

(It is necessary to align the numbers according to their place value so that we can obtain a correct solution to the answer so we can avoid mistakes in adding the decimals. Based on the rule we add the numbers according to their place value.)

- Will there be an effect if decimals are not properly aligned?

(Yes, we will be getting an incorrect answer, if decimals are not properly aligned.)

Application:

A day before the discussion students already has their partners. Students counted from 1 – 45. Those who have the same number will be partners. The teacher also instructed the students to seat beside their partner for the discussion the following day.

Students will answer the four questions in 20 minutes. The students will apply the “Think Pair Share” strategy in answering the given problems. The first 10 minutes will be used to answer the questions individually. The remaining ten minutes will be used to discuss their answers with their partners and come up with one better solution. They will be submitting only one paper per pair. After the given time, the teacher will call a volunteer from the class to discuss their answers on the board. Two students will be called to answer the same problem so that the students can compare the answers of their classmates. The teacher will check the worksheet of the students.

Worksheet – Addition of Rational Numbers

Name/s:_____Date: _____

Activity 2: Read carefully and solve the following problems. Show your solutions. Answers will be checked using the given rubric.

Problem-Solving Rubric

4 – arrived at a correct answer; used an appropriate strategy; adequately

3 – used an appropriate strategy; calculated a correct answer but could not ***or*** adequately explained the strategy but did not calculate

2 – used an appropriate strategy; did not find a correct answer;

1 – attempted to solve the problem, but completely incorrect in attempt

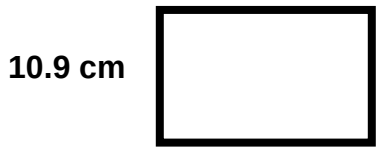
0 - no attempt/blank

Problems

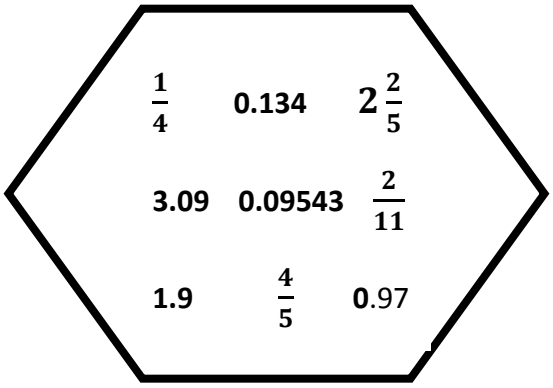
1. What is the 7^{th} and 9^{th} number in the sequence?

$$\frac{1}{2}, \frac{5}{6}, \frac{7}{6}, \frac{3}{2}, \ldots$$

2. What is the perimeter of the rectangle? triangle?



3. Which of these rational numbers when added will give the smallest sum? Note: You can only use three rational numbers.



4. Donna has a total of P 21.00, consisting of an equal number of 0.25 cents, 0.50 cents and one – peso coins. How many coins does she have in all?

Closure:

"Every test in our life makes us bitter or better. Every problem comes to make us or break us. Choice is ours whether we become victim or victor.

Lesson Plan

Lesson 2: Subtraction of Rational Numbers

Time Allotment: 1 hour

Level: Grade 7

Content: Operations on Rational Numbers

Content Standard: The learner demonstrates understanding of key concepts of rational numbers.

Performance Standard: The learner is able to formulate real – life problems involving rational numbers.

Cooperative Learning Strategy: All Write Round Robin

Each group member record his/her own answer on paper, then the students takes turn reading their answers to the group.

1. The teachers poses a problem to which there are multiple possible responses or solutions, then provides think time.

2. Students think and then write their own answers on paper without announcing their thinking aloud.

3. Students then take turns reading the answer they recorded on their papers.

Learning Competencies

I. Content: Operations on Rational Numbers

II. Sub – Content: Subtraction of Rational Numbers

III. Objectives: At the end of the lesson, students should have been able to:

- Apply concepts and rules in subtracting rational numbers
- Solve problems involving subtraction of rational numbers
- Show perseverance and cooperation in solving problems

Materials

- flashcards
- visual aids
- worksheet

Routinary Activities

- **Prayer**
- **Greetings**
- **Checking of Attendance**

Primary Activities

Activity 1: Drill (Mental Math)

The teacher will use 10 flash cards then call on a volunteer to answer the problems by performing subtraction of rational numbers.

Review

After the drill, the teacher will ask the following questions to the students and call on a volunteer to discuss his/her answer.

- How do we subtract similar fractions?
- How do we subtract dissimilar fractions?
- What are the rules of subtracting decimals?

Presentation

In three minutes read and answer the given word problem below then discuss your answers with your seatmate for about two minutes.

Problem: Laarni was trying to decide when to get up in the morning. She needs $\frac{3}{4}$ of an hour to get ready for school. It takes her $\frac{5}{12}$ of an hour to drive to school. She wanted to get to school 20 minutes early to use the library. If the school starts at 7:30, what time should she get up?

Discussion

The problem gives you the amounts of time it will take to complete the tasks ($\frac{3}{4} = 45\,minutes$ $\frac{5}{12} = 25\,minutes,$ 20 minutes). It also tells you the time the last task must end (7:30). To solve the problem, work backward to the beginning.

Task	Amount of Time	Conclusion
1	Laarni went to the library for 20 minutes. Then it was 7:30.	She went to the library 20 minutes before 7:30, at 7:10.
2	She drove for $\frac{5}{12}$ of an hour or 25 minutes. Then it was $\frac{5}{12}$ 7:10.	She got in her car 25 minutes before 7:10, at 6:45.

3	She needed $\frac{3}{4}$ of an hour or 45 minutes to get ready for school. Then it was 6: 45.	She began getting ready for 45 minutes before 6:45, at 6:00.
Laarni should get up by 6:00.		

Activity 2:

Individual work: Read carefully and solve the given problems. Show your solutions.

1. What is the common difference of each term in the sequence and what is the 9th term?

$$\frac{3}{5}, 1\frac{1}{10}, 1\frac{3}{5}, 2\frac{1}{10}, \ldots$$

2. Liza was given her allowance on Monday. On Tuesday she spent P 100.50 at the fruit stand. On Wednesday, Lorna paid Liza the P 100.00 she owed her. If Liza now has P 200.00, how much is her allowance?

Application:

The teacher will group the students with five members each. The group will apply the “All Write Round Robin” strategy to answer the given problems. Each group will submit one paper as their solution to the problems. They will

be given 25 minutes to form their solutions. After the given time the students will be called to show their solutions on the board and explain it to the class. The teacher will check the worksheets of the students using the holistic rubric.

Worksheet – Subtraction of Rational Numbers

Name/s:_____Date: _____

Activity 3: Read carefully and solve the following problems. Show your solutions. Answers will be checked using the given rubric below.

Problem-Solving Rubric

4 – arrived at a correct answer; used an appropriate strategy; adequately

3 – used an appropriate strategy; calculated a correct answer but could not ***or*** adequately explained the strategy but did not calculate

2 – used an appropriate strategy; did not find a correct answer;

1 – attempted to solve the problem, but completely incorrect in attempt

0 - no attempt/blank

Problems

1. The difference below is not correct. Change two (2) digits to make it correct.

   Given: **36.215 – 14. 82 = 19. 495**

2. Glenda did two of the activities below. She paid for them with P 1, 000.00. Her change was P 374.00. What two activities did Glenda do?

Activity	Cost
Movies	P 350. 50
Golf	P 300.50
Skating	P 200.50
Go – Kart Rides	P 275.50

3. Using the numbers 1, 2, 3, 6 and 7 as numerator and denominator of a fraction, what is the smallest difference you can get?

4. What is the measure of the missing side if the perimeter is *54* $\frac{14}{25}$ cm?

Closure:

"The opposite of a problem would likely be the correct solution."

Lesson Plan

Lesson 3: Multiplication of Rational Numbers

Time Allotment: 1 hour

Level: Grade 7

Content: Operations on Rational Numbers

Content Standard: The learner demonstrates understanding of key concepts of rational numbers.

Performance Standard: The learner is able to formulate real – life problems involving rational numbers.

Cooperative Learning Strategy: All Write Round Robin

Each group member record his/her own answer on paper, then the students takes turn reading their answers to the group.

1. The teachers poses a problem to which there are multiple possible responses or solutions, then provides think time.
2. Students think and then write their own answers on paper without announcing their thinking aloud.
3. Students then take turns reading the answer they recorded on their papers.

Learning Competencies

I. Content: Operations on Rational Numbers

II. Sub – Content: Multiplication of Rational Numbers

III. Objectives: At the end of the lesson, students should have been able to:

- Apply concepts and rules in multiplying rational numbers
- Solve problems involving multiplication of rational numbers
- Show persistence and cooperation in solving problems

Materials

- flashcards
- visual aids
- worksheet

Routinary Activities

- **Prayer**
- **Greetings**
- **Checking of Attendance**

Primary Activities

Activity 1: Drill (Mental Math)

The teacher will use 10 flash cards then call on a volunteer to answer the problems by performing multiplication of rational numbers.

Review

After the drill, the teacher will ask the following questions to the students and call on a volunteer to discuss his/her answer.

- How do we multiply fractions?
- How do we multiply decimals?
- Is it necessary to apply cancelation before proceeding to

multiplication of fractions? Why?

Presentation

In three minutes read and answer the given word problem below then discuss your answers with your seatmate for about two minutes.

Brain Teaser: **Which magazine is the least expensive for 24 issues? How much less expensive?**

Problem	Solving
Magazine	**Magazine**
24 issues	**24 issues**
First 4 issues FREE	**First 6 issues FREE**
The rest P 30.50	**The rest P 35.25**

Call on four students to show and discuss their answers on the board. Let them explain how and why they obtained their answers.

Application:

The teacher will group the students with five members each. The group will apply the “All Write Round Robin” strategy to answer the given problems. Each group will submit one paper as their solution to the problems. They will be given 25 minutes to form their solutions. After the given time the students will be called to show their solutions on the board and explain it to the class. The teacher will check the worksheets of the students using the holistic rubric.

Worksheet – Multiplication of Rational Numbers

Name/s:_____Date: _____

Activity 2: Read carefully and solve the following problems. Show your solutions. Answers will be checked using the given rubric below.

Problem-Solving Rubric

4 – arrived at a correct answer; used an appropriate strategy; adequately

3 – used an appropriate strategy; calculated a correct answer but could not ***or*** adequately explained the strategy but did not calculate

2 – used an appropriate strategy; did not find a correct answer;

1 – attempted to solve the problem, but completely incorrect in attempt

0 - no attempt/blank

Problems

1. At the party, the host decided to serve his dishes in this pattern…For every 2 guests, he would serve one plate of rice. And For every 4 guests, he would serve one plate of sauce. At the end of the party, a servant told the host that they have served a total of 65 dishes. If 65 dishes were served, then how many guests were at the party?
2. In a school 50% of the students are younger than 10, $\frac{1}{20}$ are 10 years old and $\frac{1}{10}$ are older than 10 but younger than 12, the remaining 70 students are 12 years or older. How many students are 10 years old?

3. K, L, M, and N are integers and K x L = 6; L x M = 20; M x N = 15; and K x N = 9. What is the value of: K x L x M x N?
4. John bought a handkerchief on sale for 25% off the original price and another 25% off the discounted price. If the final price was P 16.00, what was the price before the discount?

Closure:

You cannot solve a problem with the same level of consciousness that created it.” — Carl Jung

Lesson Plan

Lesson 4: Division of Rational Numbers

Time Allotment: 1 hour

Level: Grade 7

Content: Operations on Rational Numbers

Content Standard: The learner demonstrates understanding of key concepts of rational numbers.

Performance Standard: The learner is able to formulate real – life problems involving rational numbers.

Cooperative Learning Strategy: Rally Table

Students take turns generating written responses, solving problems, or making a contribution to a task.

1. Teacher poses a problem to which there are multiple possible responses or solutions, and then provides think time.
2. Students take turns passing a paper and pencil, each writing one answer or making a contribution.
3. Students then read the answers and choose the appropriate solution to each problem.

Learning Competencies

I. Content: Operations on Rational Numbers

II. Sub – Content: Division of Rational Numbers

III. Objectives: At the end of the lesson, students should have been able to:

- Apply concepts and rules in dividing rational numbers
- Solve problems involving division of rational numbers
- Show perseverance and cooperation in solving problems

Materials

- Flashcards (colored papers)
- visual aids
- worksheet

Routinary Activities

- **Prayer**
- **Greetings**
- **Checking of Attendance**

Primary Activities

Activity 1: Drill (I have…Who has???)

Students will be given pieces of colored papers (blue and yellow). Students holding yellow colored paper will be called one by one in front and say, “I have the numbers _____ and _____. Who has the common factors of _____ and _____?” The students holding the blue colored paper will stand if they think that they one of the common factors of the given pair of numbers. The process repeats until all yellow colored papers were used.

Review

After the drill, the teacher will ask the following questions to the students and call on a volunteer to discuss his/her answer.

- How do we divide integers?
- How do we divide fractions?
- Why do we need to get the reciprocal of the divisor when dividing fractions?
- How do we divide decimals?

Presentation

In two minutes answer the word problem and discuss it to the class.

Brain Teaser: Divide 30 by half then add 10. What is the answer?

Application:

Students will be grouped into ten. They will choose a leader and a secretary to guide the group. They are going to apply the rally table strategy to answer the given problems. Each group will submit one paper as their solution to the problems. They will be given 25 minutes to form their solutions. After the given time the students will be called to show their solutions on the board and explain it to the class. The teacher will check the worksheets of the students using the holistic rubric.

Worksheet – Division of Rational Numbers

Name/s:_____Date: _____

Activity 2: Read carefully and solve the following problems. Show your solutions. Answers will be checked using the given rubric below.

Problem-Solving Rubric

4 – arrived at a correct answer; used an appropriate strategy; adequately

3 – used an appropriate strategy; calculated a correct answer but could not *or* adequately explained the strategy but did not calculate

2 – used an appropriate strategy; did not find a correct answer;

1 – attempted to solve the problem, but completely incorrect in attempt

0 - no attempt/blank

Problems

1. If r is less than 10, what value of r makes r3749r0 divisible by 60?
2. What is the largest two – digit number that is divisible by 3 whose digits differ by 2?
3. Which of these fractions do not belong to the group? Name at least two fractions and state your reason.

$\frac{1}{3}$ $\frac{7}{11}$ $\frac{1}{6}$ $7\frac{3}{8}$ $9\frac{1}{7}$

$\frac{5}{12}$ $11\frac{2}{3}$ $\frac{2}{5}$ $3\frac{7}{12}$

4. When James put 10 counters in his bag it was $\frac{1}{3}$ full. When Adrian put 13 in his bag it was $\frac{1}{2}$ full. When Sophia put 7 in her bag it was $\frac{1}{4}$ full. Who had the biggest bag?

5. Marvin counted the marbles he had collected. He counted more than 40 but less than 70. When he put the marbles in groups of 5, he had 1 left over. When he put them in groups of 4, he had 1 left over. When he put them in groups of 3, he had 1 left over. How many marbles did Marvin collect?

Closure:

"The opposite of a problem would likely be the correct solution."— Joey Lawsin

Appendix L

Photo Opportunities


God Bless Us

C U R R I C U L U M V I T A E

ANNALYN O. CANALETA

San Nicolas 3, Bacoor City

annalyn.canaleta@yahoo.com

Educational Background

Elementary: Aniban Central School (1991 – 1997)

Secondary: St. Michael's Institute (1997 – 2001)

Tertiary: Philippine Normal University (2001 – 2005)

Bachelor of Science in Mathematics for Teachers (BSMT)

LET Passer (October 2005)

Graduate: Philippine Normal University (2009 – 2014)

Master of Arts in Teaching Mathematics

(MAT – Mathematics)

Professional Experience

Bacoor National High School (Villa Maria Annex) – Teacher II (2010 – present)

Bacoor National High School (Tabing Dagat) – Teacher I (2009 – 2010)

Saint Vincent De Paul College – Teacher (2005 – 2009)

Seminars/ Trainings Attended

- The Teacher's Treasure Chest Course (A Gabay Guro Project)

  Bacoor Coliseum

  October 5, 2013

  Participant

- Saturday Program in Mathematics for Regular Pupils–MTAP

  Bacoor National High School – Villa Maria Annex

  August 31 – October 5, 2103

  Trainor – Grade 7

- 2013 Division Math Olympiad

  Bacoor Elementary School

  September 12, 2013

  Technical Working Committee

- Trainer's Training Workshop on 2013 MTAP – DepED Saturday Mathematics Program

  Bacoor National High School – Molino Main

  August 16 – 17, 2013

  Participant/ Master of Ceremony

- Technical Committee E – Learning using Academic Fitness with Microsoft Applications

  Bacoor Coliseum

  July 13, 2013

Participant

- In – Service Training on Test Construction and Orientation Program

  Bacoor National High School – Molino Main

  May 29 – 31, 2013

  Lecturer

- Division Seminar Workshop on Test Construction for Grade

  Seven School Coordinators and Department Heads

  Trece Martires City National High School

  May 9 – 11, 2013

  Participant

- Division Orientation – Workshop on the Use of Revised SBM

  Assessment Process and Tool (APAT) in Assessing Schools SBM

  Level of Practice and PASBE Accreditation Process

  Trece Martires City National High School

  March 14–16, 2013

  Participant

- Orientation Workshop in the Implementation of Assessment and Rating

  of Learning Outcomes and Selection of Honor Students/Pupils on K to

  12 – Basic Education Curriculum

  Tanza National Comprehensive High School

  January 8, 2013

  Participant

- Division Seminar – Workshop in Addressing the Least Mastered Competencies in Mathematics

  Trece Martires City National High School

  Oct. 23–25, 2012

  Lecturer

- Regional Training of Grade 7 Teachers on the K to 12 Curriculum

  De La Salle University – Dasmarinas Campus

  May 14 – 19, 2012

  Participant