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Conceptual Understanding and Procedural Skills and Attitude of Grade 7 Pupils on Integers

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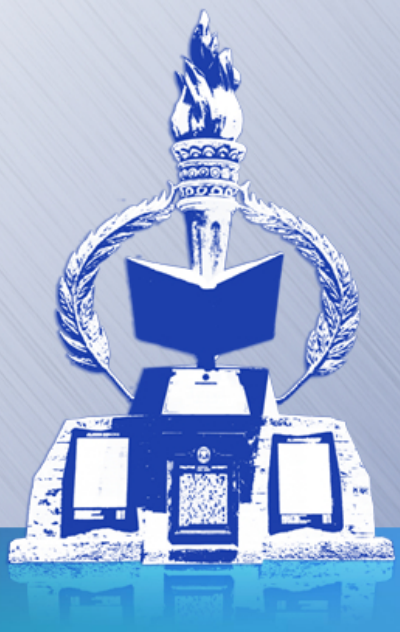

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CONCEPTUAL UNDERSTANDING AND PROCEDURAL SKILLS AND ATTITUDE OF GRADE 7 PUPILS ON INTEGERS

A Seminar Paper
Presented to the College of Graduate Studies
and Teacher Education Research
Philippine Normal University
The National Center for Teacher Education

In Partial Fulfilment
of the Requirements for the Degree
Master of Arts in Teaching
with specialization in Mathematics

by:
Rochelle O. Elcarte
March 18, 2014

APPROVAL SHEET

This seminar paper entitled **"CONCEPTUAL UNDERSTANDING AND PROCEDURAL SKILLS AND ATTITUDE OF GRADE 7 PUPILS ON INTEGERS"** prepared and submitted by **ROCHELLE O. ELCARTE** in partial fulfillment of the requirements for the degree, Master of Arts in Teaching Mathematics is hereby recommended for acceptance.

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R.O.E

DEDICATION

This research work is especially

dedicated to my beloved parents

Mr. Romulo S. Ordiales and Mrs. Lucia A. Ordiales

my sister Rochie O. Evangelista;

my two lovely children

Ate Ynah and Biboy for giving

joy, love and inspiration

while doing the research

they are the love of my life and

the reason why doing this study;

the special person in my life

Romel R. Elcarte

Who inspired, encouraged, and provided me with

All the support to finish this study.

Above all,

to **GOD Almighty**,

the source of all wisdom and skills

Who

always

showers HIS blessings

and

to make

this

simple work

a

reality

ABSTRACT

Researcher : **Rochelle O. Elcarte**

Title : **CONCEPTUAL UNDERSTANDING AND PROCEDURAL SKILLS AND ATTITUDE OF GRADE 7 PUPILS ON INTEGERS**

Key Concepts : **Conceptual Understanding, Procedural Skills, and Attitude towards mathematics.**

Degree : **Master of Arts in Teaching (MAT)**

Specialization : **Mathematics**

Adviser : **Dr. Elisa S. Baccay**

The main purpose of the study was to determine the conceptual understanding and procedural skills and attitude of grade seven pupils on integers during the school year 2013-2014. The study used descriptive method of research in looking into these three variables.

To determine the attitudes of pupils towards mathematics an attitude scale was also developed. The data reveals that the level of conceptual understanding on integers of pupils was below mastery level and above average on procedural skills on basic concepts on integers.

It is recommended that in order to establish better conceptual understanding, basic concepts should be given more emphasis when teaching integers. They should include different activities for them to really understand the concept of integers. One way of doing this would be peer groups, brighter students could teach those who need help in mathematics. And in-service training programs and summer institutes in mathematics should be regularly conducted to enable the mathematics teachers to update themselves with the new strategies and concepts of teaching integers.

It was found out, that the level of conceptual understanding and procedural skills on integers were significant . Furthermore, there is a significant relationship in the conceptual understanding, procedural skills and academic performance of the pupils. Also, the attitude towards mathematics of the pupils is positive.

To improve performance of the pupils, all possible and available materials needed for the teaching of integers especially computing signed numbers should be provided in order to bring the pupils to real life situations and to make learning more meaningful and practical.

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THE PROBLEM AND ITS BACKGROUND

Introduction

The economic growth of any nation depends to a large extent on the kind of Mathematics education its citizens get. Mathematics is an important tool in the workplace. Thus, teachers play important roles in developing the mathematical skills and competencies of pupils. These skills and competencies include reasoning, problem solving, decision making and other higher order thinking processes (NCTM, 2000). In the past, teachers stressed mastery of basic mathematical facts and algorithm. Today, educators focus on meaningful understanding of underlying concepts before applying these concepts to solve real life problems. This understanding constitute the building blocks towards constructing lifelong learning and the capability to use that learning to build new knowledge and apply them to "situations which are of significance to their private, social and professional lives" (Nisas cited in Ernest, 1991). Effective mathematics teaching requires understanding what the students know and need to learn and then supporting and challenging them to learn it well. Students learn mathematics through experiences that teachers provide. Teachers need to know

and understand deeply the mathematics they are teaching and understand and be committed to the students as learners of mathematics and as human being (Rivera, 2006). Checking for understanding plays an important step in teaching

and learning process. The background knowledge that pupils bring into the classroom influences how they understand the material that the teacher shares and the lessons or learning opportunities that the teacher provides.

In today's knowledge-based digital age, mathematics education is undergoing a rapid change. There are growing concerns to shift from traditional method to teaching and learning with understanding along with the development of students' problem-solving and critical thinking skills. It is imperative to prepare students for a knowledge-based populace (Clabaugh, 2009). Reformed pedagogies demand that students take ownership of their learning and construct knowledge as they interact with the dynamic environment.

Understanding of integers and operations with integers is an important preparations for other mathematics tasks. Integers are the set of positive whole numbers, negative whole numbers and zero. Integers are a number and operations concept that is foundational in mathematics. It finds applications in other fields such as science, business, and statistics. Presently, students struggle with this foundational concept, particularly around negative numbers (Ryan & Williams, 2007). When mathematics task involve negative numbers or a

combination of positive and negative numbers, problems arise. Sometimes weaknesses in the concepts and procedures engender frustration and negative

attitude towards mathematics. Many students struggle with understanding integers and accuracy of computation with integers. This weakness is seen in errors on students work in middle school math computation problems, high school algebra equations, and even in college mathematics, statistics, and science course work. The mathematics education community has struggled to find an instructional model that effectively supports students in constructing a rich conceptual understanding of integers and of negative numbers, in particular. Such a model would need to address the purpose of the negative numbers and justify the arithmetical operations on them in order to be comprehensive. A literature review of instructional strategies, curriculum, and research on integers revealed the following models commonly used in classrooms K-8: Annihilation model with counters or chips (Baroody & Coslick, 1998), movement on the number line (Baroody & Coslick, 1998; Cemen, 1993; Davidson, 1987, 1992; Page, 1964); transformations of an object‘s position and state (Schwarz, Kohn, & Resnick, 1993/1994; Thompson& Dreyfus, 1988); elevator or elevation model (Dahl, 1972; Froman, 1973; Janvier, 1983, 1985; Luth, 1967); use of metaphors for example, people getting on and off a bus (Davis, 1967; Streefland, 1996; Williams &Linchevski, 1997); technology, such as, calculators and virtual Manipulatives

(Browning & John, 1999; Utah State, 2008); and other real world applications, to name a few, money, temperature, and yardage in football (Davidson, 1992; Sheffield & Cruikshank, 2001).

According to Baccay (2003), assessment of student achievement Is an important part of decision-making. She said that decisions on Instructional processes, cognitive learning, student motivation, learning styles and other educational concerns are based on the results of assessment. She added also that the conventional methods of assessment need to be supplemented by other forms of assessment in order to discover what students really know and what they can do. Checking for understanding corrects misconceptions and can improve learning. This is a systematic approach to formative assessment (Mctighe, 2007). Pupils often struggle, especially in primary school where basic Computation and “right answer” are stressed. Often they end up in remedial classes, even though they have a high level of potential for higher-level mathematical thinking.

To encourage pupils performs better in Mathematics, teachers should inspire them rather than intimidate by the power of Mathematics. When pupils are inspired they will be more comfortable with numbers and will study harder. They will be more active if they experience different group activities. People should be involved as decision makers by giving them the chance to discuss their own way of getting the answer. High School students attribute their difficulty in approving

a statement to their problem in understanding mathematical concepts. In proving tasks, a student cannot a proof or continue a proof or give correct statements because of his or her wrong conceptual understanding (Cannoy, 2007). Some

pupils also have difficulty making meaningful connections within and across mathematical discourses and experiences. A pupil may not readily comprehend the relation between numbers and the quantities they represent. Lapses in making connections may result in poor comprehension leading to poor performance in mathematics, As Meyers suggests , linking concepts is what enables people to form abstract ideas and generalizations. The ability to compare and contrast principles as well as the ability to correlate ideas in mathematics depends on a person's conceptual understanding of the material(Dossey, Giordano, MCVrone, Weir, 2002). Mathematics is one subject that requires pupils to fully grasp conceptual understanding. Without the ability to interconnect concepts, the process of learning Mathematics would become disjointed and illogical (Marshall, 2006).Integers is one of the most important areas of Mathematics about the world. It provides experiences that help pupils develop understanding on numbers and their properties. It enables them to solve relevant problems and to apply integers to real-world situations. It is a fundamental component of mathematics learning for it offers ways to interpret and reflect on our everyday life and can serve as a tool for the study of other topics in mathematics and science as stated in the standards for School

Mathematics released by the National Council for Teachers of Mathematics (NCTM, 2000b).

There are many approaches to learning and about learning to teach. One is to focus on the specific thing a teacher must do and how this will affect pupils' academic performance (David, 2000). These observations eventually led to the conduct of this study. Being a mathematics teacher there were situations when difficulties arose in developing the learners' ability to apply mathematical concepts and skills in solving problems in everyday life. This study is an attempt to look for a better way to make the teaching of mathematics more meaningful and interesting. This was also aligned to the vision and mission of Commonwealth High School – Quezon City, where mathematics teaching aims to equip the learners with the basic mathematical concepts and skills not only with mastery but also with understanding. Among the basic mathematics areas, basic concepts in integers were selected as the focus of this study. The result of this study may help identify the needs of each student in learning integers and in making important instructional decisions.

Conceptual Framework

The National Council of Teachers of Mathematics Standards require that students know the procedures and understand their conceptual base. Yet there

are two types of knowledge. One is referred to as the conceptual change view and the other as empiricist view. At the dawn of behaviourism, constructivism became the most dominant epistemology in education. From the constructivist idea of Jean Piaget, Ernst von Glasersfeld (1995) evolved with a modified view of

constructivism better known as radical constructivism. Knowledge, according to his epistemology, is not passively received, nor can it be transmitted. It is actively built up by the cognizing subject. Cognition serves the individual's organization of her experiential world , not the discovery of an objective ontological reality. Although the social environment constrains the construction of knowledge, radical constructivism is an individualistic epistemology, which entails that agreement cannot be forced or bought but must borrow from conviction. It comes as a wholesome corrective both scientific totalitarianism and religious dogmatism for those who believe that truth is mystically accessible but cannot put into words, it would seem to be the epistemology of choice.

Constructivism as defined by Brashier (2000) is a "learning theory in which educators view students as active participants who construct their understanding of concepts, as meaning makers rather than empty vessels into someone can transfer pre-organised knowledge.

In the Schema Theory of Learning of Piaget (1926), learning occurs when pupils construct at their own knowledge by connecting new knowledge structures

to the structures of knowledge already in mind. Further to his theory, Bruner (1986) who was also a constructivist, said that pupils build knowledge based on previously learned information in a spiralling fashion, which enables learners to connect prior schematic concepts. Bruner says that knowing is a process. His work focuses on the importance of understanding the structure of the subject

being studied and the need for active learning as the basis for understanding (in G.K. Clabaugh, 2009).

Conceptual understanding involves the ability to apply knowledge across a variety of previously un-encountered instance (Darmofal et. Al,2002). As the students enter the classroom, They bring a particular idea to a topic on the subject they are about to learn. When the Students listen to the teacher or perform an activity for a particular topic they are developing a concept in the course of their learning process. The teacher tries to present concept in the course of their learning process. The teacher tries to present concepts differently for a student to understand. The students on the other hand ey are not confined to meaning of words and pictures. They are a kind of subject they are taking and they understand that there is a senting something that needs to be absorbed And mastered.

In constructivism terms, Hay and Barab (2009) as by the degree of active learner engagement as well as the assur arners have the ability to create meaning, understanding, and know nts are not passive receptacles of the knowledge that teacher impart when

students play an active role in rediscovering the integer conc selves, they will not be able to realize but also be motivated to ex ir own conclusions are true. Integers, Moreover, This study looked onship of these variables to academic performance.

MATHEMATICS PERFORMANCE

Conceptual Understanding

* Name
* Express
* Identify

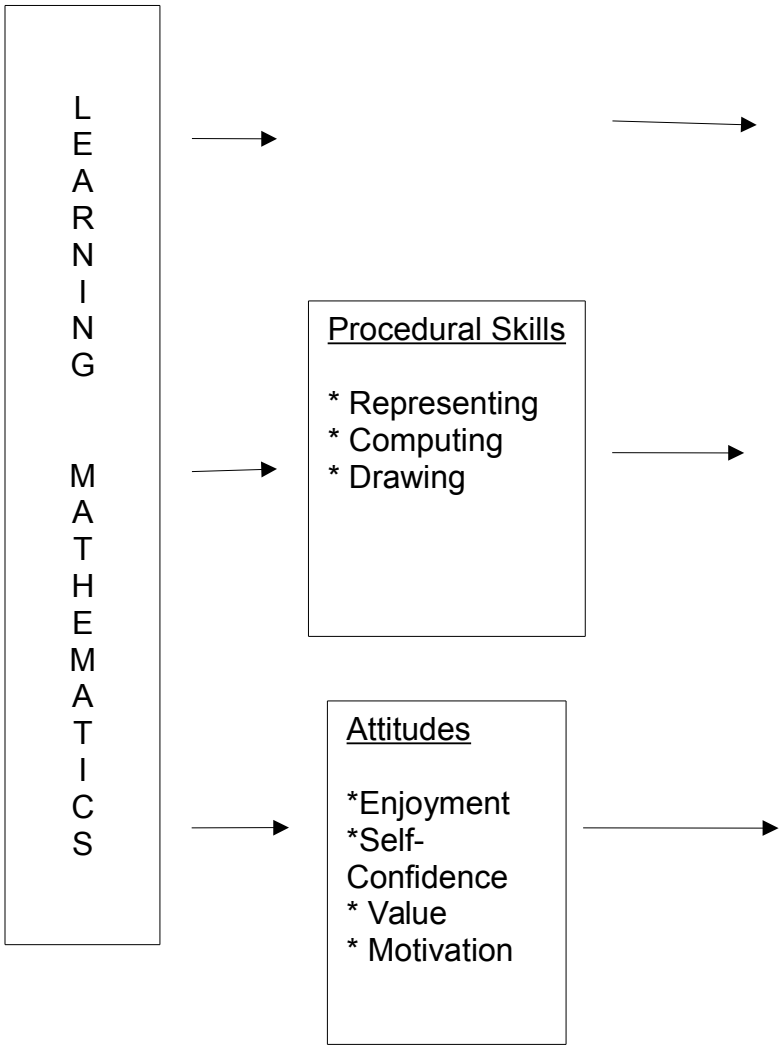

Figure1 : Conceptual Paradigm

Learning mathematics needs conceptual understanding, procedural skills and attitude towards mathematics to academic performance. Students demonstrate conceptual understanding and procedural skills in mathematics when they provide evidence that they can recognize and generate examples of concepts; use and interrelate models, diagrams, drawing, computing, identify,

manipulatives, and varied representations of concepts, and terms used to represent concept. Furthermore, teachers should give exercises designed to boost positive attitude towards mathematics to achieve positive mathematics performance.

Statement of the Problem

The study aimed to describe the conceptual understanding on Real Numbers, Integers ideas of grade seven pupils of the Commonwealth High School, Quezon City S.Y. 2013- 2014.

Specifically, this study sought answer to the following research questions:

1. What is the level of pupils' conceptual understanding and procedural skills on some selected topics on Integers?

2. What are the attitudes of grades seven pupils towards mathematics?

3. Is there a significant relationship between the following pairs of variables?

   3.1.1 Conceptual Understanding and Procedural Skills.

   3.1.2 Conceptual Understanding and Attitude Towards Mathematics.

   3.1.3 Procedural Skills and Attitude Towards Mathematics.

4. Which among the following variables are significant predictors of

academic performance?

a. conceptual understanding.

b. procedural skills.

c. attitude towards mathematics.

Significance of the Study

The result of this study would provide information concerning the conceptual understanding and procedural skills on selected topics on integers of the grade seven pupils in Commonwealth High School- Quezon City. In particular, this study will be beneficial to the following :

***Mathematics Teachers*.** This study will provide them with information about pupils' strengths and weaknesses on conceptual understanding and procedural skills on integers.

* ***Pupils*.** The result of this study will provide the teachers insights on how to make the learning of integers more suitable to the level of the pupils.

* ***Administrators*** **.**The result of these study is important to administrators,

because they can use the findings as feedback to their teachers in mathematics.

* ***Future Researchers*.** The result of this study will give inputs to future

researchers who would like to conduct a relevant study.

Scope and Delimitation of the Study

This study focused on the description of pupils' conceptual understanding and procedural skills and attitude on some selected topics in integers. It also described the pupils attitudes towards mathematics. The respondents of this study were selected grade seven pupils of Commonwealth High School Quezon City during the school year 2013 – 2014. Specifically, the study was conducted before the second quarter ended. The topics covered in this study included negative numbers, the four fundamental operations of addition, subtraction, multiplication and division of integers. The conceptual understanding includes skills such as identifying, classifying, describing and naming (NCTM, 2000b). The procedural skills include drawing, sketching and solving (NCTM, 2000b). Also on Dep.Ed k-12 curriculum, the level standards of grade 7 were learner demonstrates understanding of key concepts and principles of number sense, measurement, geometry, probability and statistics as applied using appropriate technology in critical thinking, problem solving, reasoning, communicating. Making connections and representations. Attitude towards mathematics was categorize into enjoyment, self- confidence, values and motivation.

Data pertinent to this study consisted of information collected through a developed test instrument, attitude scale and interviews.

Definition of Terms

To have a clearer understanding of the contents of this study the following terms are defined operationally.

* ***Academic Performance.*** It refers to how well a student accomplishes his or her tasks and studies. In this study, it refers to the grade point average of the respondents from first to second quarter.

* ***Attitude.*** It is the tendency of an individual to respond positively or negatively to some object, situation, concept or another person. In this study it refers to the pupils' attitude towards mathematics as measured by the attitude scale.

* ***Conceptual Understanding.*** It is the comprehension of mathematical concepts, operations and relations. In this study, it was measured through a developed test covering selected topics on integers. (Appendix A)

* ***Expert.*** This refers to a person who has adequate knowledge of concepts and in a particular subject matter or field of study. In this study, it refers to mathematics professors and academicians who evaluated the test instrument before it was administered to the respondents.

* ***Grade Point Average*.** This refers to the academic performance of the respondents during the first and second grading period of the school year 2013 – 2014.

* ***Procedural Skills*.** This refers to students' progress demonstrating their application of knowledge or symbolic representations, skills and attitudes. It involves mathematical skills with the help of pen and paper, calculator and so on. In this study, performance task is used in a performance assessment (Appendix C)which measures conceptual understanding and procedural skills of the pupils.

Chapter II

REVIEW RELATED LITERATURE

This chapter presents both conceptual and research literature which are related to the present study. The literature were obtained from both foreign and local sources which helped in the development of the conceptual framework of this study. Included in this chapter are three lines of research were reviewed: how to develop understanding of integer operations through instructional strategies and representations; how to use mathematical discussions to improve understanding, specifically one method called argumentation; and how to develop and research teacher professional development to improve teacher pedagogical content knowledge and eventually improving student understanding. Based on this literature review, the researcher suggests that there is a need for additional research on the topic of integer operations focusing on instructional strategies to improve professional development and to improve student understanding, which is the focus of this study.

Developing an understanding of integer operations

To determine what background the teachers and students may already have related to integer operations and what research has shown to be most

effective in terms of instructional strategies and representations, a review of literature was conducted focusing on three main developmental time periods in a child‘s education: early elementary, middle grades, and high school. This first review of literature, shows the work that has been done, primarily with small samples of students, and mostly of a qualitative and descriptive nature, to begin to understand instruction related to this mathematical concept of integer operations. The researcher suggests what are needed to move forward are larger scale studies, with qualitative and quantitative methods, to begin to inform future curriculum development and instruction for pre-service teachers and in-service teacher professional development. Children are typically first introduced to negative integers in upper elementary grades, using two informal semantic models. These models are helpful because they are direct examples of the properties of integers (Schwarz, Kohn, & Resnick, 1993, 1994). In the annihilation semantic model, children are told that there are positive integers and negative integers, that they are represented as collections of positively charged and negatively charged particles (respectively), and that there is a rule that allows one to cancel out a positive particle by a negative particle resulting in what some call a "zero pair" (Hayes &Stacey, 1999; Liebeck, 1990). In the extended number line semantic model, children are told that the natural number line they have been using extends not only to the right of zero, but it also extends to the

left of zero. With this model they learn that positive integers correspond to movements to the right, and that negative integers correspond to movements to

the left (Hativa& Cohen, 1995; Kent, 2000; Moreno & Mayer, 1999; Thompson & Dreyfus, 1988; Varma, Harris, Schwartz, & Martin, 2009).The annihilation and extended number line models allow children to solve integer addition problems and some integer subtraction problems; however, they are not as good at explaining the procedure for subtracting a negative integer, because situations require the addition of zero pairs in order to physically subtract from a given amount (Hayes & Stacey, 1999; Liebeck, 1990; Moreno &Mayer, 1999). For this reason, many teachers transition their students quickly to a more symbolic understanding of integers once they have the basic intuitive understanding mastered(Thompson& Dreyfus,1988). In middle school, students are often taught rules for integer arithmetic, such as that rule that says when a negative number is multiplied by a negative number the result is a positive answer. Then in high school, students are introduced to an additional rule for multiplying an inequality by a negative. Based on the researcher‘s review of literature on students‘ developing integer understanding in grades K-12, it appears that the mathematical community has been in search of a model that will satisfy the need for the negative numbers, justify the arithmetical operations on them, and explain the relationship between the operations. Fischbein (1987) argued against using the existing models for negative numbers (annihilation and number line models). Fischbein explained that the models lack ―comprehensiveness,‖ and were

based on artificial conventions which do not address the challenges that students are faced with when working with negative numbers. This literature review will lay the foundation of the current practices in K-12 education related to integer understanding as well as to the research on strategies for improving such understanding in order to illuminate the current state of what is known about the development of integer understanding in students and to inform the development of the research questions for this study.

Laying a Foundation: Kindergarten to Grade 2

Number Concepts

Before introducing integer concepts to students in upper elementary grades, it is important to consider the foundations that have been laid in grades K-2 in order to connect with prior learning about numbers and operations with whole numbers. An understanding of ordinal and cardinal properties of numbers is also an important prerequisite for students in Kindergarten to understand integers. In a study conducted by Davidson (1992) of 4-7 year olds Davidson found that children use actions that are familiar to them to represent negative quantities. At this age, the children most often described zero as ―nothing‖ instead of an actual number. At these ages, the children also showed the beginning ability to combine positive and negative amounts. The findings showed that students had difficulty coordinating the cardinal and ordinal2 meaning of

negative numbers, which Davidson attributed to the lack of experience in the children‘s everyday lives with ordinal evidence compared to cardinal evidence of negative numbers. 2 Davidson suggests that the following activities be used with students to develop Intuitions about ordinal properties and their relation to cardinal properties: (a) moving steps from a starting point and then retracing the steps back to and beyond the starting point, (b) marking the path with units to make it easier to retrace one‘s steps,(c) verifying the number of steps required to arrive at the new position and then confirming when retraced that the same number of steps were completed, and (d) using the concept of a starting point as an intuitive basis of zero (p. 21). Page (1964) showed how the number line can be explored by young students with a cricket jumping along the number line. Page shares a few ways that young children spontaneously discuss numbers that are negative: —under two,‖ —goodbye two,‖ —two below zero.‖ Some students even come up with unique Ways to label the numbers below the zero such as B1, B2, B3, for below by 1, below by 2, etc. (Baroody & Coslick, 1998), p.8.22Representations There are different representations of numbers that students explore at this early age. Using concrete objects, such as counters, to represent and develop number sense is one recommended way to introduce counting to young students (National Council of Teachers of Mathematics, 2000). The concept of zero can be introduced by putting different amounts of counters in different boxes and leaving one box empty to represent zero (Sheffield & Cruikshank, 2001). When exploring real world situations, students may naturally discover the negative numbers or ask questions about such things, which will be

a way to get them thinking about integers at an early age. For example, one might show students the negative numbers on a thermometer and discuss what kind of temperature would be measured in negative degrees (Sheffield & Cruikshank, 2001). As these studies have shown, there are valuable experiences that children in K-2nd grade can be exposed to in order to begin learning about integers.

Early Introduction and Exploration: Grades 3-5

Typically students begin to be introduced to and to explore integers (positive and negative numbers) in grades 3 through 5. This is often done through activities which extend the number line to the left past zero, exploring real world situations of temperature or bank accounts, where negative numbers are needed, and through literature connections that introduce the larger world of numbers to upper elementary students. However, one group of researchers studied the effect of early instruction in the rules of integer operations with third grade students and found that the students‘ knowledge of rules for operations that they were taught in school negatively affected their problem solving).(Nunes, Schliemann & Carraher, 1993) as they attempted to apply these rules without any conceptual understanding. For the most part research for this age group has focused more on conceptual development through different models or representations of integers and integer operations (Cemen, 1993; Hativa and Cohen, 1995).

Number Line Activities

Cemen (1993) in an article in ―The Arithmetic Teacher‖ described a strategy for number line could be made on brown paper or computer printer paper. It should be large enough for all to see when it is taped to the board in the class room. Students would be given their own small number line for their desk that could be used with a cut out figure of a person to move around along the number line. Students then could discover the computational rules. For example, adding two numbers with the same sign would mean moving in the same direction on the number line. When the signs are different, the figure would be moved in the opposite directions. Cemen explained that when the numbers have different signs, they "pull" against each other as in a game of tug-of-war. The sign of the sum would be the sign of the one that pulls harder. Subtraction on the number line would be illustrated by turning it around, which distinguishes between the negative sign as part of the number and the subtraction sign as an operation. Subtracting a negative would mean turning the figure around and walking the figure backward. This would be the same as adding a positive (not turning around and walking forward). This eventually would lead to the rule of adding the inverse. This strategy gets at concepts of magnitude (size of movement), direction (changes in location), and inverse. Hativa and Cohen (1995) conducted research in two fourth grade classes in Tel- aviv, one was assigned as treatment and one as control. They used a computer program called

The Challenger that provided a number line model for students to use to explore integer operations to reach a target number. Hativa and Cohen (1995) classified five types of problems and related student misconceptions that Involved integers: (a) subtracting a positive number from zero, (b) subtracting a Positive from a smaller positive number, (c) adding two negative numbers, (d) adding opposites (-7 + 7) , and (e) adding a positive to a negative. They found that when students are given a problem involving subtracting a positive from a smaller positive number (4 – 7) that students often would solve it the same as they would the reverse (7 – 4) as if the commutative property held true for subtraction. When given a problem involving adding two negative numbers, students often subtracted the numbers, because they assumed that a minus sign anywhere meant subtraction. When given addition of opposites (-7 + 7) the students would often just add the magnitudes (14). These challenges involve an understanding of operations and signs that are very different mathematical concepts. Students who were in the treatment group made statistically significantly greater gains in achievement based on pre and post treatment interviews.

The research of Cemen (1993) and Hativa and Cohen (1995) informed the development of the PD and the curriculum for this study. The teacher PCK assessment for this study included two items from the research of Hativa and Cohen (1995) to assess teacher understanding of the difference between an operation and a sign in an expression. The research of Cemen (1993) informed

the development of teacher and student activities using the number line representation for this study.

Number Line Model

Several researchers have studied the use of number line models with children using computer worlds for their investigation of integer operations. Thompson and Dreyfus (1988) conducted a small study observing two grade 6 students over a six week period as they used a computer program to move a turtle on the screen right and left to explore integer operations as transformations. A negative number command cause the turtle to turn around and walk the number of steps. There is a distinction made between the state (position) and the integer (change of position). After the turtle completed its movement it would turn back around. The students were asked to predict the result of a command, execute the command, and then discuss their prediction. The goal was for the students to move towards forming a generalization. Students learned that a ―negative –negative‖ is turning around twice. To solve the expression 3 – (-5), the turtle would walk three steps forward, turn (subtract), and then turn again (negative) to face the same direction before walking five steps forward. Schwarz et al. (1993, 1994) conducted a similar study with trains in a computer environment called ―Trainworlds‖ with 4 grade 5 students. The trains in this program had magnitudes and were color coded (white, grey) for

direction. The operations of cutting or gluing trains were used to represent binary addition and subtraction. Loading and unloading trains were used as unary actions (positive or negative) on trains. Comparing trains was used to demonstrate relations between negative numbers. Three of the four students were able to successfully map the situation in the post-test to the train model to solve the problem. Colthorp (1968) also researched use of the number line model by conducting a study with two teachers each teaching one intervention class and one control class of grade 6 students. The intervention class was given instruction with a concrete number line approach and the control class was given more of a rule based instruction using the algebraic approach. There were no statistically significant differences in achievement at the end of the program between the groups.

In summary, the number line model shows promise for helping teachers and students understand conceptually the role of an operation and a sign in terms of the magnitude and direction of movement. However the results of the use of this representation on student achievement is mixed; therefore, additional research is needed.

Cancellation Models

Some might wonder which model or strategy is best, the counters or the number line. Van De Walle and Lovin (2006) suggest that students should be allowed to experience both models and explain how the two models are alike. They recommend developing an integer understanding using both models at the same

time to help students connect the two models. Wilkins (1996) conducted clinical interviews with 16 grade 6 students and Identified the strategies students preferred to use to solve integer addition and subtraction problems and the accuracy of use of the different models. When given choice of a model to use, 50% of the students chose to use a mental model, 23% used a number line, and 27% used two-colored counters. However the students who used mental models were only successful 65% of the time, students who used the number line were accurate 70% of the time, and students who used colored counters were correct 75% of the time. The results showed that students who used the number line and two-colored counters were more successful than those who used mental models. The problems students were given were situated within real world contexts such as temperature, weather, mail delivery. Students tended to use continuous models for continuous situations (number line) and discrete models for discrete situations (counters). 3 Due Ball and Hill (2009) observed a grade 7 mathematics teacher conducting a lesson on integer operations with black and red chips. The students would match up each black chip with each red chip and then count the chips left over. However when the teacher modeled how to do a subtraction problem with these colored chips, the students had difficulty understanding the representation. The teacher observed was also not sure of the representation and decided to put the colored chips away and focus on a rule or strategy for converting the subtraction into addition, but then confused the students by trying to connect to a real world experience of money and debt. In order to have continued with the chips, Ball and Hill (2009) point out that the teacher could

have referenced the usual —take away‖ or regrouping‖ method, by thinking that three red chips need to be taken away, but there are only two to take away, so another red chip can be created by adding on a zero pair (one black chip and one red chip). Once three red chips are removed, there would be two black chips left. This shows that chips can be a challenging representation for modeling subtraction.

Hackbarth (2000) conducted research with of 68 grade 7 students and looked at the impact of two different manipulatives versus instruction just using the rules for integer addition and subtraction. One group (N = 23) was given —plus-minus‖ pieces, another group was given two colored chips (N = 22) and the control group (N =23) was given instruction on the rules for the operations. The plus and minus pieces were created from tile spacers in the shape of a plus and ones that had both sides cut off to form a minus. The colored chips were red on one side and yellow on the other side. The rule was based on the following abstract method a - b = a + (-b). Hackbarth (2000) found no statistically significant difference between the performance on pre, post, and retention tests (teacher made) of the three groups based on instructional method. This suggests that cancellation may not be the best instructional approach. McCorkle (2001) compared two groups of grade 7 students, based on Performance on a pre-test, post-test and follow up retention measure on integer understanding of operations of addition and subtraction. The intervention group received instruction using a relational approach where students were able to manipulate a thermometer scale with the concept of —hot cubes‖ and —cold cubes.‖ The control group was

taught with an instrumental textbook approach using the algebraic rules. Students in the intervention group on average scored higher and had better retention than students in the control group. The results of this study suggest that use of cancellation may be associated with student understanding of addition and subtraction of integers. In summary, the effects of cancellation models are mixed. McCorkle (2001) found positive results of using cancellation with addition and subtraction. Hackbarth (2000) found no significant difference between achievement of students following instruction with rules compared to use of cancellation. Ball and Hill (2009) found evidence of cancellation being challenging with subtraction for both teachers to implement and for students to use as a representation. Therefore, the evidence does not show that use of counters and a cancellation model is more effective than the number line representation.

Conceptual Understanding in Mathematics

Mathematics provides mankind with powerful tools and computational techniques to advance understanding of the world (Seitelman, 2009) Cognitive psychologist believe that learning is a very personal matter and that true understanding involves an internalization of concepts and relationship by the individual involved the application of mathematics to various fields has led to engage in productive and creative pursuits. Hence, it is imperative that mathematics concepts and skills should be fully understood (Post, 1988).

Malunes, Jr. (2005) Stated that understanding of concepts in mathematics is the key to its successful study and understanding. Much have been said on research effort that have focused on a major reform of current reform efforts is to

help students to learn mathematics with understanding. Learning becomes more meaningful when the learner is aware of instructional processes. Hence, teachers must provide opportunities for students to think about the “what” and the “how” of learning mathematics. One of the challenging task in learning mathematics deals with the numbers/integers.

Students demonstrate *conceptual understanding* in mathematics when they provide evidence that they can recognize, label, and generate examples of concepts; use and interrelate models, diagrams, manipulatives, and varied representations of concepts; identify and apply principles; know and apply facts and definitions; compare, contrast, and integrate related concepts and principles; recognize, interpret, and apply the signs, symbols, and terms used to represent concepts. *Conceptual understanding* reflects a student's ability to reason in settings involving the careful application of concept definitions, relations, or representations of either.

As noted by the National Research Council (2001), when pupils have conceptual understanding of the mathematics they have learned, they "avoid many critical errors in solving problems, particularly errors of magnitude."Getting students to see connections between the mathematics they are learning and what they already know also aids them in conceptual understanding. The NCTM

Principles provides an excellent conclusion to the discussion of conceptual understanding:

Learning with understanding is essential to enable students to solve the new kinds of problems they will inevitably face in the future.

Teachers of mathematics must create opportunities for students to communicate Their conceptual understanding of topics. This may involve lesson structures that require a change in pedagogical techniques. Ideas for supporting students in developing conceptual understanding of their mathematics must be provided in resources for teachers.

Conceptual Understandings and Theories of Negative Numbers

Negative numbers focuses on the meta-cognitive awareness of the conceptual process and allows for the deeper understanding of the concept of negative numbers. The negative sign plays a large role in understanding of negative numbers. The idea of the conceptual understanding in negative numbers leads to the fact that negative numbers are to be scaffolded and developed. Negative numbers according to Vosniadou (1994) are conceptualized when students take what they already know and work with their prior knowledge to construct meaning for the given formula. The article by Vlassiss (2004) states that in order to understand equations, students need to know the conceptual understanding of how to do algebra and occasions. Students have increasing difficulty when it comes to adding in negative numbers into equations. This could be due to the fact that many students do not have a solid understanding of how

to work with the equations and leads to further difficulty when negative numbers are added.

Murphy and Medin (1985) state that there are some conceptual cases in Understanding that are more important than others. They call this to prototype where the students will often have one idea that they initially have and it shapes the way that they view all of the other problems. The particular prototype can also interfere with learning new information, for instance in learning Geometry the students original ideas about the subject or theorem may conflict with the new(abstract one).

Vlassiss (2004) also adds that many times students will have difficulty in learning negative numbers because it does not match with their current ideas relating to natural numbers. The use of negative numbers conflicts with their original idea of how numbers are supposed to operate. Therefore, leading to difficulties in learning and comprehension. Vygotsky (1997) claims that people learn best by language. In the case of Vosniadou the students were not able toexplain how they came to their answer which showed a deficiency in conceptual understanding. Vosniadou (1994) explains the importance of meta cognitive awareness. It was apparent in the discourse that students were not able to explain the meaning or their understanding of how they came to their conclusion on negative numbers and polynomials. This misses an important step in conceptual change where students are first able to change their initial understanding of the algebraic function dealing with negative numbers and have flexibility in dealing with negatives. Shefard (2000) claims that an alternate way to

learn about negative numbers is through a process that is known as commognitive reasoning. This is where students are given conflicting information and are to work with various perspectives. She also states that the ability for students to learn is dependent on scaffolding and allowing the students to work with an expert in the field so that they can model the appropriate format and learning for the beginning student. It allows for the use of development and knowledge expansion through the guidance of a more experienced individual. The process is called the teacher learner process where the students and teachers form a relationship that involves the teacher as the active lead that fuels learning. The processes and cognition that are included in learning negative numbers allows us to better understand how to teach students and to assist them in conceptually understanding the content. Van De Walle recommends a few strategies and activities that can help students understand the concept of negative integers through relating the mathematical concept to real life situations. Here are a few examples to consider:

- **A loss of money is a negative cash flow**
- **Slowing down a car is negative velocity**
- **Driving in reverse is negative velocity**
- **Below-zero temperature is negative related to scale**
- **Below-ground level is negative related to scale**
- **A football field has two sides to them starting from the center.**

• **Bank statements have Credits (+) and Debits (-)**

Improving Teacher Content Knowledge Related to Integer Operations

In order to develop deep conceptual understanding of integers within students, teachers need to have a deep flexible content knowledge in the courses they teach. In work with pre-service and in-service teachers, several authors emphasize that teachers need to not only understand the facts and concepts of their discipline, but also the way the concepts are connected and the way members in their field go about creating new knowledge and determining the validity of new claims (Anderson, 1989; Ball, 1990; Borko, 2004; Borko&Putnam, 1996; McDiarmid, 1995; McDiarmid, Ball, & Anderson1989). To better understand this third option for PD, what follows is the research on content-focused PD and effective components of such a program. Turnuklu and teachers the following sample dialogue between a student and their teacher:

> *Teacher:* What is the result of -3 + 5?
> *Student*: -3 + 5 is - 8.
> *Teacher*: How did you do it?
> *Student:* 3 plus 5 is 8.

The sum has the sign of the first integer. (Turnuklu&Yesildere, 2007, p. 9) Turnuklu and Yesildere (2007) found that 44% of the teacher candidates understood the students‘ misconception in the dialogue, but 56% of them had their own misconceptions about addition and subtraction of integers. They did not understand the connection between addition and subtraction. Examples of their misconceptions follow:

5-3 is an addition operation. It means —5 plus -3.

There is no difference between 5-3 and 3-5

The set of integers is commutative under subtraction (Turnuklu&Yesildere, 2007, p. 9).The teachers in the study tended to try to re-explain the task or ask questions to explain the task rather than trying to understand the students‘ thinking of their misconception. This response did not satisfy the students because it did not address their misconception. According to the work of Turnuklu and Yesildere (2007), teachers need to understand the difference between a sign and an operation and the importance of assisting students in understanding the difference. According to a review of math and science PD programs by Kennedy (1998), —programs whose content focused mainly on teachers‘ behaviors demonstrated smaller influences on student learning than did

programs whose content focused on teachers‘ knowledge of the subject, on the curriculum, or on how students learn the subject‖ (p. 18). In a research study of PD, a national sample of teachers was surveyed by Garet, Porter, Desimone,

Birman, and Yoon (2001) who discovered that activities that are content focused but do not increase the knowledge and skills of teachers result in a negative impact on teacher practices. Therefore, just providing teachers with content is not

sufficient; the PD must provide a deepening of the teachers‘ conceptual knowledge and skills in the subject(s) they teach.

Procedural Skills

Studies shows that students becoming less skilled in dealing with Mathematics concepts (Guskov, 2009).Guskov thinks that poor skills started in primary school. Pupils lack mastery of number concepts and simple mental computations. He said that all kids who have problems with addition and subtraction within the limits of 20, and multiplication and division within the limits of 100 have not mastered many basic topics of mathematics. They have difficulties with common fractions, simple algebraic transformations, simple equations and the rest. Slow mental computations result from failure in understanding more complicated operations, such as reducing to a common denominator, operations with brackets and similar terms, solving simple equations. He said that basic concepts in mathematics in the primary level should be given more emphasis so as pupil could master the lessons considered being last mastered skills.

Similar to the Guskov claim, Diaz (2007) commented that there is a pressing need to reform mathematics education in the Philippines. Based on his observations of TIMMS where the result of Filipino students performed poorly in mathematics compared with other students from other countries. He perceived that foundations in all mathematical ideas were the root of the problem. Filipino Grade and High School students do not understand and have not mastered the basic mathematics early on in life. He suggested that mathematics concepts and skills should be studied from kindergarten to high school. Nathan (2002) says that many students, despite a good understanding of mathematical concepts, are in consistent in computing. They make errors because they misread signs or

carry numbers incorrectly, students often struggle, especially in primary school, where basic computations and “right answers” are stressed.

Good students learn facts and skills by which they organize and express their thoughts and talents. It is true that all are born with the ability to learn. People do it every day in their lives, often without being aware of it. However, studying is a special form of learning; it is achieved with some specific purpose in mind. All individuals need to learn how to study (Landsberger, 2005).

Landsberger (2005) gave a list of keys to academic success: they are; taking responsibility, putting things in proper order, discovering one’s key productivity periods and places, prioritizing productivity periods and places for the most difficult study challenges, considering oneself in a win-win situation, consulting with the teacher, and continuously challenge oneself. Poor reasoning skills are also another area of concern among secondary school students. Many are unable to extract necessary information from given data and many more are unable to interpret answers and make conclusions. Traditional approaches in

learning integers emphasize more on how much the students can remember and less on how will the students can think and reason. Thus, learning becomes forced and seldom brings satisfaction to the students.

A Distinction Between Conceptual Knowledge and Procedural Skills

The Terms conceptual knowledge and procedural knowledge are primarily Used to describe two forms of understanding. They are ways in which people

come to comprehend ideas brought forth in the world. These two forms of understanding can be defined as:

* *Conceptual Knowledge* : Knowledge that is rich in relationships. It can be thought of as a connected web of knowledge, a network in which the linking relationships are as prominent as the discrete pieces of information. Relationships pervade the individual facts and propositions so that all pieces of Information are linked to some network (Heibert&Lefevre, 1986).

* *Procedural Skills* : One kind of procedural skills is a familiarity with the Individual symbols of the system and with the syntactic conventions for acceptable configurations of symbols. The second kind of procedural skills consists of rules or procedures for solving mathematical problems. Many of the procedures that student possess probably are chains of prescriptions for manipulating symbols (Heibert&Lefevre, 1986).

Taking a closer look at conceptual skills, It is clear that this form of Knowledge is based upon making connections. It is the quality of the person's understanding and their ability to correlate ideas (Star, 2002). As Meyers (2007) puts it,

> Depth in mathematics is about the underlying connections between concepts, the generalization of ideas, the power of seemingly simple results, and the realization that mathematical facts make sense ...These connections and generalizations take our understanding of mathematics – and the world around us – in new directions (Meyers, 2007).

As Meyers suggests, linking concepts is what enables people to form abstract ideas and generalizations. The ability to compare and contrast principles as well as the ability to correlate ideas in mathematics depends on a person's conceptual understanding of the material (Dossey, Giordano, Mc.Vrone, Weir, 2002). Mathematics is one subject that requires people to fully grasp conceptual understanding, the process of learning math would become disjointed and illogical (Marshall, 2006).

On the other hand, procedural knowledge is ultimately defined as understanding procedures. This means that knowledge is focused on how to work something rather than understanding why it operates. Relationships are learned through steps, meaning that the first step is linked to the next. Unlike conceptual knowledge, procedural understanding is not rich in connections and therefore has no depth (Star, 2002). Although it seemingly has no depth, procedural knowledge should not be forgotten. It is imperative for students to understand procedures and be able to step through processes. Procedural knowledge feeds into conceptual knowledge and subsequently enriches it.

Procedural Knowledge or more appropriately *skill* refers to the ability to physically solve a problem through the manipulation of mathematical skills : with pencil and paper, calculator, computer, etc. There is thus, in a theoretical sense, a difference between conceptual and procedural knowledge in mathematics

Procedural knowledge is often thought about as certain skills we possess, tasks we can complete processes we are able to follow. Procedural knowledge is

knowing how to control the relevant factors for examining some phenomenon (Reber & Reber, 2001), performing a certain task or completing an activity. Procedure knowledge also means knowing the method of manipulating a specific condition or the technique for implementing a task. This may include the procedures we use to do a science experiment, write an essay or solve a mathematical equation.

Students deal with concepts when they discuss "what" something is. They demonstrate conceptual knowledge when they recognize, label and generate examples of what concepts are and what they are not . Students used conceptual knowledge when they use concepts and their representations to discuss or clarify mathematical objects, ideas, or problems. Conceptual knowledge is used to compare and contrast objects, as well as to form interrelationships between concepts and principles (Dossey et.al., 2002).

Improving Conceptual and Procedural Knowledge of Students

In order for students to become mathematically competent in conceptual knowledge, teachers must present the information in a clear and concise manner. In her article, "Using Models to Build Understanding of Functions" (2001), Kathleen Cramer suggest just that she finds it essential that students should continuously be involved in concrete models and be able to express how they work, why they work, and how they compare to other problems (Cramer, 2001). In order for students to fully grasp these concepts, Cramer

believes that teachers need to adequately teach and inform his or her class. She states,

> The teacher's role in this type of instruction is first to identify good problems and organise them in a sequence that builds on previous problems. Teachers need to lead students in discussion, asking questions to help clarify the mathematics and draw connections among different problems (Cramer, 2001)

In order for the brain to respond well to mathematics education, teachers must present information using real life experiences and do it in a challenging way (Marshall, 2006).

In the field of mathematics, much study has been done on conceptual and procedural knowledge. The relationship between the learner's knowledge of concepts and their ability to carry out procedures is an important issue that has been in depth. Most research in this area has endeavoured to determine the highest degree of correlation between the two types of knowledge (Star, 2000). In the study of Pesek and Kirshner, they found that student whose instruction focused on relationships and concepts demonstrated a better understanding of area and perimeter concepts than students who were given procedural knowledge first . This finding definitely illustrated that a better understanding of the subject matter is attained when it is taught conceptually.

The Five Interdependent Components of Mathematical Proficiency

While some argue for mathematics to be taught conceptually and others push for a procedural approach, Findell, Kilpatrick and Swafford (2001) have come to the conclusion that mathematics proficiency depends on five interdependent components. Within their book, Adding It Up: Helping Children

Learn Mathematics (2001), they reveal what they believe contributes to Mathematics proficiency. They describe mathematics proficiency as five intertwined strands (as shown in figure 2) that work together to form one whole understanding. These five components include: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. These strands working together as one provide a solid learning process which leads to mathematical understanding (Findell, Kilpatrick, Swafford, 2001).

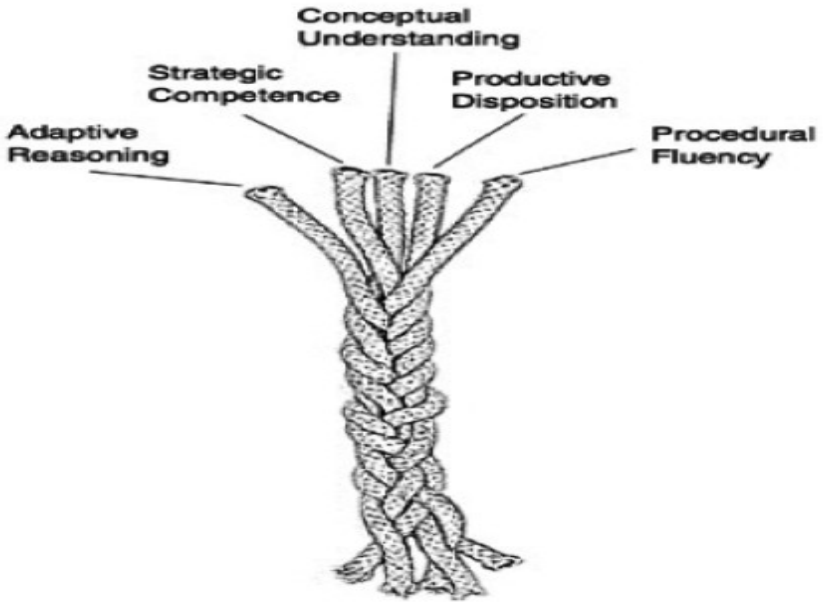

Figure 2

Ensuring mathematical proficiency among our students is a very big issue in the Philippine education. For the past years, the Filipino educators are looking

and experimenting different teaching techniques and programs to ensure or develop the proficiency of our students. The latest of these moves is the implementation of the new assessment procedure and grading system in school.

The K – 12 Curriculum, as they claimed, focuses on the level of proficiency of the students.

But what do we mean by "mathematical proficiency"

According to National Research Council (NRC), mathematical proficiency Means learning mathematics successfully. This is further broken down into five strands; understanding, computing, applying, reasoning, and engaging. These strands are connected to each other, thus to achieve proficiency in math, one must be proficient with these five strands. Each strand is a very important part and shows vital signs of the student whether he is proficient or not.

In the K to 12 Curriculum, proficiency in each subject area is the primary goal. The department goes beyond classroom activities. They wanted to teach through the standards using real life, relevant, and challenging math activities and task. The grading system reflects the proficiency of the students. Students' grades will be classified as Beginning, Developing, Approaching proficiency, Proficient, and Advanced. One of the issues of these descriptions is that it is not clearly stated and described in each level of proficiency. The teacher know a very little understanding of each level.

But more than the description, the real challenge to the Filipino educators is how to develop the mathematical proficiency among our students. I believe that developing the proficiency of the students. I believe that developing the proficiency of the students in mathematics starts from worthy and relevant introduction of the concept. This should be followed up by different activities rooted from daily life activities. The teachers should establish the relevance of the lesson to the students' life. They should be able to realize its importance. Performing calculations is necessary but more than this, the students should be able to rationalize on his answer. Make judgement or decision as to what is the best solution to be used for a particular problem or case. But being proficient in math is not enough. We must teach our students to be a reflective problem solver.

Performance of Students on Conceptual and Procedural Knowledge

On content knowledge and procedure knowledge, Talion (2009) examined students' conceptual and procedural knowledge for solving problems number, properties and operations, as well as Algebra and functions. The results showed that students were not only at their basic level on conceptual knowledge and procedural knowledge in solving mathematical problem. Discussion of mathematical concepts and procedures were not comprehensively learned by the students. They had not retained much of the skills they learned in class.

According to Houchin's Study (2007), he revealed that high school students with mathematical difficulties were fluent only in computational skills at

the second and third grade levels. Computational fluency was found with most whole number basic facts in addition, subtraction, multiplication, and division. Lack of computational skills was demonstrated in many items requiring, regrouping, most multiplication and division items, and rational items involving fractions and decimals.

According to Daro (2006) the poor performance of U.S students in math can be traced to the method used to teach math at the elementary level. They focused on specific problems and not on building the foundations necessary for understanding higher level math. These foundations can only be built with a mathematics program that teaches concepts and skills, and problem solving.

Attitude Towards Mathematics

The attitude towards the study of mathematics is widely perceived and influence mathematics performance of learners. Numerous studies have reported a positive correlation between attitude towards subject and achievement (Ma and Xu, 2004). This has implications for teachers, who need to find ways of engaging interest of students in their particular subject. According to Pagano (2007) mathematics as a whole is a difficult subject to learn in which varied teaching

strategies should be integrated. He said that educators must constantly look for innovative ways to pigue students interest and break through learning barriers. Jaramillo (2002) stressed that as teachers, we know that learning happens when the students are motivated it is for this reason he said that we should always strive to provide a rich learning environment and maintain the students high level

of interest. Heinze (2008) stated that the development of an individual students achievement depends on the achievement level of the specific classroom and therefore on the specific mathematics instruction. Interest in mathematics could be regarded a predictor for mathematics achievement. Malunes, Jr. (2005) believe that student's anxiety and fear affects understanding mathematical concepts. This could eradicate if their difficulties encountered are properly identified and addressed.

Recent research shows that one of the major factors influencing students' motivation is how they explain their successes and their failures. In a study of Stipek and other(In Posamentier, 1998) result showed that girls tend to attribute failures in mathematics and low ability and bad lack. On the other hand, they attribute success in mathematics to high ability. In addition, girls were more likely than boys to hide their papers after failure and to have less pride in their successes. The researchers suggested that teachers should help students in general and girls in particular, to realize that they have the ability to control their own academic destiny and that the specific strategies and types of efforts they make or don't make lead to specific outcomes.

Teachers can generate positive feelings in the learner (Posamentier et.al, 1998). If the learning task are presented cleverly, these Simple exercises will generate a positive attitude that will carry over to somewhat more complicated problems or exercises on the same topic. Furthermore, mathematics teachers should give exercises designed to boost positive attitudes which are not too simple because if successes comes to easily, it will not have much significance

or impact. Teachers also need to cultivate the ability of the learners to determine what motivate themselves to learn mathematics. To motivate students effectively problems and topic must be appropriate in their content, structure and level of difficulty (Posamentier, et. Al, 1998).

Attitudes, Values and Needs Observed Among Mathematics Students:

The most common problems of school on academic

to attain excellence and gain intellectual progress. School children are considering the following as their problems**.**

1. Do not easily understand the teachers explanation.
2. Can hardly cope up with the requirements of the teachers.
3. Poor memory.
4. Shy to participate in class discussion.
5. Worried during examinations.

When it comes to modify children's behavior teachers may have to make changes to fit particular child's interest and age.

Adjustment to school work

Problems of school children in school work are the following:

1. Having difficulties in research work.

2. Forgetting things learned in school.

3. Problem in budgeting time.

4. Getting low grades.

5. Weak in writing, spelling, grammar, especially problem solving.

6. Having trouble in passing examination.

7. Unable to express in words.

8. Not interested in books.

9. Afraid or hesitant to speak in class discussion.

10. The success of an individual teacher is by no means entirely a matter of his soul attitude towards teaching.

The Students Nature

Students think better when they are given freedom. They think that they are expected to play specific roles in the classroom. They should be afraid to ask questions, to make mistakes, and to initiate request and activities. They think better when they are not in state of anxiety or a fearful that all their action and reactions are being recorded and evaluated. They think best when they are provided and centered on them a real people. Some students still not been exposed sound discipline, lack of classroom control and most likely impede their developing dispositions. Punishment may help to rest or order, promote discipline by teaching them to obey rules and to follow instructions.

Synthesis

The importance of mixed learning environment has proven to be vital in mathematics education. One cannot teach solely based on procedures and likewise one cannot focus exclusively on concepts. As it was proven previously, concepts are built from procedures and procedures are made clear through concepts.

The reviewed literature and related studies were concerned with the acquisition of the two type of knowledge: Conceptual and procedural knowledge. In the field of mathematics much study has been done on these two types of knowledge. Some studies revealed that students learned better if they taught conceptually before the procedural knowledge (Pesek and Kirshner, 2000). For this aforecited literature, this study was anchored. This review could help in answering the problem raised in this study and determine the factors that affect the learning of pupils on basic concept on integers. This investigation attempted to contribute to the existing knowledge about conceptual understanding and procedural skills and attitude of Grade 7 pupils.

In order to evolve with meaningful learning of integers among students, instruction should focus on integer concepts, and ensure mastery of procedural skills. Teachers should provide also varied activities to improve the attitudes of pupils towards learning mathematics.

Chapter III

RESEARCH METHODOLOGY

This chapter discusses the research design study, the respondents of study, the research instruments, the data gathering procedure and statistical tools used in this study.

Research Design

This study utilized descriptive method of research. This method is used to obtain information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation. It involves a range of activities from the survey to content analysis (Lawrence &Neuman, 2003). Descriptive research is defined as fact finding with adequate interpretation. The true meaning of the data collected should be reported from the point of view of the objectives and the basic assumptions of the project underway (Calderon and Gonzales, 2006).

This study is descriptive because it aimed to describe the conceptual Understanding, procedural skills, and attitude of grade 7 pupils on integers and determine which among these variables are significantly correlated.

This study was conducted at Commonwealth High School (CHS), one of the biggest secondary schools in the division of Quezon City. This school is the major educational landmark of the city serving the National Government Center consisting of the populated barangays of Commonwealth and Payatas A.

The school is composed of 7 buildings with a total of one hundred twenty (120) rooms and has a population of at least nine thousand (9000) students with 42 sections in grade 7 and at least 35 sections from grade 8, Third year and Fourth year. Aside from regular classes, the school offers special classes such as Home Study Program (HSP) with four sections per year level and classes held every Saturday; Technology and Vocational curriculum, Alternative Learning System (ALS), and Special Education for the visually and hearing impaired students.

Presently, in Commonwealth High School, there are a number of programs is being run by Dr. Sally B. Barcelona. She has spearheaded a number of programs and projects. Foremost of these is the development of the state-of-the-art facilities such as electronic systems to facilitate research and monitoring, including the first student Information System (formerly Student Tracking System); Bulwagang Daluyan Conference Hall; Science Laboratory;

TEPD laboratory; conventional and e-libraries; TLE practices house; guidance office; clinic; administrative offices; property room; Reading Center; SP Room

and Fitness and Wellness Center was constructed. New donated books were used by the researcher in conceptualizing this study.

The Respondents of the Study

The researcher randomly selected fifty (50) Grade seven pupils of Commonwealth High School who fitted the criteria for this study. The average grade in Mathematics 7 during their first and second quarters of the school year 2013-2014.Same level of understanding and handled by the same mathematics teacher.

Table 1 shows the frequency distribution of respondents of the study. All of them were ask to answer the knowledge test, procedural skills and attitude towards mathematics.

Table 1
Frequency Distribution of Respondents

Sex	*Number of Pupils*	*Percent*
Male	18	36
Female	32	64
Total	*50*	*100*

Table 2

Frequency and Percentage Distribution of Respondents According to Age

Age	*Frequency*	*Percent (%)*
12	20	40
13	27	54
14	3	6
Total	*50*	*100*

Table2 shows that the respondents age range from 12-14 years old. These range are within the normal age of the students for the past years. And more than half or 54% of the respondents are thirteen years old and only 6% were fourteen.

Research Instruments

The research instrument used to gather data from the respondents included a knowledge test on basic concepts on integers (Appendix A), procedural skills (appendix C) and attitude towards mathematics (Appendix B) .The knowledge test is a 40 item multiple- choice type of test, while the procedural test consisted of eleven items, and a fifty items on attitude towards mathematics. The test was designed to measure the conceptual understanding and procedural skills and attitude of grade seven pupils on integers.

The following steps were followed in the construction and validation of the knowledge test on basic concepts of integers.

Step 1 Writing the table of specification.

Step 2 Writing the preliminary form of the test.

Step 3 First try-out of the test.

Step 4 Second try-out and item analysis.

Step 5 Content validation of the final form.

Step 6 Administration of the final form of the test.

Step 1 : *Writing the Table of Specification*.

It has been observed for the past years of teaching mathematics that pupils are having difficulties in computing signed numbers. Some teachers were interviewed about the lesson in Mathematics in which student most and topics which are difficult to them. Based on the result of the interview, a table of specification (Appendix D) was made to ensure that all the selected topics were represented in the test. The table of specification were classified as to conceptual understanding, and procedural skills (Appendix E) which includes knowledge and comprehension under conceptual understanding; under procedural skills, behaviors measured were analysis and application.

Step 2:

Writing the Preliminary form of the Test

The preliminary test material(Appendix F) consisted of 40 multiple Choice type items and a self task. In the self task, the pupils would write two challenging and interesting problems that can be solved using a variety of strategies involving operation on integers. Problem 1 should involve addition or subtraction of integers. Problem 2 involves multiplication and / or division of integers (may also include addition or subtraction). For the item validation of the test the test items and scoring rubrics were presented to the adviser and to the head of Mathematics in Commonwealth High School. Revisions were done incorporating the suggestions on the preliminary form. Below shows the suggestions of the research adviser and mathematics teacher.

Suggestions for the preliminary form of the test.

Original	Suggestion
5. A < 0. Then "a" must be. a. Positive b. Negative c. Zero d. Cannot be determined	If a < 0, then "a" must be ____.
9. Manuel borrowed 300.00 php from Rica on Monday, returned php 175.00 on Thursday and borrowed Php 250.00 on Saturday. How much does Manuel still owe Rico? a. 325 php	Manuel borrowed Php. 300.00 from Rica on Monday. He returned Php. 175.00 on Thursday and borrowed Php. 250.00 on Saturday. How Much does Manuel still owe Rico? a. Php. 325

b. 350 php c. 375 php d. 475 php	b. Php. 350 c. Php. 375 d. Php. 475
28. Gary wants to buy a refrigerator whose cash price is php. 8 463. If he buys it on credit, he to pay php. 1 542 for 6 months. How much more is the price? Of the refrigerator when purchased on credit than in cash? a. Php. 628 b. Php. 789 c. Php. 812 d. Php. 944	Gary wants to buy a refrigerator whose cash price is php. 8 463. If he buys it on credit, he has to pay php. 1 542 for 6 months. How much more is the price of the refrigerator when purchased on credit than in cash? a. Php. 628 b. Php. 789 c. Php. 812 d. Php. 944

Step 3: *First try-out of the Test*

The developed test was tried out to randomly selected group of grade 7 pupils, to determine the time limit of the test and to ascertain the clarity of the directions as well as the suitability of the language used. The test was administered under good environmental condition. It has no time limit. The average time that the pupils took to finish the test was 1 hour and 25 minutes. At the start of the test, the respondents were instructed not to hesitate to ask questions about the directions and terms or words used in the test that were difficult to understand. The pupils showed cooperation and good behaviour while answering the test. Items in the test which were found to be difficult by the pupils were given due attention. Revise according to the result of the preliminary

Step 4: *Second Try-out and Item Analysis*

The developed test was tried out to fifty (50) grade seven pupils, to determine the time limit of the test and to ascertain the clarity of the directions as well as the suitability of the language used.

The test was administered under good environmental condition. It has no time limit. The average time that the pupils took to finish the test was 1 hour and 10 minutes. Before the test started, the respondents were instructed not to hesitate asked questions about directions, terms, or words used in the test that were difficult to understand by the respondents. After giving them the clarity of the directions most of the students are still asking regarding what to do with certain directions, some of the respondents, in spite of instructing them not to hesitate asked question was still shy, and so they just asked their seatmates with a very low tone in a way that the researcher will not know what they have been doing. After 5 minutes of seeing the respondents asking with their seatmates the researcher decided to explain the direction again carefully. After which the respondents started to answer the instruments silently. Below were the sample items of self task that was revised completely based on the item analysis (Appendix L) and on the result second try-out (Appendix K).

OLD	**NEW**
Procedural Test Each one is tasked to write 2	**Materials:**

challenging and interesting problems that can be solved using a variety of strategies. The problem categories are as follows: Problem 1: involves addition and/ or subtraction of integers Problem 2: involves multiplication and/ or division of integers (may also include addition or subtraction) Each individual will present their problems on a one on one interview. You may write the problems on a paper, you will explain the solutions during interview. Submit a copy of the problems and solutions to your teacher.	40 counters, 20 each of two different colors Colored pencils that match the counters Ruler Paper First decide on one color to represent positive numbers and the other color to represent negative numbers. Record your color assignments: positive: _____ negative: _____ 1. -13 + 8 = _____ Sketch your counters and circle any neutral pairs that you make.

Step 5: *Content Validation of the final form*

The constructed test together with the table of specification was presented to the research adviser for comments and suggestions (Appendix J). It was further validated by a mathematics expert. The constructed test was then revised based on the comments and suggestions of the expert.

Step 6: *Administration of the final form of the test*

The final form test (Appendix A) was given to fifty (50) Grade 7 pupils. The final form instrument was administered for 3 consecutive days. The first day was The Knowledge Test, consist of 40 items. The time limit set to finish of the knowledge test was 60 minutes. On the second day was the procedural test. The procedural test was all revised based on the result of the first and second try out of the respondents. Most of the respondents did not answer or even try to answer the instrument on procedural test. The time limit set to finish the procedural test was 55 minutes. Third was the attitude towards mathematics which was last for 28 minutes. The pupils showed cooperation and good behaviour while answering the instruments.

6.a Reliability

6.b Establishing the construct validity

2. Attitude Scale

This was also given to know the attitude of pupils towards mathematics. This instrument was also needed to determine if the attitude of Grade 7 pupils affects the study habits in mathematics.

3. Interview: A structured interview the questions used were based in the developed test instrument. This instrument was needed to substantiate the result of the test.

Scoring/ Checking of the Test Papers

The researcher personally checked all the instruments used in this study. For the conceptual understanding the highest possible score is fourty (40), with one point for each correct answer for multiple – choice question. For the procedural skills, the highest possible score is twenty (20) with one point each

from numbers 1-10 and 10 points was given for the last question. And an attitude towards mathematics scale questions of fifty (50) to know the attitude of grade 7 pupils in mathematics.

Data Gathering Procedure

To carry out the objectives of the present study. The following phases were observed:

1. The researcher requested permit to conduct the study (Appendix N) from the principal of (CHS) Commonwealth High School of Quezon City. This was done to allow the researcher to administer the validation of the instrument and administer the questionnaires to the target respondents.

2. The permit was signed and issued by the principal of (CHS), after which the questionnaires were validated (Appendix O) at CHS with the help of the mathematics department head and expert mathematics teachers. And the head of guidance and testing of Immaculate Conception Cathedral School of Quezon City for validating attitude towards mathematics.

3. After the validation and approval of the panel, the researcher distributed the questionnaires to the respondents.

Data Analysis Procedure

The following statistical tools were used to analyze the data gathered in this study.

* **Mean.** This was used to describe the conceptual understanding, procedural skills and attitude towards mathematics of grade 7 pupils on integers.

* **Split Half Method.** This was used to determine the reliability of different tests. It is divided into halves and then each of those halves are scored separately from each other. They are useful when time is limited. The most common way to perform a split half reliability test is to divide it in half and the assign even numbers to one half and odd numbers to the other

* **Pearson Product-Moment Correlation.** This was used to determine there is a significant relationship between conceptual understanding, procedural skills, attitude towards mathematics and grade point average of pupils in mathematics.

* **Standard Deviation.** This was used with which deviations of individual scores may be compared.

Chapter IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter deals with the presentation, analysis and interpretation of data based on the order of the statement of the problem of the study.

Problem 1: What is the level of Pupils' performance in terms of conceptual Understanding and procedural skills on integers?

Table 3
Level of Pupils' Conceptual Understanding on Integers

	Mean	Standard Deviation	Interpretation
Conceptual Understanding	23.8	5.70	low
Procedural Skills	7.92	5.72	Above average

Table 3 shows the level of pupils conceptual understanding on integers the 40 items in the knowledge test, obtained a mean score of 23.8 with a standard deviation of 5.70, the result is below mastery level based on Dep.Ed standards. According to the standards, the mastery of conceptual understanding

is obtained if the percentage of the score is 75% or higher. And on procedural skills, obtained a mean score of 7.92 with a standard deviation of 5.72, the result is above average.

Table 4
Frequency of Correct Responses of the Pupils in the Knowledge Test Measuring Conceptual Understanding

Item #	*Number of Respondents with Correct Responses*	Percent %	Item #	*Number of Respondents with Correct Responses*	
1	47	94	21	45	
2	41	82	22	19	
3	23	46	23	31	
4	27	54	24	24	
5	43	86	25	6	
6	29	58	26	39	
7	46	92	27	35	
8	41	82	28	40	
9	39	78	29	21	
10	32	64	30	4	
11	43	86	31	30	
12	11	22	32	21	
13	25	5	33	14	
14	17	34	34	26	
15	40	80	35	27	
16	37	74	36	22	
17	39	78	37	33	
18	13	26	38	34	
19	18	36	39	36	
20	24	48	40	37	

Table 4 shows that the respondents are having difficulty in item number 12, 18, 25 and 30 some of the respondents don't have the answer in number 33. The data also revealed that majority of the respondents got the correct answer in item number 1, 7 and 21.

Table 5
Presents the Frequency of Correct Responses of Grade 7 Pupils In terms of Procedural Skills

Item #	Number of Pupils with Correct Responses	Percent (%)
1	44	88
2	44	88
3	42	84
4	45	90
5	42	84
6	40	80
7	37	74
8	42	84
9	27	54
10	33	66
11	25	50

Based on the result in procedural skills the pupils have difficulties in computing numbers consisting of four digits and above. Most of the respondents' test papers have erasures in sketching counters of tiles while answering the procedural test maybe because at first they just want to do it, but after doing two or three items there's a realization of working it in an easier way. And some of the respondents attempt to do it but did not finish the entire activity. Few of the

respondents after doing the representation of the counter tiles they switch the assigned counter tiles that results to wrong outcome.

Problem 2 What are the Attitudes of grade 7 pupils towards mathematics?

Table 6
Attitude Towards Mathematics

Indicators	Mean	Interpretation
1. I love mathematics.	3.12	positive
2. I don't like mathematics	1.4	positive
3. I am always full of anxiety in a math Class.	2.42	Positive
4. I would like to work in the field of mathematics.	2.76	positive
5. I am scared every time I have to take a test in math.	1.96	positive
6. Mathematics requires a hardwork, patience, and perceverance.	3.64	Strongly positive
7. Just to think of taking a math subject gives me a cold feet.	2.32	positive
8. I perspire in fear every time I take a test in math	2.4	positive
9. Mathematics is like playing any game for me.	*2.48*	*positive*
10. Mathematics make me think logically	3.38	strongly positive
11. Mathematics trains me to be systematic	3.32	Strongly positive
12. Mathematics trains me to be disciplined	3.36	Strongly positive
13. Mathematics is so difficult that only those who are gifted can understand it.	1.66	Strongly Disagree
14. Scientific and technological advance-ments depends a great deal on mathematical theory.	2.78	positive

15. It makes me nervous even to think about having to take so many units of math before I graduated.	2.48	positive
16. I feel at ease in math.	2.46	negative
17. I enjoy math class more than any other subject.	2.7	positive
18. Mathematics makes me feel uneasy, nervous, and uncomfortable.	1.96	Positive
19. One hour in a math class seems eternity.	2.34	positive
20. Mathematics is challenging.	3.5	Strongly positive
21. In math, one doesn't have to memorize much. It's more of understanding an logical thinking.	3.12	Positive
22. Mathematics is fun and fascinating.	3.24	strongly positive
23. Mathematics stimulates me and gives me a feeling of security.	2.98	positive
24. I seem to be in maze when doing Mathematics.	2.98	positive
25. I am always tense in a math class.	2.2	positive
26. I consider people who do well in math to be weird.	1.48	positive
27. Mathematics is a very interesting and exciting subject.	3.2	positive
28. Mathematics makes me feel confident.	2.96	positive
29. Mathematics is the most practical subject	3.02	positive
30. The saying "No pain, No gain" applies very well in studying mathematics.	3.3	Strongly positive
31. Mathematics is God-like since it is Precise and truth.	3.26	Strongly positive
32. I feel good whenever I am able to solve math problem	3.34	Strongly positive
33. I dread mathematics as if it were a Contagious disease.	1.92	positive
34. A person who is good in math has greater chance of succeeding in life.	3.06	positive
35. I find mathematics boring and dull.	1.36	positive
36. I usually feel sleepy in my mathematics class.	1.54	positive
37. A good mathematics training is a big		

Advantage in entering any line of work.	3.52	Strongly positive
38. Life can go on without mathematics.	2.08	positive
39. Mathematics contributes greatly in scientific technology and advancement.	3.4	Strongly positive
40. My past math teachers have never succeeded to motivate me to study my math lesson.	1.68	positive
41. Mathematics is needed in everyday life situations.	3.42	Strongly positive
42. I am very attentive in a math class.	3.06	positive
43. I misbehave in my math class because I cannot understand a thing.	1.54	positive
44. My mind travels fast when I am in my math class.	2.62	positive
45. I solve other problems in math aside From the assigned ones.	2.58	positive
46. Interest and right attitude for mathematics can be developed by having a good math teacher.	3.32	Strongly positive
47. Studying math is time consuming, thus, depriving us the chance to attend to other more fruitful and enjoyable activities.	2.44	positive
48. Mathematics is my favourite subject.	2.86	positive
49. I find it difficult to think clearly when working with mathematics operation.	2.3	positive
50. In mathematics I can be creative and Discover things for myself.	3.26	Strongly positive
overall	**2.67**	**positive**

The attitude scale test is composed of fifty (50) statements about mathematics. Statement numbers 1, 4, 6, 9, 10, 11, 12, 14, 16, 17, 20, 21, 22, 23, 24, 27, 28, 29, 30, 31, 32, 34, 37, 39, 41, 42, 44, 45, 46, 48, 50 are all positive oriented. While the remaining 19 statements are all negative

oriented. In general the attitude toward mathematics of Grade 7 pupils is not significant with the grade point average in mathematics.

Problem 3 Is there a significant relationship between conceptual understanding and procedural skills; conceptual understanding and attitude towards mathematics and procedural skills and attitude towards mathematics?

Table 7
Presents the Correlation Between Conceptual Understanding, Procedural Skills and Attitude of Pupils

Paired Variables	Correlation Coefficient	P. Value	Interpretation
Conceptual Understanding and Procedural skills	0.474	0.001	Significant
Conceptual			

understanding and attitude towards mathematics	0.068	0.638	Not significant
Procedural skills and Attitude towards mathematics	- 0.082	0.573	Not significant

Table 7 shows the correlation between conceptual understanding and procedural skills were significant with a correlation coefficient of 0.474 and a computed p-value of 0.001. It also shows that the correlation between conceptual understanding and attitude towards mathematics were not significant with a correlation coefficient of 0.068 and a computed p.value of 0.638. And procedural skills and attitude towards mathematics were also not significant with a correlation coefficient of -0.082 and a p.value of 0.573. According to the Schema Theory of learning of Piaget (in Hergenhahn and Olson, 2005), Every

experience a person has involves both assimilation and accommodation. Events for which the organism has corresponding schemata are readily assimilated, but an event for with the organism has no existing schemata necessitate accommodation. Thus, all experiences involve two equally important processes; these are recognition or knowing which corresponds to the process of assimilation and accommodation which results in the modification of the cognitive structure modification, according to Piaget, can be roughly equated with learning.

Problem 4 Do the Conceptual understanding, Procedural Skills and Attitude Scale Towards Mathematics significantly influence the Grade Point Average (GPA) of Pupils.

Table 8
Grade Point Average of the pupils in Mathematics

	Mean	Standard Deviation
GPA	88.64	3.46

Table 8 shows that the respondent's grade point average is above average with a mean of 88.64 and 3.46 standard deviation

Table 9
Correlation Matrix for Conceptual Understanding, Procedural Skills, Attitude Towards Mathematics and GPA of pupils.

Paired Variables	Correlation Coefficient	P. Value	Interpretation
Conceptual Understanding and GPA	0.617	0.000	Significant
Procedural Skills and GPA	0.410	0.003	Significant

Attitude Towards Mathematics and GPA	0.058	0.689	Not Significant

Table 9 shows the correlation matrix for conceptual understanding, procedural skills, attitude towards mathematics and grade point average of pupils. The correlation coefficient between paired variables of conceptual understanding and grade point average were significant with the correlation coefficient of 0.617 and a computed t-value of 0.000. The procedural skills and grade point average were also significant with the correlation coefficient of 0.410 and a computed t-value of 0.003. The attitude towards mathematics and grade

point average were not significant with a correlation coefficient of 0.058 and a computed t-value of 0.689. The spiritual curriculum was conceptualized by Bruner (in G.K. Clabaugh, 2009). It points that pupils build knowledge based on previously learned information in a sparingly fashion, which enable learners to connect prior schematic concepts. He said that interconnection of the new experience with the prior knowledge result in the re-organization of the cognitive structure which creates meaning and allows the individual to go beyond the information given.

Further, Bruner said that effective teachers must provide assistance and guidance as students build understanding and allows them to become

independent learners (in G.K. Clabaugh,2009).

Table 10
Regression Analysis for Predicting GPA

Predictors	Beta	t	P. Value	Interpretation
Constant				
Conceptual Understanding	0.617	5.433	0.000	Significant
Procedural Skills	0.410	1.183	0.003	Significant
Attitude Towards Mathematics	0.058	0.139	0.689	Not Significant

Adj. R = 0.617

Adj. R^2 = 0.381

As reflected in the regression analysis 38.10% of the variability in the Grade Point Average is jointly explained by the conceptual understanding and procedural skills of grade 7 pupils both at 0.05 level of significance. Thus, the predicting equation is

Predicted GPA = 79.728 + 0.617 X + 0.410 X

Chapter V

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary of the study including the findings, the conclusion, and the recommendations based on conclusion.

This study covered the determination of Conceptual Understanding, Procedural Skills and Attitude of grade 7 Pupils on Integers at Commonwealth High School. The researcher developed a test in conceptual and procedural knowledge and attitude.

Summary

The objectives of the study was to describe the level of conceptual understanding, procedural skills and attitude of grade 7 pupils on integers. Moreover, it attempted to find out whether these variables are significantly correlated to their academic performance. Data were gathered through test, scale and interviews.

Findings

Based on the data gathered, the study yielded these findings:

1. The level of pupil's conceptual understanding on integer topics is below mastery level while the level of pupils' procedural skills on selected topics on integers is above average.

2. The pupils' attitude towards mathematics based from the result were positive.

3. There is a significant relationship between the pupils' conceptual understanding and procedural skills. There is no significant relationship between conceptual understanding and attitude towards mathematics. And there is no significant relationship between procedural skills and attitude towards mathematics.

4. There is a significant relationship between conceptual understanding and grade point average (GPA). There is a significant relationship between procedural skills and grade point average. There is no significant relationship between attitude towards mathematics and grade point average. Among the three variables, conceptual understanding is the significant predictors of academic performance.

Conclusions

Based on the above findings, these conclusions were made.

1. The grade seven pupils were performing good in procedural skills but have difficulty understanding the concept of integers.

2. The pupils have a positive attitude in mathematics but the attitude towards mathematics is not a factor that affects pupils' academic performance.

3. Conceptual understanding, procedural skills and attitude towards mathematics are important factors that influence academic performance in mathematics.

Recommendations

Based on the findings and conclusion of this study, the following are hereby recommended.

1. Teachers should use interesting learning activities and different teaching strategies to enhance pupils' conceptual understanding and procedural skills.

2. Curriculum materials should focus on enhancing pupils' conceptual understanding and procedural skills. Specially, computing signed numbers should be provided in order to bring the students to real life situations and to make learning more meaningful and practical.

3. Peer groups could be organized so that brighter students could teach those who need help in mathematics.

4. In service training programs and summer institutes in mathematics should be regularly conducted to enable the mathematics teachers to update themselves with the new strategies and concepts of teaching Integers that will enhance the conceptual understanding and procedural skills of the pupils.

5. Pupils mathematical strengths and weaknesses be identified using the result of the test.

6. This study should be replicated. If so, the following should be taken into consideration:

- Change of participants
- Change of target grade level
- Use of other statistical treatment
- Consider the time spent by participants in working with the test items.

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Appendices

Appendix A
Final Form Test on Knowledge Test

Name: _____ Score: _____
Grade 7/ Section: _____ Age: _____
Birthdate:_____

I. Read each item carefully. Write the letter of the best answer in the blank provided for each item.

_____ 1. Which number is a whole number but not a counting number?
a. -1 b. 0 c. 1 d. 2

_____ 2. Which of the following are whole numbers less than 3?
1. 0 b. 1,2 c. 0,1,2 d. 1,2,3

_____ 3. Which of the following statement is TRUE?

a. All integers are whole numbers

b. All integers are rational numbers
c. All real numbers are rational numbers
d. Irrational numbers are NOT real numbers

_____ 4. What property justifies the equation below?
(4+2)(-3) = (-3) (4+2)

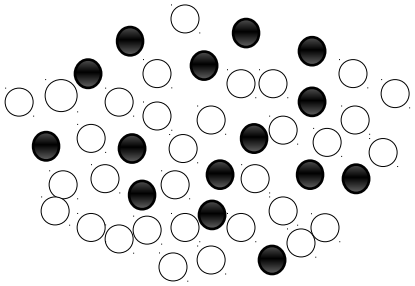
a. Commutative property of addition
b. Commutative property of multiplication
c. Associative property of addition
d. Associative property of multiplication

_____ 5.a< 0. Then "a" must be _____.
a. Positive c. Zero
b. b. Negative d. Cannot be determined

_____ 6. What will you multiply to -3 to get 1?
a. 3 b. 1 c. 1/3 d. -1/3

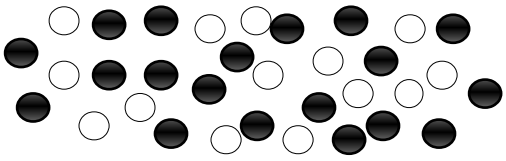
7 – 8. Identify an integer addition for each illustration and **give the sum. Black circles – negative while white** circles are positive.

_____ 7.



a. 28 + 15 = 43 c. -28 + 15 = -13
b. 28 + (-15) = 13 d. -28 + (-15) = -43

_____ 8.



a. 19 + (-14) = 5 c. -19 + (-14) = -33
b. -19 + 14 = -5 d. 19 + 14 = 33

_____ 9.Manuel borrowedPhp.300.00from Rica on Monday, returned Php 175.00

Thursday and borrowed Php. 250.00 on Saturday. How much does Manuel
still owe Rico?

a. 325 php c. 375 php
b. 350 php d. 475 php

_____ 10. A profit of Php 350 followed by a loss of Php. 420 is the same as ____ ?

a. 70 c. 770
b. – 70 d. -770

_____ 11. Which list is in order from least to greatest?

a. -36, -32, -5, 20, 24 c. 24, 20, -5, -32, -36
b. -5, -32, -36, 20, 24 d. -32, -36, 24, 20, -5

_____ 12.If the difference of -19 and -16 is subtracted from the difference of 8 and -13.

a. 2 b. -24 c. 24 d. 5

_____ 13. Which of the following set of integers are arranged in descending order?

a. -12, -21, -11, 11, 0 c. 0, 12, -41, -21, -12
b. 0, -33, -45, -53, -74 d. 12, 0, -12, -21, -41

_____ 14. How much greater is -79 than -96?

a. 17 b. -17 c. -175 d. 175

_____ 15. Simplify: 18 – 6 + (-3).

a.- 9 b. -15 c. 15 d. 27

_____ 16.When multiplying integers, count the number of negative factors. If the number of negative factors is odd, then the product is___.

a. negative c. Zero
b. positive d. None of the above

_____ 17. Supply the missing number in -256 ÷ ___ = - 16.

a. 14 c. 16
b. 15 d. 17

_____ 18. What must be subtracted to -21 to obtain 12?

a. 9 b. -9 c. 33 d. -33

_____ 19.Which of the following phrase represents the “opposite” of a freezing point at 10 degrees below zero.

a. 0 c. -10
b. 1 d. 10

_____ 20. Simplify: $(-3)^3 - (-2)^3$.
a. -35 b. 35 c. 19 d. -19

_____ 21. A businessman makes a profit of Php. 18, suffers a loss of Php 7loses another of Php 9 and gains Php. 10.

a. 18 + 7 – 9 – 10 = 26 c. 18 – 7 – 9 + 10 = 12
b. 18 – 7 + 9 + 10 = 30 d. -18 – 7 – 9 + 10 = -24

_____ 22. What is the smallest positive integer by which 75 can be multiplied to make it a perfect square number?
a. 2 b. 3 c. 5 d. 6

_____ 23. The sum of three consecutive integers is 108.Find the integers.
a. 34, 35, 36 c. 35, 36, 37
b. 34, 36, 38 d. 36, 37, 38

_____ 24. A clockwise rotation of 60˚ followed by a counter clockwise rotation of 110˚ is the same as ____.
a. 50˚ c. 170˚
b. -50˚ d. -170˚

_____ 25. The entrance to a silver mine is 195 meters above the sea level. The mine is 102 meters deep. How high is the entrance from the bottom of the mine?
a. Subtract 102 from 195 c. Add 195 to -102
b. Subtract 195 from 102 d. Subtract -102 from 195

_____ 26. Which of the following when multiplied gives a positive product?
a. (3)(3)(-3) c. (-3)(-3)(-3)(3)
b. (-3)(-3)(-3)(-3) d. (-3)(-3)(-3)

_____ 27. Romulo bought a share of stocks for php2 435.The next day, the price of each share dropped by php 24. On the third day, the price rose by php 31. How much was Dallas's stock worth at the end of third day?
a. Php 2 442 c. Php 2 424
b. Php 2 490 d. Php 2 380

_____ 28. Gary wants to buy a refrigerator whose cash price is php 8 463. If he buys it on credit, he to pay php 1 542 for 6 months. How much more is the price of
the refrigerator when purchased on credit than in cash?
a. Php 628 b. Php789 c. Php 812 d. Php 944

_____ 29. Which of the following is the multiplicative inverse of 6 5/9?
a.59/9 b. 6 9/5 c. 9/59 d. 61/9

_____ 30.Meanne donated 3/5 of her monthly allowance to the flood victims. If her monthly allowance is php 5 200,how much is left to her?

a. Php 3 120 c. Php 2 500
b. Php 3 000 d. Php 2 080

_____ 31. Simplify: -2 + (-5) + (-4).

a. 1 b. -1 c. 11 d. -1

_____ 32. What is the absolute value of -/-100/

a. 100 b. -100 c. -/100/ d. /-100/

_____ 33. What number must be subtracted from -15 to get 10?

a. 5 b. -5 c. 25 d. -25

_____ 34. Simplify: -5(3-8) + 4(-3). a. 13 b. -13 c. 37 d. -37

_____ 35. Evaluate: -2 x [8 + (-10 + 3)]

a. 2 b. -2 c. 30 d. -30

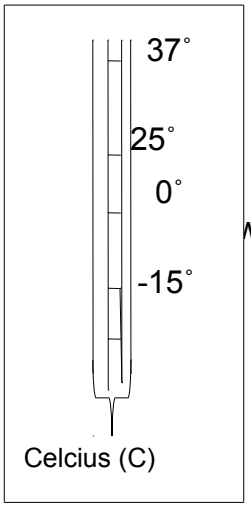
_____ 36. What type of property is 3 + (7+11) = 3 + 18 = 21.

a. Associative property for addition c. Identity property for addition
b. Commutative property for addition d. Inverse property for addition
c.

_____ 37.Aling Yolanda owns a house worth Php.700,000. When a strong typhoon came,it was destroyed . To restore it, MangPedring had to spend Php. 200,000.He has to buy 100,000php worth of furniture. What is the net worth of his house?

a. Php. 200,000.00 c. Php. 600,000.00
b. Php. 400,000.00 d. Php. 800,000.00

38- 40. Using a picture. Use the thermometer to answer questions below.



- normal body temperature

- room temperature

water freeze

- colder temperature

_____ 38. Which represent a colder temperature?

a. -15˚ c. 15˚

b. 1˚ d. 25˚

_____ 39. What integer represents the freezing point of water?

a. -15˚ c. 15˚

b. 0˚ d. 17˚

_____ 40. What number represents the Celsius reading for normal body temperature.

a. -37˚ b. -25˚ c. 25˚ d. 37˚

Appendix B
Attitude Towards Mathematics

Name: _____ (optional) Grade 7 / Section: _____

Directions: Below is a list of student's attitudes towards mathematics. Please check the appropriate scale to what extent do you agree or disagree about each item. Using the scale below.

Scale	**Descriptive Value**	**Range**
4	Strongly Agree	3.25 – 4
3	Agree	2.50 – 3.24
2	Disagree	1.75 – 2.49
1	Strongly disagree	1.00 – 1.74

As a Grade 7 pupil, I perceive that:	4	3	2	1
1. I love mathematics.				
2. I don't like mathematics.				
3. I am always full of anxiety in a math class.				
4. I would like to work in the field of mathematics.				
5. I am scared every time I have to take a math class.				
6. Mathematics requires a hardwork, patience, and				

perceverance.				
7. Just to think of taking a math subject gives me a cold comfort.				
8. I perspire in fear every time I take a test in math.				
9. Mathematics is like playing any game for me.				
10. Mathematics makes me think logically.				
11. Mathematics trains me to be systematic.				
12. Mathematics trains me to be disciplined.				
13. Mathematics is so difficult that only those who are gifted can understand it.				
14. Scientific and technological advancements depend a great deal on mathematical theory.				
15. It makes me nervous even to think about having to take so many units of math before I graduate.				
16. I feel at ease in math.				
17. I enjoy math class more than any other subject.				
18. Mathematics makes me feel uneasy, nervous, and uncomfortable.				
19. One hour in a math class seems eternity.				
20. Mathematics is challenging.				
21. In math, one doesn't have to memorize much. It's more of understanding and logical thinking.				
22. Mathematics is fun and fascinating.				
23. Mathematics stimulates me and gives me a feeling of security.				
24. I seem to be in maze when doing mathematics.				
25. I am always tense in a math class.				
26. I consider people who do well in math to be weird.				
27. Mathematics is a very interesting and exciting subject.				
28. Mathematics makes me feel confident.				
29. Mathematics is the most practical subject.				
30. The saying, "No pain, No gain" applies very well in studying mathematics.				
31. Mathematics is God-like since it is precise and truth.				
32. I feel good whenever I am able to solve math problem.				
33. I dread mathematics as if it were a contagious disease.				
34. A person who is good in math has greater chance of succeeding in life.				
35. I find mathematics boring and dull.				
36. I usually feel sleepy in my mathematics class.				
37. A good mathematics training is a big advantage in entering any line of work.				
38. Life can go on without mathematics.				
39. Mathematics contributes greatly in scientific technology and advancement.				

40. My past math teachers have never succeeded to motivate me to study my math lesson.				
41. Mathematics is needed in everyday life situations.				
42. I am very attentive in a math class.				
43. I misbehave in my math class because I cannot understand a thing.				
44. My mind travels fast when I am in my math class.				
45. I solve other problems in math aside from the assigned ones.				
46. Interest and right attitude for mathematics can be developed by having a good math teacher.				
47. Studying math is time consuming, thus, depriving us the chance to attend to other more fruitful and enjoyable activities.				
48. Mathematics is my favourite subject.				
49. I find it difficult to think clearly when working with mathematics operation.				
50. In mathematics I can be creative and discover things for myself.				

Appendix C
Performance Task

Name: _____ Score: _____
Grade7/ Section: _____ Age: _____

Materials:
40 counters, 20 each of two different colors
Colored pencils that match the counters
Ruler
Paper

First decide on one color to represent positive numbers and the other color to represent negative numbers. Record your color assignments:

positive: _____ negative: _____

I. Use the counters to model the following problems, in which you combine positive and negative integers. Remember that one positive counters paired with one negative counter is equal to zero and is called a neutral pair. After you have made as many neutral pairs as you can, the remaining counters represent the solution.

1. -13 + 8 = _____ Sketch your counters and circle any neutral Pairs that you make.

2. 9 + (-2) = _____ Sketch your counters and circle any neutral pairs that you make.

3. -21 + 17 = _____ Sketch your counters and circle any neutral Pairs that you make.

4. -7 + 10 + (-3) + 5 = _____ Sketch your counters and circle any neutral pairs that you make.

5. Write some guidelines that will help you to remember what to do when combining positive and negative integers.

_____

_____

_____

_____

Use your guidelines to solve the following problems:

6. 754 + (-322) = _____

7. 1249 + 231 = _____

8. -118 + 267 = _____

9. -236 + (-67) + 975 + (-532) = _____

10. 1361 + (-1007) + (-28) + (-306) = _____

11. Write an original problem of your own that uses the concepts of positive and negative numbers. Be sure to include the answer to your problem.

_____

_____

_____

_____

_____

_____

Appendix D
Table of Specification

TABLE OF SPECIFICATION									
Topic	Focus of Assessment	Domain					Number of items		
		K	P	U	P				

Real Numbers	At the end of the lesson the student should be able to:							
Negative numbers	Identify whole and counting numbers;	1, 2, 6	3, 5				5	
Integers	Compare and order of integers	38, 39, 40					3	
	Describe and illustrate the absolute value of a number as the distance of the number from zero;	32, 19,	24, 25				4	
	Know the process of arranging numbers using number line.	11, 13	14,				3	
Addition and Subtraction of integers	Add and subtract integers;	23,		7, 8, 21	41 – 45		8 1	
	Solve problems involving addition and subtraction of integers.	9, 10, 12, 15, 18, 28, 31, 33, 34, 35, 37,	27,				12	

Topic	Focus of Assessment	Domain					Number of items
		K	P	U	P		

Multiply Integers	Multiply integers; Solve problems involving integers.	20, 22, 29,	16,	26,	46 - 50		10
Division of Integers	Divide Integers; Solve problems involving integers.	30	17,				2
Rules for Operating on Integers	Identify the rules for operating on integers.	36	4				2
						Total	50

Appendix E
Conceptual and Procedural Item

Procedural Items	Conceptual Items
4, 6, 7, 8, 9, 10, 12, 14, 15, 17, 18, 20, 21, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37,	1, 2, 3, 5, 11, 13 16, 19, 22, 26, 36, 38, 39, 40

Appendix F
First Try Out of the Knowledge Test and Procedural Skills

Name: _____ Score: _____
Grade 7/ Section: _____ Age: _____
Birthdate:_____

II. Read each item carefully. Write the letter of the best answer in the blank provided for each item.

_____ 1. Which number is a whole number but not a counting number?
a. -1 b. 0 c. 1 d. 2

_____ 2. Which of the following are whole numbers less than 3?
a. 0 b. 1,2 c. 0,1,2 d. 1,2,3

_____ 3. Which of these numbers is greater than -1.098?
a. -3.12 b. -2.23 c. -1.381 d. -0.03

_____ 4. Which of the following statement is true?
a. All integers are whole numbers
b. All integers are rational numbers
c. All real numbers are rational numbers
d. Irrational numbers are NOT real numbers

_____ 5. What property justifies the equation below?
(4+2)(-3) = (-3)(4+2)
a. Commutative property of addition
b. Commutative property of multiplication
c. Associative property of addition
d. Associative property of multiplication

_____ 6.A < 0. Then “a” must be.
a. Positive b. Negative c. Zero d. Cannot be determined

_____ 7. What will you multiply to -3 to get 1?
b. 3 b. 1 c. 1/3 d. -1/3

_____ 8. Phil Mickelson score after a round of golf is -7. Tiger woods’ score is +2. How many points is Phil ahead of tigers?
a. 9 b. 8 c. 7 d. 5

_____ 9. Which of the following statements is TRUE?
a. -4 > -1 b. 1.3 < 1.28 c. -1/2 < -1/3 d. 1/3 = 0.3

_____ 10. Find /-10/

a. -10 b. 10 c. –(10) d. (-10)(-10)

_____ 11. Which list is in order from least to greatest?
c. -36, -32, -5, 20, 24 c. 24, 20, -5, -32, -36
d. -5, -32, -36, 20, 24 d. -32, -36, 24, 20, -5

_____ 12. Evaluate the expression $-10 + 3(27 \div -3)^2$.
a. 223 b. 44 c. -136 d. -567

_____ 13. Which of the following set of integers are arranged in descending Order?
c. -12, -21, -11, 11, 0 c. 0, 12, -41, -21, -12
d. 0, -33, -45, -53, -74 d. 12, 0, -12, -21, -41

_____ 14. How much greater is -79 than -96?
b. 17 b. -17 c. -175 d. 175

_____ 15. Simplify: 18 – 6 + (-3).
a. 4 b. -4 c. 16 d. 20

_____ 16.How many watermelon php. 68 each can Rhianna buy with php 1,600?
a. 24 b. 23 c. 22 d. 21

_____ 17. How much is Rhianna's change in number 16, If there is any?
a. Php 36 b. Php 32 c. Php 30 d. Php 28

_____ 18. What must be subtracted to -21 to obtain 12?
b. 9 b. -9 c. 33 d. -33

_____ 19. 87.098 is 15.23 more than what decimal number?
a. 71. 868 b. 102.328 c. 71.688 d. 102.238

_____ 20. Simplify: $(-3)^3 - (-2)^3$. a. -35 b. 35 c. 19 d. -19

_____ 21. What is the next number in the series 4, 8, 15, 25, 38, ___?
a. 44 b. 54 c. 64 d. 74

_____ 22. What is the smallest positive integer by which 75 can be Multiplied to make it a perfect square number?
b. 2 b. 3 c. 5 d. 6

_____23. A jeepney driver filled his tank with 36L of gasoline. If he uses 4½ L for each round trip, how many round trips can he make before Refilling?

a. 5 b. 6 c. 7 d. 8

_____ 24. There are 336 oranges in 12 baskets. How many oranges are there In 7 baskets?
a. 140 b. 185 c. 196 d. 252

_____ 25. The entrance to a silver mine is 195 meters above the sea level. The mine is 102 meters deep. How high is the entrance from the Bottom of the mine?
c. Subtract 102 from 195 c. Add 195 to -102
d. Subtract 195 from 102 d. Subtract -102 from 195

_____ 26. Which of the following when multiplied gives a positive product?
c. (3)(3)(-3) c. (-3)(-3)(-3)(3)
d. (-3)(-3)(-3)(-3) d. (-3)(-3)(-3)

_____ 27. Dallas bought a share of stocks for php 2 435. The next day, the price of each share dropped by php 24. On the third day, the price rose by php 31. How much was Dallas's stock worth at the end of third day?
a. Php 2 442 b. Php 2 490 c. Php 2 424 d. Php 2 380

_____ 28. Gary wants to buy a refrigerator whose cash price is php 8 463. If he buys it on credit, he needs to pay php 1 542 for 6 months. How much more is the price of the refrigerator when purchased on Credit than in cash?
b. Php 628 b. Php789 c. Php 812 d. Php 944

_____ 29. Which of the following is the multiplicative inverse of 6 5/9?
a.59/9 b. 6 9/5 c. 9/59 d. 61/9

_____ 30. Mean donated 3/5 of her monthly allowance to the flood victims. If Her monthly allowance is php 5 200, how much is left to her?
c. Php 3 120 b. Php 3 000 c. Php 2 500 d. Php 2 080

For numbers 31 – 33 S and B are points along a line.

_____ 31. If S is at -19 and B at 26, How long is SB?
a. 7 b. -7 c. 45 d. -45

_____ 32. If point A is between S and B , such that SA : AB = 4:5, what is
The coordinate of A?
a. -9 b. -4 c.1 d. 6

_____ 33. If M is 39 units left of B, what is the coordinate of M?
a. 65 b. -65 c. 13 d. -13

_____ 34. There are 100 pigs and chickens in a farm. If there are 244 legs
In all, how many chickens are there?
a. 78 b. 22 c. 68 d. 32

_____ 35. Which of the following set of integers are arranged in ascending
Order?
a. -52, 22, -18, -71, 10 c. -71, -52, -18, 10, 22
b. 10, -18, 22, -52, -71 d. -18, -52, -71, 22, 10

_____ 36. Simplify: -2 + (-5) + (-4).
b. 1 b. -1 c. 11 d. -11

_____ 37. What is the absolute value of -/-100/
b. 100 b. -100 c. -/100/ d. /-100/

_____ 38. What number must be subtracted from -15 to get 10?
b. 5 b. -5 c. 25 d. -25

_____ 39. Simplify: -5(3-8) + 4(-3)
a. 13 b. -13 c. 37 d. -37

_____ 40. Evaluate: -2 x [8 + (-10 + 3)]
b. 2 b. -2 c. 30 d. -30

Appendix G
First Try-out of Procedural Test

Procedural Test

Each one is tasked to write 2 challenging and interesting problems that can be solved using a variety of strategies. The problem categories are as follows:

Problem 1: involves addition and/ or subtraction of integers
Problem 2: involves multiplication and/ or division of integers (may also include addition or subtraction)

Each individual will present their problems on a one on one interview. You may write the problems on a paper, you will explain the solutions during interview. Submit a copy of the problems and solutions to your teacher.

Rubric Your output and presentation will be graded using rubric

Appendix H
Answer Key for the First Try Out

1. B
2. C
3. D
4. B
5. B
6. B
7. D
21. B
22. B
23. D
24. C
25. D
26. B
27. A

8. A
9. C
10. B
11. A
12. D
13. D
14. A
15. A
16. B
17. A
18. D
19. A
20. D
28. B
29. C
30. D
31. C
32. B
33. D
34. A
35. C
36. D
37. B
38. C
39. A
40. B

Appendix I
Item Analysis of the First Try-out

Item No.	No. of Correct Responses				Index of Difficulty	Index of Descrimination	Remarks
	Upper 27%		Lower 27%				
	F	%	F	%			
1	**13**	**93**	**7**	**50**	**0.71**	**0.43**	Retain
2	**9**	**64**	**10**	**71**	**0.68**	**-0.07**	Revise
3	**6**	**43**	**1**	**7**	**0.25**	**0.36**	Retain

4	**5**	**36**	**2**	**14**	**0.25**	**0.21**	Retain
5	**6**	**43**	**2**	**14**	**0.29**	**0.29**	Retain
6	**7**	**50**	**2**	**14**	**0.32**	**0.36**	Retain
7	**13**	**93**	**7**	**50**	**0.71**	**0.43**	Retain
8	**11**	**79**	**5**	**36**	**0.57**	**0.43**	Retain
9	**12**	**86**	**8**	**57**	**0.71**	**0.29**	Retain
10	**8**	**57**	**2**	**14**	**0.36**	**0.43**	Retain
11	**12**	**86**	**3**	**21**	**0.54**	**0.64**	Retain
12	**5**	**36**	**2**	**14**	**0.25**	**0.21**	Retain
13	**9**	**64**	**1**	**7**	**0.36**	**0.57**	Retain
14	**9**	**64**	**8**	**57**	**0.61**	**0.07**	Retain
15	**5**	**36**	**5**	**36**	**0.36**	**0.00**	Retain
16	**5**	**36**	**1**	**7**	**0.21**	**0.29**	Retain
17	**11**	**79**	**7**	**50**	**0.61**	**0.21**	Retain
18	**2**	**14**	**2**	**14**	**0.14**	**0.00**	Retain
19	**1**	**7**	**2**	**14**	**0.11**	**-0.07**	Revise
20	**1**	**7**	**1**	**7**	**0.07**	**0.00**	Retain

Item No.	**No. of Correct Responses**				**Index of Difficulty**	**Index of Descrimination**	**Remarks**
	Upper 27%		**Lower 27%**				
	F	**%**	**F**	**%**			
21	11	79	2	14	0.46	0.64	retain
22	8	57	4	29	0.43	0.29	retain
23	7	50	6	43	0.46	0.07	revise
24	9	64	3	21	0.43	0.43	retain
25	9	64	3	21	0.43	0.43	retain
26	8	57	3	21	0.39	0.36	retain
27	10	71	2	14	0.43	0.57	retain
28	11	79	2	14	0.46	0.64	retain
29	11	79	2	14	0.46	0.64	retain
30	13	93	2	14	0.54	0.79	retain

31	9	64	3	21	0.43	0.43	retain
32	10	71	3	21	0.46	0.50	retain
33	10	71	3	21	0.46	0.50	retain
34	9	64	2	14	0.39	0.50	retain
35	8	57	2	14	0.36	0.43	retain
36	11	79	3	21	0.50	0.57	retain
37	10	71	4	29	0.50	0.43	retain
38	8	57	4	29	0.43	0.29	retain
39	9	64	4	29	0.46	0.36	retain
40	9	64	4	29	0.46	0.36	retain

Appendix J
Comments Given to Knowledge Test in Mathematics

Here are some comments given to them before the test was made for the first try-out.

1. ABC are all possible answers improve the choices.
2. This item is not applicable for knowledge test in integers.
3. This item does not measure conceptual understanding.
4. Recast the stem in question form.
5. Replace all the option.

6. Modify your options.

7. Write the peso sign before the number.

8. Check your concepts and grammar.

9. No answer for this item.

10. Arrange the options accordingly.

11. Use brackets when sets are grouped.

Appendix K
Second Try Out of the Knowledge Test

Name: _____ Score: _____
Grade 7/ Section: _____ Age: _____
Birthdate:_____

I. Read each item carefully. Write the letter of the best answer in the blank provided for each item.

_____ 1. Which number is a whole number but not a counting number?
a. -1 b. 0 c. 1 d. 2

_____ 2. Which of the following are whole numbers less than 3?
a. 0 b. 1,2 c. 0,1,2 d. 1,2,3

_____ 11. Which list is in order from least to greatest?
e. -36, -32, -5, 20, 24 c. 24, 20, -5, -32, -36
f. -5, -32, -36, 20, 24 d. -32, -36, 24, 20, -5

_____ 12. Evaluate the expression -10 + 3(27÷-3)².
b. 223 b. 44 c. -136 d. -567

_____ 13. Which of the following set of integers are arranged in descending Order?
e. -12, -21, -11, 11, 0 c. 0, 12, -41, -21, -12
f. 0, -33, -45, -53, -74 d. 12, 0, -12, -21, -41

_____ 14. How much greater is -79 than -96?
c. 17 b. -17 c. -175 d. 175

_____ 15. Simplify: 18 – 6 + (-3).
a. 4 b. -4 c. 16 d. 20

_____ 27. Dallas bought a share of stocks for php 2 435. The next day, the price of each share dropped by php 24. On the third day, the price rose by php 31. How much was Dallas's stock worth at the end of third day?
a. Php 2 442 b. Php 2 490 c. Php 2 424 d. Php 2 380

Appendix L
Item Analysis in the Second Try Out Of the Test.

Item No.	No. Of Correct Responses				Index of Difficulty	Index of Discrimination	Remarks
	Upper 27%		Lower 27%				
	F	%	F	%			
1	13	93	5	36	0.64	0.57	retain
2	9	64	5	36	0.50	0.29	retain
3	12	86	6	43	0.64	0.43	retain
4	11	79	4	29	0.54	0.50	retain
5	10	71	4	29	0.50	0.43	retain
6	9	64	4	29	0.46	0.36	retain
7	8	57	4	29	0.43	0.29	retain
8	13	93	3	21	0.57	0.71	retain
9	12	86	2	14	0.50	0.71	retain

10	11	79	4	29	0.54	0.50	retain
11	9	64	3	21	0.43	0.43	retain
12	9	64	3	21	0.43	0.43	retain
13	9	64	3	21	0.43	0.43	retain
14	10	71	3	21	0.46	0.50	retain
15	8	57	5	36	0.46	0.21	retain
16	8	57	5	36	0.46	0.21	retain
17	9	64	5	36	0.50	0.29	retain
18	8	57	5	36	0.46	0.21	retain
19	7	50	5	36	0.43	0.14	retain
20	10	71	2	14	0.43	0.57	retain

Item No.	**No. Of Correct Responses**				**Index of Difficulty**	**Index of Descrimination**	**Remarks**
	Upper 27%		**Lower 27%**				
	F	**%**	**F**	**%**			
21	11	79	2	14	0.46	0.64	retain
22	8	57	4	29	0.43	0.29	retain
23	7	50	6	43	0.46	0.07	revise
24	9	64	3	21	0.43	0.43	retain
25	9	64	3	21	0.43	0.43	retain
26	8	57	3	21	0.39	0.36	retain
27	10	71	2	14	0.43	0.57	retain
28	11	79	2	14	0.46	0.64	retain
29	11	79	2	14	0.46	0.64	retain
30	13	93	2	14	0.54	0.79	retain
31	9	64	3	21	0.43	0.43	retain
32	10	71	3	21	0.46	0.50	retain
33	10	71	3	21	0.46	0.50	retain
34	9	64	2	14	0.39	0.50	retain
35	8	57	2	14	0.36	0.43	retain

36	11	79	3	21	0.50	0.57	retain
37	10	71	4	29	0.50	0.43	retain
38	8	57	4	29	0.43	0.29	retain
39	9	64	4	29	0.46	0.36	retain
40	9	64	4	29	0.46	0.36	retain

Appendix M
Scoring Rubrics on Performance Task

Criteria	Great! (3)	Good (2)	U-uh! (1)
Quality of the Context Used	Realistic, Appropriate, and Interesting	Realistic and Appropriate but not interesting	Unrealistic and inappropriate

Clarity of the Problems	Clearly stated; uses Correct terms and phrases	Lacks clarity; Contains grammatical Errors; may be misinterpreted	Confusing; lacks Necessary data And/or condition
Openness to Multiple Solutions	Can be solved in at Least 3 ways	Can be solved in 2 ways	Can be solved in Exactly one way
Accuracy of Solutions	Solutions are Accurate and well-explained	Solutions have minimal errors	Solutions are inaccurate

Appendix N
Interview to the Respondents

Oral Interview

Interview 1

1. ***Researcher*** (**R**): ***Can you tell me about what you have been doing with +/- numbers***

   Male(**M**) 1: Use calculators to find negative and positive numbers

   Female(**F**) 1: make graphs, negative numbers

   M1: compare, find the difference, and use equations, -5 + something equal something, and you have find what it equal in the calculator, so we have to write down every single step.

2. **R**: ***Did you use a number line to solve the problems***

   F1: the teacher puts up a number line so we started doing those things.

M1: like this start at the negative and then go positive

3. **R:** ***Turn to a blank page in your notebook, show me how you write it out.***

M1 : regular number line, 0, 2, 4, 6, 8, 10. It is supposed to start at -6 add 4, 1,

2,3, 4 so -2.

F1: In these graphs, up and down, down is negative and up is positive so when you are talking about temperature or something or water.

M1. They make us do this to help us understand negative and positive and the direction they go in.

4. R: ***Do you remember what it is called***

M1- Number line

F1- Like the 6 is negative you have to change it so you are not subtracting, you are adding, so it makes it positive.

M1- If it is negative 6, instead of subtracting you add. You do the opposite of what they are asking you to do.

5. **R** :***Can you show me your solution in -13 + 8?.***

M1- She always tells us to do a story right. So you owe someone 13 pesos but you only have 8. So you subtract, I still do the subtraction so its minus 13. 8 minus 13.

F1 - Sometimes I get confused about multiplying positive and negative numbers. And also adding and subtracting integers. I Thought its addition but its subtraction.

M1. I got confused on the algebra expressions because sometimes it says negative and I thought oh, you subtract it. You have to change that to a positive because two negative signs can‘t be together. So I just change that to a positive.

6. R: ***Do you guys like the number line***

F1. I like the number line better

M1. I understand better with the pieman than the number line. The number line is too long, too many numbers.

F1. So if you have numbers like 100, 500, it doesn‘t go all that way. +5, +5, I get confused

M1. Like when a negative and a positive is a negative

7. R: ***How would you improve the number line activities***

F1. Only use it for little numbers

M1. Don‘t use it for extremely large numbers.

8. R. ***how would you do this 754 + (- 322)***

F1. That would be 432 by subtracting 322 from 754

M1. 754 minus 322 equals 432

Interview 2

1. R: Tell me what you have been learning about positive and negative numbers

   Female 1 (F1): Subtracting and adding with them

   F2: multiplying and dividing

2. R. can you tell me a little more about subtracting and adding with them

   F1: We aren‘t the best at it but we are all getting better at it. I can‘t think right now because of the recorder

3. R : pretend it is not here, your teacher won‘t listen to them, this is a safe zone. What do you think about using a number line

   F2: That was easy

4. R: What do you mean?

   F1: Sometimes we don‘t know how to show it, but if you use a numberline and it says -2 you can go to -2 and then if it says add 6 you can add 6 and see what you get. To me seeing something makes it easier.

   F2: It was easy.

R: Do you like it better than another method?

F3: Yeah, to see the numbers and to see which is the answer. If you put a -4 + -5 it is hard to see the numbers, but I put a number line and easier .

R: What about other methods?

F1: I don‘t know what its called, but it is like a chart and there is a negative side and a positive side, she (teacher) uses it a lot though.

F2: I forgot what it is called.

F3. Negative 6 you put it here and then if they say add something you put it on the positive side. So you can see what crosses each other out. So whichever has ones left over is your answer.

R: So if you had -6 and +5 how would you do it with that method.

F2: Adding or subtracting?

R: Let‘s try adding first.

F3. She‘s better at it, I get all confused.

R: -6 + 5, why don‘t you try the method you like the most with that

F2: Negative 1.

R: So how do you know its negative 1

F3: There‘s one left (points)

R: There‘s one left on the negative side? Ok what do you like least about the number line

F2. Sometimes you don‘t want to fill in all the negative sides, it takes a long time to write the number line.

F3. I like it, nothing bad about it.

R: Calculator activities graphing integers as vectors

F1: I don‘t like them, the way they explain it is complicated. I‘d rather show my work on paper than use the calculator. Like when they tell you to press Y=, zoom, window

F2: On the calculator there is a lot to do. Writing takes longer. I know the calculator is more accurate, but when she gives us the packet with all these instructions it is confusing.

F3. The calculator is easy. But pressing all the buttons is confusing, pressing delete, gets confusing.

R: If you had to rank the number line, the crossing out method, and the calculator

F1: the number line, her way (teacher), then the calculator

F2. The number line, then the calculator, then the teacher‘s way

F3. The number line, the teacher‘s way, then the calculator

R: suggestions to improve number line activities to make it better

F1: No

F2: Not really

F3: no

R: you said you had an issue with putting all the negative sings

F1: I guess you could just put a bracket with a negative above it. Because when you are taking a test you only have a certain amount of time, so you could just put a negative with a bracket above the number line

R: 5 – 12 This is not a test, we are just interested in how you think about it.

F1: I got a different answer so now I'm confused.

R: It's okay if you get stuck

F2. Positive side and then add 12 so its going to be 17

F1: I just subtracted, and it went to -7 rather than 17 so now I'm confused.

R: Is there anything you can do to check to see what's the right one

F1: I think its 17. If you are really just subtracting then it is -7, but if you are adding then it is 17.

F3. No this way over here.

R: do you want to try it another way, we don't have a calculator which is your second favorite.

F3. It's 17.

F1. That way (teacher way) is confusing to me. It's -7 (uses cell phone)

F1. I was right, okay, I'm not confused anymore. I just looked at 5 and subtracted 12 and got -7.

Interview 3

R: So tell me what you have been learning about positive and negative numbers

M1: we've just been learning to multiply, add, subtract, divide.

R: how were you doing that

F1: with a pencil, your mind, with the numbers, the teacher helps us

M1: I understand it, its' pretty easy. The teacher explained it more better than our middle school teacher.

R: Did you like the number line

F1: putting on the negative numbers and positive

F2: She is saying that, but you know how the negative numbers are here and the positive numbers are here and you have to count backwards.

R: Can you show me an example. What did you like most about that method

F1: everything.

R: Is there anything you didn‘t like

M1: I didn‘t like the number line. -3 + 10 - #, you have to keep going back and forth and back and forth . -3 , 1,2,3,4,5,6,7,8,9, 10. Seven.

R: Can you write out in a number sentence what you mean.

M1. I get this, but I don‘t like using that method. That little think shows these two will be negative and these two will be positive, so if you have a -3 and a – 26 you put those two together and add so it will be 3 + 26 you take those two negatives and put them as positive.

R: Can you show me how you would do this one with that method

M1: negative and a positive, 3 and -10 so it will be negative unless the number is big, so it would be a negative 7, but since 3 is less than 10 it will be positive.

R: What was one of your favorite activities or methods for solving the problems

F1:. I don‘t know how to start

F2: look at patterns, find 1 go to that 1

M1: not the patterns we‘re talking about negatives

F2: okay never mind.

F1: add and multiply, you know the one we were doing with x, 4 + -2 and you have to cross it out. 1 ,2, 3, 4, put the positives here and negatives here and get the answer. 4 x 3 = 1, 2, 3, 4, and that‘s 12.

+ + + +
+ + + +
+ + + +

M1. Since this is a row, this is three positives

F1. No you don‘t do that, first you do the negative

M1. Oh the opposites

F2, I don‘t know how.

Interview 4

R: Tell me a little bit about the positive and negative numbers activities you've been doing in class

M1. How a negative times a negative and stuff like that, how a positive and a negative react to each other. How they work.

R: can you show me or describe it

M1. -5 x 3, you can do 3 rows of or 5 rows or 3 rows of -5 and then that will equal -15 but if you turn it the other way around it will be a positive 15.

F1. You turn it 3 x -5

M1. +3 x -5 would equal +15 because a positive times a negative,

F1. A Positive times a negative equals a positive and a negative times a positive is a negative

M1. No a negative times a negative is a positive and a positive times a positive is a positive.

(writes out rules)

(Interruption – class going out to computer lab, noisy)

R: How did you come up with yours.

M1. A negative times a positive is a negative, a positive times a negative is a negative,

F1. A negative times a negative is a positive, and a negative times a positive is a negative

M1. And two negatives times a negative is a positive.

R: how would that help you on this problem

M1. A positive times a negative is a negative 3 x -5 = -15

R: Tell me what you liked most about using a number line

M1: It helps us if it is decimals it helps me.

R: What do you mean

M1. Like point, say there are ten lines, this is .10 and this is -.10 out of a whole. If there were only 5 lines it would be .20 and -.20.

R: So how would you solve a problem using this

F1. Like -25 – 5, so this is negative side and this is the positive side, so it is like you owe someone 25 dollars. Then you are asking for 5 more so you are going to add it up, so it is negative 30.

M1. But if you subtract it , it goes more to the

F1. When you are adding you go to the positive side, when you are subtracting you go to this side.

F1. -25 – 5 equal -20.

M1. That one is -20 and that one is -30. Hers says I owe you -25 but now you don‘t have to owe me 5 pesos. Mine says I‘ve been buying you lunch so you owe me 25 pesos.

R: you explained it differently.

F1. If you have 25 and you take away 5 you are still asking for more. So you can be taking away, it depends on this number, if it is negative 5 you are going to go this way, you are going to subtract more, if it is positive 5 you are taking away so you are going to the positive side.

R: So you are getting different answers. Is there another method you could use to check

M1: Calculator

R: pushing the numbers or like you did in the class

F1. If you got a different answer, the negative sign has to be in the right spot in a calculator or we still could get different answers.

R: Which did you like better

F1: I liked the face for the negative times a negative.

M1: the number line for adding and subtracting

F1: For adding and subtracting the number line

M1. For positive and negative fractions I turned it into a decimal. Percents are the same as decimals. Once you turn a fraction into a decimal you can see how much to take out

R: Suggestions for improving number line activity

M1: Do more fractions to help people who have problems. Make papers for that person who is having trouble with fractions. Everyone has the same paper but different signs.

F1. I liked them, I like the way it works, it helps to find the difference of negatives and positives, also to find what is bigger like -5 and -25, we use which one is closer to zero.

M1. It can help you find the range, the difference of a number, what is in r between.

R: 5-12

M1. I wouldn‘t use a number line, I would just subtract, since you can‘t do it, it goes into the negative.

R: what do you mean you can‘t do it

M1. I have to use a number line. You are at 5 and you take away 12, 1,2,3,4,5,6……12 so it would be right here, at -7.

R: You also got -7 by just using numbers.

M1. I solve with just regular numbers and explain with the number line

F1. I flip it, 12 – 5 and the difference is 7. I find out which is bigger, 12 is bigger, 5 is positive, I have to take more than 5 so I have to go to the negative side. So I have to take 5 and 7 more which is 12 and I end up in the negative side which is -7.

Appendix N
Letter of Request to the Principal

Division of City Schools
School District II
Commonwealth High School
2nd District, Quezon City, Metro Manila

December 12, 2013

Dr. Sally B. Barcelona
School Principal IV

Dear Ma'am,

Greetings!

The undersigned is currently enrolled in MAT-550 and working on a paper entitled "Conceptual Understanding, Procedural Skills and Attitudes of Grade 7 pupils on Integers", a partial requirement for the degree Master of Arts in Teaching Mathematics in Philippine Normal University.

One of the requirements in my proposed study is to gather data using questionnaires. These will be given to 50 grade 7 pupils from sections 2 – 15. The questionnaires will serve as my tool to assess the conceptual understanding of pupils in integers from their previous experiences/ learning.

In view of this, may I ask permission from your good office to please allow me to administer test using my developed instrument which was validated by a P.N.U. mathematics experts and approved by the research adviser. Attached herewith is a copy of the test questionnaire and mathematics attitude scale.

Your positive response regarding this matter is highly appreciated.

Thank you very much.

Respectfully yours,

Rochelle O. Elcarte
Researcher

Noted:

Dr. Elisa S. Baccay
Adviser

Approved by:

Dr. Sally B. Barcelona
School Principal IV

Appendix O
Letter to the Evaluator

December 12, 2013

_____

_____

Faculty, Mathematics
College of Science
PNU

Dear Sir/ Ma'am,

Greetings!

The undersigned is currently enrolled in MAT- 550 and working on a paper entitled "Conceptual Understanding, Procedural Skills and Attitudes of Grade 7 Pupils on Integers", a requirement for the degree Master of Arts in Teaching Mathematics. Being aware of your expertise in the field, may I ask a favour from you to please evaluate the developed test which will be used for the final test administration. Attached herewith are the copy of the developed instrument and an Evaluator's Assessment instrument.
Your positive response regarding this matter is highly appreciated.

Thank you very much

Respectfully yours,

Rochelle O. Elcarte
Researcher

Noted:

Dr. Elisa S. Baccay
Adviser

Appendix P
Letter of Request to the Evaluator
Content Validation for the Attitude Scale

December 9, 2013

_____
_____
_____
_____

Sir/ Ma'am:

Greetings of Peace!
I am presently working on a paper entitled "Conceptual Understanding, Procedural Skills and Attitude of Grade 7 Pupils on Integers", as a requirement for the degree Master of Arts in Teaching Mathematics.

Being aware of your expertise in the field, may I ask a favour from you to please evaluate the survey questionnaire I developed which will be used to determine the attitude of pupils towards mathematics.

Attached herewith are the copy of the survey questionnaire and the expert's Assessment Checklist.

Your positive response regarding this matter is highly appreciated.
Thank you very much.

Respectfully yours,

Rochelle O. Elcarte
Researcher

Noted:

Dr. Elisa S. Baccay
Adviser

Curriculum Vitae

Personal Information

Name	:	Rochelle Ordiales-Elcarte
Age	:	36 y.o.
Date of Birth	:	October 02, 1977
Place of Birth	:	Quezon City
Citizenship	:	Filipino
Religion	:	Catholic
Status	:	Married
Name of Spouse	:	Romel R. Elcarte
Name of Children	:	Rhianna O. Elcarte
		Romel O. Elcarte Jr.

Educational Attainment :

Level	Name of School	Degree Course	Year Graduated
Elementary	BagoBantay Elementary School, Quezon City	Intermediate	1990
Secondary	San Francisco High School, Quezon City	Secondary	1994
Tertiary	Philippine Normal University, Manila	BSE –Home Economics	1998
Graduate	Harvardian Colleges Of Pampanga	12 units Elementary Education	1999
	Philippine Normal University, Manila	MAT- Mathematics	2014

Work Experiences

Inclusive Dates	Position Title	School
December 15, 2009 to present	Teacher I	Commonwealth High School
July 2009 to December 14, 2009	Contractual Teacher	Commonwealth High School
June 2001 to March 2009	Permanent Teacher	Saint Joseph Catholic School
June 1998 to March 2001	Contractual Teacher	St. James College of Quezon City

Training Programs

Title of Seminar/ Conference/	Inclusive Dates	
Workshops/ Short Course	From	To
"Intensive Training for Elementary and Secondary Mathematics Teachers Focused on Content (Problem Solving Strategies in Mathematics)"	July 6, 13,	21, 27 & 28 2013
Regional Training of Grade 7 Math Teachers under The K-12 Basic Education Program of the Department of Education.	May 24	May 28, 2012
3-day In-service Training for Teachers (INSET)	October 26	October 28, 2011
Gearing Towards K-12	October 8	October 9, 2011

Promoting Appropriate Uses of Technology in Teaching		July 3, 2010
Regional Mass Training of First Year Teachers on The 2010 Secondary Education Curriculum	June 8	June 11, 2010
School Roll – Out of School Based Management Advocacy Materials and Training of Teachers for the Assessment of School Based Management Practices	July 28	July 31, 2009
Basic Faith Formation	May 19	May 21, 2008
The Catholic School Apostolate		May 17, 2006

Achievements :

Graduate Studies Scholar, Graduate Studies of Education,Philippine Normal University (2010 – 2014).
“Alay kay Inay Foundation ng Lungsod Quezon.