Philippine Normal University

Publication Office Online Commons

Seminar Paper

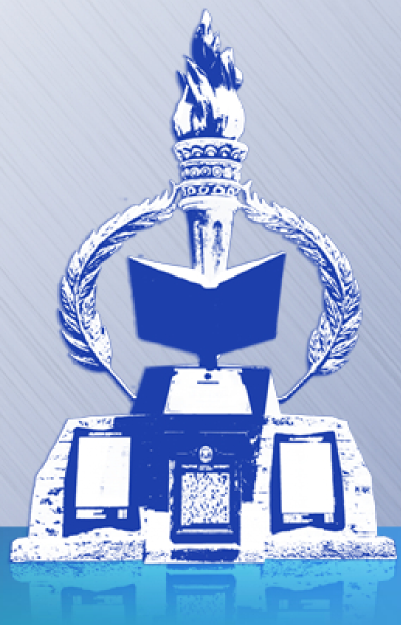
CGSTER

March 2015

Developing Students' Performance in Mathematics Using the Four Corners and a Diamond Graphic Organizer

Ma. Kristina G. Garcia

Philippine Normal University



Philippine Normal University
National Center for Teacher Education

DEVELOPING STUDENTS' PERFORMANCE IN MATHEMATICS USING THE FOUR CORNERS AND A DIAMOND GRAPHIC ORGANIZER

A Seminar Paper Submitted to the Faculty of
College of Graduate Studies and
Teacher Education Research
Philippine Normal University
Taft Avenue, Manila

In Partial Fulfillment of the
Requirements for the Degree
Master of Arts in
Teaching Mathematics

by
Ma. Kristina G. Garcia
March 2015

ACKNOWLEDGEMENT

I would like to express my deep gratitude and respect to my mentor and adviser, Dr. Rene R. Belecina, for the patience, guidance, advice and encouragement he has provided throughout my time as his student.

I must express my gratitude to my friend and colleague Ryan by his willingness to proofread and countless pages of meaningless mathematics.

Nevertheless, it is lucky for me to meet new friends who inspirit my effort to overcome my difficulties. These friends are Janella Cadiente and Marc Marquez.

Completing this work would have been more difficult were it not for the support and friendship provided by the others members of the school of STI Ortigas-Cainta.

I owe more than thanks to my family members for their support and encouragement throughout my life.

Finally, to God Almighty for the wisdom and strength he has given to me.

M.K.G.G,

Philippine Normal University
National Center for Teacher Education

ABSTRACT

Name: Ma. Kristina G. Garcia

Title: Developing Students' Performance in Mathematics Using the Four Corners and a Diamond Graphic Organizer

Key Concepts: Four Corners and Graphic Organizer, Students Performance in Mathematics

Degree: Master of Arts in Teaching

Specialization: Mathematics

Adviser: Rene R. Belecina, Ph.D

The main purpose of the study is to develop the students' performance in mathematics using the four corners and graphic organizer on the mathematics achievement of the selected first year students of STI Ortigas-Cainta. The study used the four corners and a diamond graphic organizer as an instrument strategy employing the quasi experimental design specifically the non equivalent control group design. Instruments used in the study were the achievement test in special products and factoring; students' perception questionnaire and the Four Corners and a Diamond Mathematics Graphic Organizer. The data gathered were interpreted both quantitatively and qualitatively. The result shows that the use of the Four Corners and a Diamond Graphic Organizer on students' performance were determined by comparing the students pretest and posttest scores in Mathematics Performance Test using the t-test and independent means. Students' perceptions on the use of the Graphic Organizer were gathered using

organizer was an effective tool in learning the concepts and processes in College algebra. Thus, students were helped in learning mathematics better through the use of the Graphic Organizer. The Four Corners and a Diamond Graphic Organizer being found helpful in better learning in developing students’ performance in Mathematics, it is therefore recommended to teachers to use as one of their teaching strategies to improve the performance the students in learning Mathematics.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The main purpose of the study is to develop the students' performance in mathematics using the four corners and graphic organizer on the mathematics achievement of the selected first year students of STI Ortigas-Cainta. The study used the four corners and a diamond graphic organizer as an instrument strategy employing the quasi experimental design specifically the non equivalent control group design. Instruments used in the study were the performance test, students' perception questionnaire and the Four Corners and a Diamond Mathematics Graphic Organizer. The data gathered were interpreted both quantitatively and qualitatively. The result shows that the use of the Four Corners and a Diamond Graphic Organizer on students' performance were determined by comparing the students pretest and posttest scores in Mathematics Performance Test using the t-test and independent means. Students' perceptions on the use

CHAPTER I

The Problem and Its Background

Introduction

Through the years, mathematics has been the school subject which is posing the greatest challenge among students. A greater majority of them believes that mathematics is difficult. This belief is confirmed by several studies conducted on mathematics learning which show that students learn only one-third of what they are supposed to learn in mathematics (Ibe, 2005). The third International Mathematics and Science Study (TIMSS) also shows that Filipino students ranked 42nd in mathematics achievement out of 45 countries which participated in the study.

One cannot help but conclude that there must be something wrong with the way mathematics is being taught to our students. In many countries, including the Philippines, most teachers teach a mathematics to students and pupils in the following manner: review the previous lesson, check homework, introduce the new topic or concept, demonstrate on the chalkboard, provide practice exercises (rote drill), and have children work individually, to check whether the process has been learned. This typical practice in teaching mathematics tends to be uninteresting as it does not require inquiry or higher thought process. It does not encourage cooperative learning and brain storming. It does not develop communication among students and with their teachers.

Students nowadays show unwillingness to answer or not attempt to answer math problem, their answers are not well thought. Some are not confident, hesitant and forgetful of what he or she is doing in the middle of a math problem because they have problem in recalling what have been taught in previous class.

On the other hand mathematics teachers are experiencing major changes not only in the subject content, but also in the way they teach. Nearly all of these teachers came through school when mathematics consisted of a collection of facts and skills to be memorized or mastered by a relatively homogeneous group of students taught using a lecture approach. Now teachers are called on to teach new, and more challenging mathematics to a very diverse audience using active learning approaches designed to develop understanding. Teachers should ensure that all students are given opportunities to think and work quietly by themselves where they are not required to process the varied and sometimes conflicting perspectives of others.

It is important for educators to adopt instructional design techniques to attain higher achievement rates in mathematics. (Rasmussen &Marrongelle, 2006). Considering students' needs and comprehension of higher-order mathematical knowledge, instructional design provides a systematic process and a framework for analytically planning, developing, and adapting mathematics instruction (Saritas, 2004)

Ives (2007) states that research confirms that some relationship exists between some language skills and some mathematical skills. Thus as a teacher who would like her students to excel in mathematics, He would look for strategies that would limit the use of language and the students would be able to use graphic representations to help them solve mathematical problems. Studies have shown, students who use graphic organizer have improved their ability to comprehend reading material. Thus, teachers are more motivated to use strategies like graphic organizers to reduce the load of written words and transfer it to “graphic arrangements of words, phrases, and sentences, and they may also include graphic elements such as arrows, and boxes” (Ives, 2007) to help students learn.

Graphic organizers come in many varieties and have been widely researched for their effectiveness in improving learning outcomes for various students. Graphic organizer is a diagram that shows the various relationships between ideas or information. Math graphic organizers are useful tools in the process of understanding and solving math concepts or problems. A mathematical graphic organizer may be used to isolate important details, support the progress of the math problem, enhance recall, motivate, clarify math for targeted instructional area information or assist a student in organizing thoughts.

The four corners and a diamond graphic organizer especially encourage students to begin working on a problem before they have an identified solution method. As in the four square writing method, the students then organize and edit their thoughts by writing their solution in the traditional linear response, using connecting phrases and adding details and relationships. The steps for the open response write-up are as follows: (1) state the problem; (2) list the given information; (3) explain methods for solving the problem; (4) identify mathematical work procedures; and (5) specify the final answer and conclusions.

The graphic portion of the organizer allows all students to fill in parts of the solution process. It encourages all students to persevere—to "muck around" working on a problem. Further, teachers quickly can identify where students are confused when solving a problem by simply examining the graphic organizer.

As teachers, it is their job to find ways to help low-achieving students succeed. By implementing graphic organizers into the classroom, students gain more guidance and organization in identifying their existing prior knowledge and building upon their knowledge effectively. The teacher will gain more insight into where gaps reside in student prior knowledge and how to fill those gaps, as well as be able to identify gaps in developing knowledge.

With the end view of developing students' performance in mathematics, through the use of Four Corners and Diamond Graphic Organizers this study was conducted.

Conceptual Framework

This study is based on several theories which serve the framework of the investigation.

Knowledge gained about how the brain processes information has been instrumental in the development of teaching techniques and learning strategies. Several cognitive theories in particular lend support to the use of graphic organizers in helping students process and retain information. Schema theory, dual coding theory, and cognitive load theory provide the basis for explaining the characteristics of graphic organizers that support the learning process.

According to schema theory, memory is composed of a network of schemas. A schema is a knowledge structure that accompanies or facilitates a mental process. According to Winn and Snider (1996), all of the definitions of schema theory contain the following characteristics:

First, a schema is an organized structure that exists in memory and combined with other schemas, contains the sum of an individual's knowledge.

Second, schema consists of nodes and links that describe relationships between node pairs.

Third, schema is formed through generalities, not specific information.

Fourth, schemas are dynamic. As new information is learned, is assimilated into existing schemas or causes the formation of new schemas.

Fifth, schema provides contexts for how new experiences are interpreted. How information is interpreted is based on existing schemas (Winn & Snider, 1996).

According to Dye (2000) "the graphic organizer has its roots in schema theory". When students learn something new, they must be able to retain the information for later use. The knowledge is stored in a scaffold hierarchy as a way of organizing information. According to Slavin (1991), people encode, store, and retrieve learned information based on this hierarchy. Information that fits into a student's existing schema is more easily understood learned and retained than information that does not.

The teacher's task is to ensure that the student has prior knowledge related to the concept and to provide a means for helping the students make connections between prior knowledge and new concepts. Graphic organizers make it easier to link new information to existing knowledge and help students build the schema they need to understand new concepts (Guastello, Beasley, & Sinatra, 2000). If prior knowledge is activated, the schema will be able to provide a framework to which new information can be attached and learning and comprehension will be improved.

Another theory where the use of graphic organizer is based in the Dual Code Theory. Paivio (1986) published a dual coding that assumes that memory consists of two separate but interrelated systems for processing information. One system is specialized in processing non-verbal imagery and the other is specialized in dealing with language. While each system can be activated independently, there are connections between the systems that allow for the dual coding of information. The visual system specializes in processing and storing images. The processed and stored images are termed imagens (Paivio, 1986). The verbal system processes linguistic information. The resulting stored linguistic information are termed logogens (Paivio,1986). Paivio describes both imagens and logogens as meaningful units of memory similar to "chunks" described by Miller (1956). According to Saavedra (1999), dual coded information is easiest retrieve and retain because of the availability of two mental representations, verbal and visual,instead of one. The more students use both forms, the better they are able to think about and recall information (Marzano, Pickering, & Pollock, 2001).

The theoretical foundations of dual coding theory have definite implications on the value and use of graphic organizers. Marzano, Pickering, and Pollock (2001) state that graphic organizers “enhance the development of non-linguistic representations in students and therefore, enhance the development of that content” (p.73). The use of graphic organizers also helps students generate linguistic representations. As a visual tool, graphic organizers help students process and remember content by facilitating the development of imagens. As a linguistic tool, text based graphic organizers also facilitate the development of logogens thereby dual coding the information.

In line with the connection between mental processing and the use of graphic organizer, Cognitive Load Theory shows how the amount load affects the mental processing of a person. Cognitive load is the amount of mental resources necessary for information processing (Adcock, 2000). Cognitive load theory maintains that working memory can deal with limited amount information and if its capacity is exceeded, the information is likely to be lost.

According to Cooper (1998), working memory has a capacity of between four to ten elements depending on the student’s existing schemas. Extraneous cognitive load refers to how much demand is placed on working memory to learn the new material. The level of extraneous cognitive load may be modified through different modes of instruction, thus facilitating student learning. Visual learning tools such as graphic organizers can reduce the cognitive load and as a result, allow more of the working memory to attend to learning new material (Adcock, 2000). As a result, content can be addressed at more sophisticated and complex levels through the use of graphic organizers.

In proportion to the above mentioned statement, R.C. Anderson (1998), an educational psychologist, developed the “Schema Theory” which deals with concept of schema in understanding the interaction of key factors affecting the comprehension process. Schema theory states that all knowledge is organized into units. Within these units of knowledge, or schemata, is stored information. A schema is a generalized description or a conceptual system for understanding knowledge-how knowledge is represented and how it is used. According to this theory, schemata represent knowledge about concepts: objects and the relationships they have with other objects, situations, events, sequences of events, actions, and sequences of actions.

Consequently, “A theory related to graphic organizers is schema theory. It states that new information must be linked to preexisting knowledge... a person takes this new information and stores it in preexisting hierarchies or channels.” To add to the prior knowledge that students have, graphic organizers organize this information and help students begin processing it. Then, it can be constructed into the existing scaffold of the students’ mind, essentially increasing learning and knowledge.”

Therefore, Schema theory explains that within the memory exists schemas, or networks of information. The use of a graphic organizer can help students link the existing knowledge organized in schemas to the new knowledge.

Some educators believe that colleges and universities should adopt a system of tracking students in order to cater to the needs of different groups of students with different levels of thinking. Other educators believe that colleges and universities should make an institutional commitment to the development of formal reasoning, thereby requiring that all students graduating from college demonstrate a mastery of formal reasoning patterns. Whatever solutions educators intend to adopt in the process, it is important that they devise ways of finding out the level of cognitive performance of their college students in mathematics.

Several theories have been developed to explain the cognitive development of children. Piaget(1956), claims that learners at the concrete operational level begin to develop their mathematical thinking. They can remember images of physically absent objects but cannot deal with ideas. This mental ability grows and develops as they increase their awareness of the views of others. At the formal operational stage, Piaget believes that the learners are able to deal with ideas and think beyond the concrete reality. These ideas are expressed in terms of statements and propositions, which they use in communicating their logical thought. They develop the ability to solve problems mentally through the use of representations and mental models. They are able to follow the scientific way of finding solutions to problems or derive conclusions from the given premises of an argument. They manifest higher order thinking skills by responding to inquiries logically and making effective decisions. Aside from the operations that they engage in at the concrete operational level, they are able to exhibit ratio and proportional thinking, probability and co relational thinking needed to perform well in mathematics.

The potentials of formal operational thought according to this theory develop during the middle school years. According to the theory, these potentials can be actualized by ages 14, 15, or 16 years, if proper learning experiences are encountered by the individual. These experiences consist of both the individual and social aspects of learning.

Apparently, learning mathematics involves formal operational thought. The research of Piaget shows that individuals are formal operational thinkers by ages 15 or 16, the usual ages of college freshmen in the Philippines. Consequently, mathematics teachers expect college freshmen to perform at the formal level. So, the curricula and syllabi for mathematics courses in the Philippines are designed with the goal of engaging students in formal level learning activities. Central among Piaget's conceptions is the idea of sequential stages of cognitively different levels of intellectual development.

Developing knowledge in students is a topic with many viewpoints and varying procedures depending on the ability level and previous experiences of a student. With such a variety of students coming into a classroom every day, it can be a challenge to determine what prior experiences the students have had, how the students learn best (if they even know), and how well they are able to build connections. Marzano (2007) and Gil-Garcia & Villegas (2003) cite that there are two major types of knowledge that govern how we learn: declarative and procedural. Declarative knowledge has to do with knowing facts and definitions, whereas procedural knowledge has to do with knowing how to complete a task (Gil-Garcia & Villegas, 2003). In order to build up one's procedural knowledge, it is imperative that the appropriate declarative knowledge already be in place. The development of both of these types of knowledge requires that one must regularly use and apply what has been learned.

To become fluent in their declarative and procedural knowledge, it is important for them to connect the new information to something that they already know or have experience with; their prior knowledge. This understanding comes from the idea of schema theory. According to Dye (2000), "schema theory states that new information must be linked to pre-existing knowledge and the teacher's task is to ensure that the child has prior knowledge related to the concept and to provide a means to assist the child in making the necessary connections between what is being taught and the child's prior knowledge". In courses with low-achieving, special education students, it is important to pay special attention to how information is presented and ensure that it is organized and focused on the important points, so that the students can more easily make the connections needed.

The methods available for assisting students in making connections vary slightly, but many of the ideas can be summarized by Marzan (2007). He explains a process for introducing students to new information that involves previewing, grouping, chunking, questioning, drawing conclusions or summarizing in a nonlinguistic manner and reflecting. Previewing involves students drawing out what knowledge they already have about the topic and introducing students to some of the main ideas that will come out in the lesson, book, video, etc. Grouping involves separating students into small groups to facilitate the learning and organization of information. Chunking requires the teacher to break the new information up into smaller pieces for students to process based on available prior knowledge, so that their working memory does not get overloaded. Questioning requires students to dig deeper into the new content and explain their understanding or make inferences based on their understanding. Students representing their knowledge non-linguistically, requires them to utilize a means other than verbal communication to demonstrate their understanding: writing, drawing, acting, etc. Finally, reflection involves the students looking back on the learning experience and processing it as a whole to identify what was learned and how confident they are in the new information/process.

One major tool that teachers can use to develop new knowledge in students that has an overwhelming amount of research support is the graphic organizer.

The graphic organizer allows the students to see the process of organizing information and further aids in their ability to properly learn and store the necessary information (Gil-Garcia & Villegas, 2003). From the teacher's perspective, the graphic organizer allows the teacher to easily recognize how students make their connections and identify gaps in the learning process (Greenstein, 2010). In addition, Marzano, Pickering, and Pollock (2001) discuss "dual-coding" theory, in which there are two major ways of storing knowledge: linguistically (verbal and text-based) and non-linguistically (sensory and image-based). The majority of what is done in the classroom is linguistic-based and students must, on their own, develop the nonlinguistic portion, if so inclined. Marzano, Pickering and Pollock argue that if instead teachers offer assistance, possibly in the form of graphic organizers, the results will show higher student achievement.

Based on the theory behind, the purpose of, and the studies done about graphic organizers, it is apparent that they are a very effective to help students organize information, identify prior knowledge and build on that prior knowledge. At the end of their study, Gil-Garcia and Villegas (2003) go so far as to say that, “the advance organizers may be the answer to enhance authentic, active, and dynamic teaching that in retrospect would lead to higher comprehension of complex curriculum and content”.

Marzano, Pickering and Pollock (2001) break graphic organizers down into six major categories: descriptive patterns, time-sequence patterns, process/cause-effect patterns, episode patterns, generalization/principle patterns and concept patterns. Descriptive patterns entail linking facts or details to a topic. Time-sequence patterns involve placing events in chronological order. Process/cause-effect patterns require students to fill in causes that lead up (in order) to the effect. Episode patterns help students keep track of the major details of a specific event. Generalization/principle patterns allow students to structure examples under the heading of a major idea. Concept patterns allow students to organize details, examples, facts and dates around a central idea.

Using diagram has been identified as the effective strategies to improve efficiency in mathematical problem solving (Uesaka et al, 2007). Through the study by Pantziara et al (2009) who investigated the effect of three types of diagrams; network, hierarchy and matrix in non-routine mathematical problem solving for all abilities of students. They have administered two different test to the same students which were Test A (without diagram) and Test B (with diagram). Findings indicated that presented diagrams in non-routine problem helped students who previously encountered difficulty in solving problems without diagrams and non-routine problems could be given without diagram at first and useful diagrams for their solution could be provided next while matrix diagrams were found to make the problem easier than network and hierarchy diagrams.

Through the study by Pantziara et al (2009) who investigated the effect of three types of diagrams; network, hierarchy and matrix in non-routine mathematical problem solving for all abilities of students. They have administered two different test to the same students which were Test A (without diagram) and Test B (with diagram). Findings indicated that presented diagrams in non-routine problem helped students who diagrams and non-routine problems could be given without diagram at first and useful diagrams for their solution could be provided next while matrix diagrams were found to make the problem easier than network and hierarchy diagrams.

Alan Zollman (2009) introduced the Four Corners and A Diamond Graphic Organizer. He used it to improve students' achievement in three areas of mathematics assessment in open-response problems: mathematics knowledge, strategic knowledge, and mathematical explanation.

The Four Corners and A Diamond Graphic Organizer was derived by Zollman from the squares writing graphic organizer described by Gould (1999). It has five areas with headings as follows:”what do you need to find”, “brainstorm possible ways to solve this problem”, try your ways here”, “what things do you need to include in your response” and the diamond at the center of the diagram with the heading “what mathematical ideas did you learn by working this problem”.

This graphic organizer, adapted for mathematical problem solving, was originally designed to teach essay writing to children in a five paragraph, step-by-step approach. The objective is to assist students in pre-writing and organizing ideas, which are the skills beneficial for solving mathematical problems.

The template for the Four Corners and a Diamond Mathematics Graphic Organizer can be produced using a blank piece of paper. The paper is folded to make the four corners by folding the paper horizontally and then vertically. The inner corner of the paper is folded up and when unfolded, the paper has four corners and a diamond on the center. The students can use each of the four corners to describe how they do the following steps in solving math problems: understand the problem, devise a plan, carry out a plan and look back or evaluating the task done. In the implementation, the most important aspect is how a student his or her response.

These describe the totality of learning, attainable if students are immersed in graphic organizer such as the Four Corners and A Diamond Graphic Organizer where they can have the opportunity to engage in metacognitive activities.

In the study, the use of the Four Corners and A Diamond Graphic Organizer was introduced to one group of students. Lessons for the other group of students were facilitated following the same Course outline but without the introduction and utilization of the said tool. The independent variable is the use/non-use of the Four Corners and a Diamond Mathematics Graphic Organizer and the dependent variable are the development of the students' performance in mathematics.

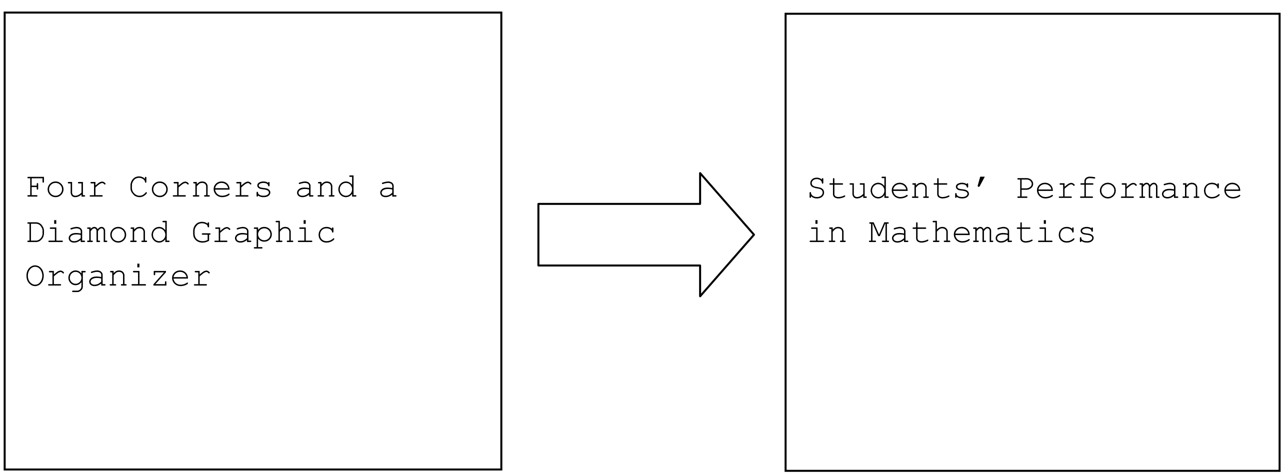


Figure 1. Conceptual Paradigm of the Study

Statement of the Problem

The purpose of this study was to develop students' performance in mathematics using four corners and a diamond graphic organizer.

Specifically, it sought answers to the following questions:

1. Is there a significant difference between the pretest and posttest mean scores in the mathematics performance test of the following groups?
   1.1 control group
   1.2 experimental group
2. Is there a significant difference between the mathematics performance of the control and experimental groups in the following?
   1.1 pretest
   1.2 posttest
3. How do the students perceived the use of four corners and a diamond graphic organizer?

Significance of the Study

The study aimed to develop the students' performance in mathematics using four corners and a diamond organizer. The graphic organizer increase learning and help the students express their ideas and concepts within the learning task. It is also serve as a medium that can enhance their understanding towards a more effective learning.

The findings of this study would be of benefit to the following:

The students. The results of the study will help them to consolidate their mathematical ideas, increased their confidence in mastering important concepts and improved their performance test by using the four corners and graphic organizer as their tool in learning mathematics.

The teachers. The results will help them aware about the effect of using the four corners and a diamond graphic organizer in developing students' performance in mathematics. With the information in hand, teachers could identify difficult concepts not yet mastered by many students and adjust their teaching styles and strategies.

The administrators. The findings of the study will provide the administrators the baseline data that will guide them in deciding what programs and projects to implement in order to improve teachers' methods of teachings and introduce innovative activities to make learning more effective.

Curriculum Planners. To help improve the current curriculum of their respective institution by integrating the use of graphic organizer in their teaching strategies.

Future Researcher. The data in this study can serve as baseline information to pursue further similar studies that may lead to the refinement, further validation of the findings of the study and will be a part of a cyclical process of enhancing the students' performance in Mathematics through the use of graphic organizers.

Scope and Delimitation of the Study

The purpose of this study was to develop the students' performance in mathematics using Four Corners and a Diamond graphic organizer. The sample was comprised of two homogeneous sections of the first year BSIT students enrolled in College Algebra at STI College Ortigas-Cainta during the first semester of the school year 2014-2015.One section was composed of 38 students, treated as the experimental group, and the other was composed of 34 students, considered as the controlled group. They both belong to the morning session. The students in experimental group used the Four Corners and a Diamond Graphic Organizer which was adopted from the research conducted by Alan Zollman (2009). The experimental and control groups have undergone the lessons using the Courseware prescribed by STI College. The experiment was conducted for 5 weeks during the midterm of the school year 2014-2015. The BT101A was treated as the control group while BT102A was treated as the experimental group. They both belong to the morning session.

Only one chapter was covered in this study, which are operations on polynomials and finding the roots. The researcher handled the two groups to minimize the teacher factor effect.

Definition of Terms

For better understanding of this study, the following terms are conceptually and operationally defined.

Control Group. This refers to the group of students who were assessed using the traditional method such as pen and paper type of assessment and board activity.

Experimental Group. This refers to the group of students who were assessed using Four Corners and a Diamond Graphic Organizer.

Four Corners and a Diamond Graphic Organizer. This refers to the graphic organizer which intends to improve students' performance in Mathematics. The *four-corners-and-a-diamond* has five areas: What do you need to find? What do you already know? Brainstorm possible strategies to solve this problem. Try your ways here. What things do you need to include in your response and what mathematics did you learn by working this problem? In this study, the Four Corners and a Diamond Mathematics Graphic Organizer devised by Zollman(2009) was used.

Graphic Organizer. This is a chart and an assessment tool used to represent and organize student's knowledge or ideas.

Mathematics Performance. This refers to the students' performance in the Mathematics performance test.

Mathematics Performance Test. This is a multiple choice test covering the topic on special products and factoring. This test was used as pretest and posttest during the experimental period.

Chapter II

Review of Related Literature

This Chapter includes an overview of information relating to the use of graphic organizer in content classrooms. Attention is focused on the learning theories that graphic organizes and studies relating to teacher implementation of graphic organizer.

Graphic Organizer

Numerous studies confirm the benefits of using graphic organizers in the classroom in terms of helping students develop and process information. The mere fact this is a method that has been backed by such a strong body of evidence has imbued me with confidence that this intervention will yield positive results. Graphic organizers are a way to help students "grapple with core ideas of the content and develop sophisticated relational understandings of it" (Ellis 2004). They help students to process information as opposed to memorizing and stressing facts (Ellis 2004), which is what history, is predominantly concerned with. Too often when we teach children in our particular content areas we take a Scholar Academic approach and essentially leave the children to sort themselves out and create their own knowledge as the all-knowing teacher shares his wisdom with his impressionable and precocious students. Graphic organizers are a way to differentiate this instruction, while appealing to a wide variety of learning styles.

Graphic organizers are structures or templates that help students to understand the relationships between concepts and vocabulary. They are a quick and effortless way to deliver effective instruction if used appropriately and responsibly in the classroom. "The learner does not have to process as much semantic information to understand the information. This is one reason why graphic organizers are such powerful devices for students with language based learning disabilities" (Ellis 2004).

The research question seeks to reaffirm the claims that Ellis and others assert because of the overwhelming belief in graphic organizers expressed by educators in various academic settings.

Graphic organizers are a literacy strategy often used by language arts and history courses. However, these visual aids can be modified to fit mathematics content. By replacing the original elements, such as arrows, with equations and symbols, these graphic organizers can be extremely useful for helping students understand mathematics (Ives, 2007). By using graphic organizers, you're allowing students "…to quickly organize, analyze, and synthesize one's knowledge, concepts, relationships, strategy and communication. It also gives every student a starting point for the problem solving process" (Zollman, 2009)

In order for students to effectively understand and apply mathematics, students need to be able to properly apply reading strategies to the text in order to extract the crucial information needed to solve the given problem (Ward, 2005). Reading and literacy strategies help students understand the language of mathematics, the underlying connections within the subject, and can help them decipher meanings and derive formulas from the text.

Graphic Organizer in other subject areas

Over the past thirty years, reading comprehension has been one of the major foci of research. To ameliorate this problem, teachers can provide comprehension interventions through the use of semantic maps, concept diagrams and story maps.

Semantic maps are visual devices that students can use to derive implicit and explicit meaning from ideas, concepts and details in text. This strategy increases students' understanding by helping them acquire, maintain and organize information. One way that this strategy can be used, is by presenting students with a completed semantic map depicting the key words and concepts of a passage. They should then read each paragraph. After finding the main ideas in the passage, students should link these key ideas to those on the map.

In addition, the use of semantic maps enables students to focus on key vocabulary and concepts that will enhance reading comprehension. When using this strategy, teachers should activate student's prior knowledge. For instance, in teaching the concept "whales", teachers can trigger background knowledge by showing a video on whales and then allowing students to suggest key words that relate to the topic .Students can actively participate in creating a semantic map that depicts major concepts being studied. A research synthesis conducted by Kim et al.(2004)illustrated that semantic organizers when compared to other instructional strategies (e.g., dictionary instruction)significantly improved comprehension skills of students with learning disabilities.

Another effective graphic organizer that can be used to improve comprehension skills is concept diagrams. Concept diagrams visually present the relationship among concepts. According to Cesarone (2007), concept diagrams are “chart-like graphic that describes a concept and its various relationships, with general concepts at the top, supporting concepts at the bottom, and lines showing the connections between the concepts”. Cesarone (2007) recommended that concept diagrams be used with students with LD as these students encounter tremendous difficulty in expressing and linking ideas. Moreover, this technique can be used to evaluate students understanding of information, by asking Organizers students to create their own concept diagrams. This would enable the teacher to see “misdirected links or wrong connections” (Helfgott, 2007). Helfgott (2007) elaborated that concept diagrams provide an “accurate, objective way to evaluate areas students have not grasped”. The multiple ways that this strategy can be used to increase comprehension makes it a necessary tool in all classrooms.

Finally, the use of story maps has been proven effective in improving reading comprehension with students with learning disabilities. This strategy allows students to systematically identify important story elements such as characters, plot and setting. DiCecco and Gleason (2002) stated that story maps improve students’ literal, interpretative and applied comprehension skills. They elaborated that this method assists in learning new vocabulary as well as recall information from a story. In fact, it helps students pay attention to important parts of a story. One way to use this approach is by the teacher reading a story and stopping at strategic points. Each stop contains questions that will aid students in identifying the relevant parts of the story. Students should be provided with immediate feedback as to help them understand new information correctly. Story maps activate prior knowledge before reading, help student monitor comprehension during reading and summarize key ideas after reading. It is an instructional device that reconstructs and builds schema.

In addition, story maps assist students in integrating previous knowledge with existing knowledge (Keel, Dangel&Owens, 1999). This method connects the elements so that students can better understand the beginning, middle and end of a story. Sorrel (1990) stated that story maps help students clarify concepts, make predictions and summarize key points. As a result, students are better able to give more comprehensive explanations of the setting, characters, plot, problem and resolution of a story.

Studies show that graphic organizers, such as semantic maps, story maps and concept diagrams,are effective tools in improving comprehension of students with LD (Boulineau, Fore, Hagan-Burke and Burke, 2004; Kim et al., 2004). These graphic organizers go beyond assisting in the acquisition of information but also help students to develop, maintain and generalize skills (Boulineauet.al, 2004). Research has shown that teachers who use graphic organizers can significantly improve comprehension skills of students with LD (Bulgren, Deshler &Lenz, 2007). Therefore, educators must consider the use of graphic organizers as a means of aiding students derive meaning from text (Duke & Pearson, 2002).

There is considerable evidence that graphic organizers are ideal methods for presenting large amount of data in a simplified manner (Gallavan and Kottler, 2007) Because of the magnitude of concepts in Social Studies, many educators struggle with presenting ideas in the specified period of time. Research shows that limited time equates to limited achievement. Therefore, graphic organizers are efficient ways to maximize engage time and thus increase learning in Social Studies.

Gallavan and Kottler (2007)noted that “students become more motivated, demonstrate faster short term recall and greater long-term achievement when [graphic]organizers are used effectively in Social Studies” (p.117). Social Studies lessons become more authentic and practical as students make relationship among concepts. This empowers them to be strategic learners and independent thinkers. They are able to make reasoned and informed decisions, share ideas and thus achieve the goal of Social Studies; which is, to become competent members of society.

Graphic organizers make learning Social Studies content manageable. This technique teaches students how to focus on the critical concepts by organizing and summarizing key ideas. During Social Studies lessons, graphic organizers can be used in an unlimited number of ways. They can be used across the learning stages as well as individually and in large groups.

Ellis (2004) highlighted several steps that educators can employ when using graphic organizers. They must first explain how the organizer is used. In this way, students will learn about both how content is organized and how the graphics work in these visual strategies. Then, there must be modeling on how to use the method, followed by guided practice. Guided practice can be done in several phases. First, students practice as an entire class. Here the teacher and all students give ideas on how to complete graphic organizer. Second, there can be small group practice, where students learn from their peers. Lastly, students work with the organizer on their own but get assistance when needed.

After using the graphic organizers, students will be ready to engage in independent practice. Here, students have mastered the skill, and can complete and/or create graphic organizers on their own. Teacher must follow this sequence for each format introduced. However, it must be noted that graphic organizers must not be over used as they can create boredom. Alternative formats must be used to keep students interested in the Social Studies lesson. Ellis (2004) claimed that graphic organizers are powerful ways to evaluate student's understanding of content. Therefore, if this visual technique is used sparingly and effectively, Social Studies teachers should expect to see positive gains in students' acquisition of content and thus, in school achievement.

The teaching of Science is a rather challenging task for many teachers (Sorgo, 2006). This is so for many reasons. First, Science is a subject pregnant with abstract concepts, units of measurements, graphs, experiments, application of ideas and practical activities. Learning isolated facts do not equip students with the skills necessary to be successful at the Science lesson. Because concepts are interrelated, content may seem overwhelming to students with learning disabilities Second, many students enter the Science classroom with preconceived notions of what things are and how they work. Science is all around us and so this frequent encounter of concepts leads to the development of many misconceptions. These misconceptions are based on cultural beliefs, commercials, personal interpretations and religious beliefs. Third, science textbooks contain difficult vocabulary and puzzling explanations of concepts that make them problematic to comprehend (Kinniburg& Shaw, 2007). One way teachers can combat these problems is through the use of graphic organizers.

Shmaefsky (2007) explained that graphic organizers such as concept maps enhance the acquisition and application of scientific skills. A concept Map gives a visual picture of the relationship among concepts. It stimulates students' prior knowledge and thus leads to authentic, meaningful learning. This approach assists students in conceptualizing and remembering factual information. Moreover, it can be used as a learning strategy where students solve problems inductively and deductively, actively think through task, and apply information to everyday situation. Because this visual strategy can accomplish all those science goals in a relatively short period of time, it should be implemented in Science classrooms.

Graphic Organizer in Mathematics

Zollman (2007) differentiate the four corners and diamond graphic organizers differ from the traditional Polya's four-step mathematical problem-solving hierarchy in terms of objectives. Zollman stated, “Obviously, the four corners and a diamond graphic organizer is designed to help students understand the problem, devise a plan, carry out the plan, and look back. However, by having the non-linear layout of the graphic organizer, the student is not expected to do these "steps" in a hierarchical, procedural order that some students misapply. It is the implementation process, how students form their response that is the important aspect of the four corners and a diamond graphic organizer.”

Zollman also emphasized that, “the pictorial orientation allows students to record their ideas in whatever order they occur. If students first think of the unit for their final answer, then this is recorded in the fifth, bottom-right area. This idea (the unit), then, is not needed in the short-term memory because a reminder is recorded. If students first think of a possible procedure for their answer, this is recorded in the third, upper-right area. The four corners and a diamond graphic organizer allow, and even encourage, students to use their problem-solving strategies in a non-hierarchical order. A student can work in one area of the organizer and later work a different area. It also shows that completing a problem-solving response has several different, but related, aspects.“Thus, students do not begin writing a response until some information or ideas are in all five areas. The four corners and a diamond graphic organizer especially encourage students to begin working on a problem before they have an identified solution method. As in the four square writing method, the students then organize and edit their thoughts by writing their solution in the traditional linear response, using connecting phrases and adding details and relationships. The steps for the open response write-up are as follows: (1) state the problem; (2) list the given information; (3) explain methods for solving the problem; (4) identify mathematical work procedures; and (5) specify the final answer and conclusions.

Moreover, the graphic portion of the organizer allows all students to fill in parts of the solution process. It encourages all students to persevere—to "muck around" working on a problem. Further, teachers quickly can identify where students are confused when solving a problem by simply examining the graphic organizer.

Four Corners and a Diamond Graphic Organizer

A study done by Zollman (2009) also indicated that the use of graphic organizers in math classes to be beneficial. Zollman utilized the four corners and a diamond graphic organizer (FCD) to determine the effects on learning disabled and non-learning disabled middle school students ability to solve open-ended response problems dealing with math knowledge, strategic knowledge and math explanation problems. In his study, Zollman identified a problem that is not only relevant to middle school math students, but also low-level high school students. He indicated that, “typically low-ability students do not attempt to show any work in one or more response categories, while average-ability students often have disorganized responses. Higher-ability students sometimes skip steps in their explanations". The hope was that the non-hierarchical layout of the organizer would allow students to solve the problem naturally without worrying about needing linear thinking. Through the use of pre and posttests Zollman found that the use of the graphic organizer on math problems significantly improved performance for all levels of students (learning disabled and non-learning disabled). The low ability level students were at least trying and showing some work. Middle ability level students had more organized work and high ability level students were better able to communicate the way in which the problem was solved.

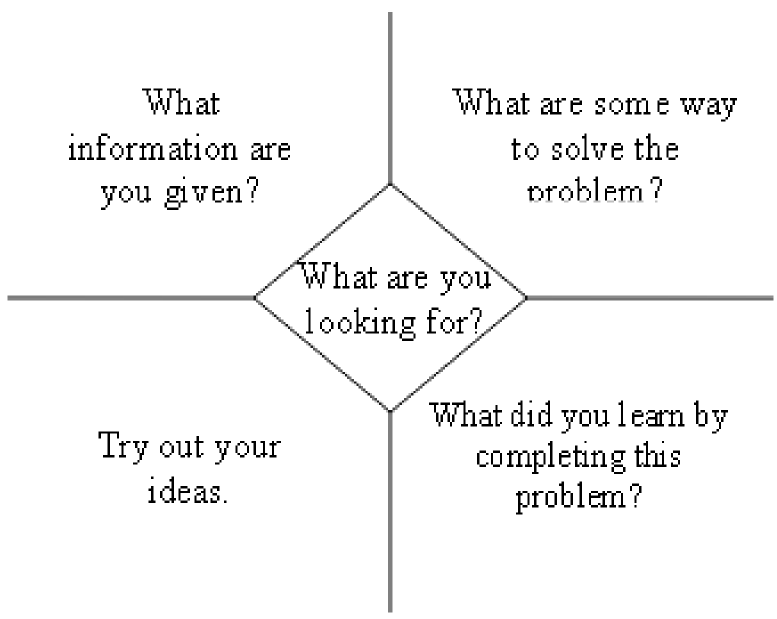


Figure 1.Four Corners and a Diamond Graphic Organizer (Adapted From Zollman 2009).

Implications of Graphic Organizer in Developing Students' Performance

Various studies confirm the benefits of using graphic organizers in the classroom in terms of helping students develop and process information (Drapeau (1999), Bellanca (2007), and Willerman & Mac Harg (1991).The mere fact this is a method that has been backed by such a strong body of evidence has imbued me with confidence that this intervention will yield positive results. Graphic organizers are a way to help students "grapple with core ideas of the content and develop sophisticated relational understandings of it" (Ellis 2004). They help students to process information as opposed to memorizing and stressing facts (Ellis 2004), which is what history, is predominantly concerned with. Too often when we teach children in our particular content areas we take a Scholar Academic approach and essentially leave the children to sort themselves out and create their own knowledge as the all-knowing teacher shares his wisdom with his impressionable and precocious students This strategy makes the information less vague and ambiguous. It helps students focus on relevant details. As Ellis (2004) noted it "reduces the cognitive demand on the learner". Thus, the use of graphic organizers increases the likelihood that students will retain the information presented. The ripple effect is that there is more time for learning. As students are bombarded with less data, more time is available to process new concepts. Consequently, students can become more reflective and goal directed learners. The probability of being successful at the learning task is enhanced. Success breeds confidence, and confidence leads to increase attempts at difficult tasks. Science lessons include perseverance and inquiry skills. It can be concluded that graphic organizers help develop skills that may create tomorrow's scientists.

Ellis (2004) explained that graphic organizers help students become strategic learners. This is the ultimate goal of teaching. As students learn new concepts and try to make connections, they develop higher order thinking skills. In Science classes, these skills are critical in planning and conducting experiments as well as in investigating issues. Additionally, graphic organizers present content in a combination of ways- visually, orally and aurally. This multiple presentation mode engages more students in the Science lesson. Science class is filled with authentic experiences such as how home appliances work, how the body functions, and the phases of the moon. Hence, graphic organizers equip students with ways to understand and use resources in their environment efficiently. Students will be better equipped to tackle today's challenges as well as those that await them in the future. The use of graphic organizers helps students access Science information and maybe create a greater love for the world we live in.

Hutchison and Padgett (2007) noted that "great teaching is artful when students get information into their memory in an organized fashion to facilitate later retrieval". Graphic organizers help achieve just that. Moreover, it assists students in dispelling misconceptions; discovering meanings from difficult scientific words and formulating connections between ideas. Therefore, teachers should make use of graphic organizers because of its multiple benefits. This strategy motivates students to want to learn Science and thus create a love for the subject.

A study by Githua and Nyabwa (2007), indicated that the use of analogies increased students' success in solving mathematical problems in enhance learning. They proposed six steps for creating and using GO for teachers which were state objectives, oral presentation, integrative reconciliation, promotion of active reception learning, encouragement to adopt critical approach, application to solution of problems.

According to Clark (2007), Graphic Organizer not only enable students to record and categorize information, but also help students to understand difficult concepts, generate thoughts, and identify connections between ideas. When used effectively, these visual tools can have a positive impact on student achievement.

The study of Guanco(2007) entitled " The effectiveness of Advance Organizers on the Students' Achievement in General College Chemistry" revealed that teaching chemistry concepts using advance organizer can facilitate meaningful learning and can enhance students' achievement in Chemistry. It was also concluded that the Advance Organizer method compared to the traditional lecture method was a better method in teaching Chemistry concepts.

Zollman (2009) designed a classroom action research to investigate a problem solving instructional approach by using GOs. The designed GO is use to teach how to write essay writing in 5 steps. The five steps included the questions about what the students need to find, what they already know, brainstorm the possible ways to solve the problem, show the calculations, and the students' conclusion or opinion about the problem solving given. They found that GO helped students to construct content and strategic knowledge; improved their mathematical communication skills. Besides, GO also helps students with all ability levels to produce more complete answer.

There were many articles and papers that had been written related to the usage of graphic organizers in different educational capacities. Some of the most compelling and informative research materials came from papers written by Samuel Leary, Renee Ben-David, and Andrea Fisher.

In the study, Enhancing Comprehension through Graphic Organizers, (Ben-David, 2002) there was a comparison between graphic organizer lessons and assessment and linear note taking lessons and assessments. There were eight lessons that were studied and this was performed with 16 students that had special needs. In the results of the study it was found that there was no difference in the results for the student learning gains. For all research done the average was about the same. Ben-David mentioned that there possibly could have been a different outcome to the results if the population size of the students had been larger or if the study was done on general education students. The present used a large population size and show that there was a difference between graphic organizer and traditional classroom lessons. The article, Implementing Graphic Organizer Notebooks: The Art and Science of Teaching Content, (Fisher, 2001) explained the various ways that graphic organizers could be used to enhance teacher lessons. In this study there was no definitive data to show student achievement, but Fisher made many classroom observations about student interest and progression. She found that this graphic organizer approach generated more classroom discussion, and promoted student achievement. The present study also found that graphic organizer instruction generated more student involvement and promoted active learning. These things are all positive for student learning and achievement and the reflections of found in the Fisher 2001 study were very similar to the results found in my study.

The Leary study on Thinking Maps (1999) was one of the most influential papers in preparation for this study, but it too found that there was no significant difference in the use of Thinking Maps on student achievement for standardized tests. Leary's study centered on the use of the Thinking Map techniques, but not necessarily the teaching interactions and student engagement that make graphic organizers work effectively. Just the use of graphic organizers without the teacher interaction and student participation would probably not yield a significant gain, in the present study the graphic organizers were not just used passively. The graphic organizer lesson was a whole exercise that integrated student and teacher involvement. This method of teaching showed a significant gain in mathematics performance of the students.

Synthesis

It can be noted from the discussion of related literature that there is a strong relationship between the teaching strategies of the teacher and the student's achievement. The researches supported that the use of advance organizer can contribute to the performance of the students in mathematics. It can also be seen in other subjects that the used of Graphic Organizer is an effective strategy since it can be bridge between new learning and related knowledge. One study closely related to this research is the study done by Ward (2005).It can be noted from their study that graphic organizer is an effective tool to properly apply reading strategies to the text in order to extract the crucial information needed to solve the given problem. The present used the graphic organizer. Another closely related to this research is the study done by Guanco (2007). It can be noted from her study that advance organizer was a better teaching in method in chemistry than the traditional lecture method. The present used the strategy in College algebra class.

The reviewed literature and studies were deemed relevant to the present study since researcher was able to get ideas on how graphic organizer in a regular class was conducted.

Chapter III

METHODOLOGY

This chapter describes the methods of research, the respondents of the study, the instruments used in gathering data and the statistical treatment applied to analyze the data.

Research Design

The study used the quasi-experimental design of research specifically the non-equivalent comparison group pretest-posttest design. Quasi-experimental is to test causal hypotheses about manipulable causes-as well as many structural details, such as the frequent presence of control groups and pretest measures, to support a counterfactual inference about what would have happened in the absence of treatment.

Quasi-experimental research could be described as a best attempt at an experiment when it is impossible, or not reasonable, to meet all the criteria of a true experiment. This type of research is typically identified as being void of randomization of either subjects or treatment and/or the lack of comparison groups (Gribbons and Herman, 1997). Meanwhile, Prater (1983) describes quasi-experimental research to be a design with the intent to be as much like a true experiment as possible. The two traditional platforms are: (1) matching studies, in which participants are compared with individuals that are comparable on variables of interest that do not receive the intervention; and (2) interrupted time series, in which observations made prior to an intervention are compared again and additional observations are made after the intervention has happened. These types of studies present themselves in various formats.

On the other hand, Dawson (1997) reaffirm his Plater's as he asserts that the general goal of quasi-experimental research is to investigate cause and effect relationships. This approach to research allows for greater understanding of program features and practices. Because there is a loss of control in the quasi-experimental design, it is necessary for the researcher to decide what and when to measure.

In this study, quasi-experiment was the most appropriate to use because it determined whether the Four Corners and a Graphic Organizer has the intended effect on the mathematics performance of the experimental group. This is a method of systematic observation of two groups of students, one is the experimental group and the other is the control group. The use of Four Corners and a Diamond Graphic Organizer was implemented to the experimental group as the lesson progressed. The two groups were given a pretest at the start of the lesson and the posttest upon completion of the lesson.

Participants of the Study

The study involved the two sections of first year students enrolled in College Algebra School Year 2014-2015 at STI Ortigas- Cainta under the Bachelor of Science in

Information Technology (BSIT) degree program during the first semester of SY 2014-2015. Below was the profile of the respondents.

Section	Female	Male	Total
BT101A	7	25	30
BT102A	10	28	33

To avoid extraneous variables the participants of study were selected from eight sections handled by the researcher, matching was done among the number of students, utilizing the ranking method. From the rank order list, the first two subjects were drawn. One of them was randomly assigned to the experimental group and the other to the control group.

Convenience Sampling was used by the researcher which is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher.

Research Instruments

Instruments that were used in this research study are Mathematics Performance Test, interview guide, reflective journal student work samples, surveys, daily quizzes and Mathematics Graphic Organizer.

Performance Test in Mathematics

The test was used as pre-test and post-test. It was developed by the researcher (Appendix C). To ensure a good distribution of topics tested, a table of specifications (TOS) was constructed. The purpose of a TOS was to identify the achievement domains being measured and to ensure that a fair and representative sample of questions appear on the test. It allows the teacher to construct a test which focuses in the key areas and weighs those different areas based on their importance. Moreover, it provides the teacher with evidence that a test has content validity and that it covers what should be covered.

The initial draft of the instrument consists of 35 items and it was evaluated by three mathematics teacher (where the researcher is presently teaching) and to the thesis adviser (Appendix B)). The researcher created a survey form using a 10-item likert rating scale to the check the validity and reliability of the teacher made test. Once the scores of 5 teachers reached the arithmetic mean of 2.61 and above, the test has now face and content validity. The validity of the actual test was evaluated mainly in terms of its content. The first draft was administered in the second year students of STI College. After pilot testing, checking answer sheets followed. Answer sheets of the students were used for Item Analysis. Items with discrimination index of less than or equal to 0 were disregard. The final form consists of 30 items with 10 items in remembering, 9 items in understanding, and 11 items in applying.

Interview Guide or Protocol

To determine the result that graphic organizers had on the students' understanding of mathematics, confidence, ability to access prior knowledge, and teacher awareness of progress, the teacher conducted interviews with students to gain more detailed insight into their thought process. The interview guide consists of 3 questions that require the respondents to give their opinion regarding the effectiveness of the Graphic Organizer. Student interviews occurred twice throughout the course of the study, once at the beginning and once at the end (Appendix J).

Daily Quizzes

Daily quizzes were given to students approximately every other day during the Unit to help students assess what they know and need more practice with, and to allow the teacher to see which topics require more time. By giving daily quizzes during this unit, the teacher was able to assess the progress that is making toward carrying over prior knowledge into future units.

Reflective Journal

By keeping a reflective journal the teacher was able to track her observations of student progress throughout the study and determine whether or not she is more aware of student progress through the students' use of graphic organizers. She recorded observations of class discussions that took place during use of the graphic organizers and observations of students using the graphic organizers on a daily basis.

The Four Corners and a Diamond Graphic Organizer

The Four Corners and a Diamond Mathematics Graphic Organizer was adopted from Zollman (2009). This graphic organizer has five areas: What do you need to find? What do you already know? Brainstorm possible strategies to solve this problem. Try your ways here. What things do you need to include in your response and what mathematics did you learn by working this problem? The template for the Four Corners and a Diamond Mathematics Graphic Organizer can be produced using a blank piece of paper. The paper is folded to make four corners by folding the paper horizontally and then vertically. The inner corner of the paper is folded up and when unfolded, the paper has four corners and a diamond on the center. The students can use each of the four corners to describe how they do the following steps in solving math problems: understand the problem, devise a plan, carry out a plan and look back or evaluating the task done. In the implementation, the most important aspect is how a student from his or her response (Appendix L).

The Perception Questionnaire

The students' perception questionnaire consists of 5 questions developed for the study based on the similar instruments from Abalon (1998)(Appendix H). The word "science" is changed to "mathematics" in all the five questions. The questionnaire requires the respondents to give their opinion regarding the use of Advance Organizer by putting a check mark on the appropriate column provided opposite each item. The questions are answerable by either strongly agree (5), agree (4), undecided (3), disagree (2), strongly disagree (1). The scale below was used for the descriptive rating.

Numerical Rating	Descriptive Rating
4.20-5.00	Strongly Agree
3.40-4.19	Agree
2.60-3.39	Undecided
1.80-2.59	Disagree
1.00-1.79	Strongly Disagree

Data Gathering Procedure

The researcher sought permission from the head office of STI Ortigas-Cainta to conduct the study in First Year students of Bachelor Science in Information and Technology.

Phase I – Pre-Experimental Phase

The lesson started with some interesting and challenging exploratory activities that made the students aware of what is going to happen or where the said pre-activities would lead to through meaningful and relevant real life content.

Pretesting was done on September 1, 2014. Before the test administration, the researcher informed the students from both the experimental and control groups that one purpose of the test is to determine their entry knowledge about operations on polynomials, solving for roots: factoring quadratic polynomials.

No advance discussion was made by both teacher and students about the covered topics. The pretest, consisting of the said exam was one hour.

Phase II- Experimental Phase

During the conduct of the experimental phase, the experimental group used the graphic organizer as the lesson progressed. The two sections of the subjects were taught operations on polynomials, special products and factoring.

BT101A (Control Group) were exposed to the traditional teaching strategy. Same instruction was given to the group excluding the use of Four Corners and a Diamond Graphic Organizer.

BT102A (Experimental Group), on the other hand were introduced to the use of the Four Corners and a Diamond Graphic Organizer as the lesson progressed.

Phase III- Post Experimental Phase

After the treatment, a post-test was administered to the two groups. Results of this test were tabulated and were compared with the pre-test results. The mean score were computed and statistical test was employed to analyze the effect of the Four Corners and A Diamond Graphic Organizer on the performance of the students in Mathematics.

The Students' perception questionnaires were given to the students in the experimental group to determine their perception on the use of Four Corners and a

Diamond Graphic Organizer. The mean scores were computed per item in the questionnaire to evaluate the mean response of the students for each item. After analyzing the result of the perception survey, the comments of the students in the questionnaire were summarized. Students were interviewed to confirm the results of the response of the qualitative analyses.

Time Table on the Conduct of the Study

Topic	Duration	Activities	Output
Lesson 1 • Basic concepts of polynomials • Adding and Subtracting of polynomials Lesson 2 • Multiplying and Dividing of polynomials	2 days	Discussion Recitation Seatwork	Quiz FCDGC Journal
Lesson 3 • Types of Special products -product of two binomials -square of binomial	2 days	Discussion Recitation Seatwork	Quiz FCDGC Journal
-product of sum and difference Lesson 4 • Types of Special products – Cube of a binomial – Special case of product of binomial and trinomial	2 days	Discussion Recitation Seatwork	Quiz FCDGC Journal
– Square of a trinomial Lesson 5 – Types of Factoring Common monomial factoring – Difference of two squares	3 days	Discussion Recitation Seatwork	Quiz FCDGC Journal
Lesson 6 • Types of Factoring -Sum and difference of two Cubes	3 days	Discussion Recitation Seatwork	Quiz FCDGC Journal
– Perfect square trinomial – Other trinomial – Factor by grouping	4 days	Discussion Recitation Seatwork	Quiz FCDGC Journal

Data Analysis Procedure

The following indicators were used to evaluate the development on the students' performance in mathematics:

- **Mean and Standard Deviation**. The pretest and posttest scores of the participants in performance in mathematics and students' perception questionnaire.
- **t-test for dependent samples**. This was used to compare the pretest and posttest mean scores of the control and the experimental group.
- **t-test for independent samples**. This was used to compare the posttest mean score of the control and experimental group.

All statistical analyses were processed using the SPSS version of the software and Microsoft Excel (Appendix N).

Chapter IV

Presentation, Analysis, and Interpretation of Data

This chapter deals with the presentation, analysis and interpretation of data according to the problems formulated in the study

Problem 1: Is there a significant difference between the pretest and posttest mean scores in Mathematics performance test of the following groups?

1.1 control group

1.2 experimental group

Table 1 presents the mean achievement scores of the experimental group before and after the experiment.

Table 1. Pre and Post Mathematics Performance Test of the Experimental Group

	Mean	**SD**
Pretest	13.52	4.360
Posttest	20.15	4.611

The experimental group has a mean score of 13.52 before and a mean score of 20.15 after the experiment. As shown in the table the mean score of the experimental group has increased by 6.63. This result confirms the findings of Zollman (2009) that the use of Four Corners and a Diamond Graphic Organizer is an extremely useful instructional method in the middle grades mathematics classroom.

Table 2 presents the mean achievement scores of the control group and after the experiment.

Table 2. Pre and Post Mathematics Performance Test of the Control Group

	Mean	SD
Pretest	13.57	5.864
Posttest	15.37	4.958

The control group had a mean score of 13.57 before and a mean score of 15.37 after the experiment. It was observed in this analysis that in the post-test in achievement in Mathematics, the mean of the experimental group had a dramatic increase. In contrast to the control group, where achievement in mathematics increased slightly, the experiment group showed a considerable improvement in Mathematics Achievement test.

Problem 2: Is there a significant difference between the mathematics performance of the control and experimental groups in the following?

2.1 pretest

2.2 posttest

Table 3 shows the difference between the pretest and posttest mean scores of the control group.

Table 3.t-test for the Difference between the Pre-test and Post-test Mean Scores of the Control Group

	Mean	SD	df	t	P-value	Interpretation
Pretest	13.57	5.864	58	-1.283	0.204	Not Significant
Posttest	15.37	4.958				

The finding shows that there was no significant difference between the performance of the students who did not use the Four Corner and a Diamond Graphic Organizer since the p-value of 0.204 is greater than the alpha value of 0.05 that led to the acceptance of the null hypothesis. Thus, there was no significant difference between the pre and post test results of the students who did not use the Four Corner and a Diamond Graphic Organizer.

Table 4 shows the difference between the pretest and posttest mean scores of the experimental group.

Table 4. t-test for the Difference Between the Pre-test and Post-test Mean Scores of the Experimental Group

Mean	SD	df	t	P-value	Interpretation
13.52	4.360	64	-6.007	0.000	Significant
20.15	4.611				

The findings revealed that there was a significant difference between the performance of the students who use the Four Corner and a Diamond Graphic Organizer since the p-value of 4.91×10^{-8} was greater than the alpha value of 0.05 that led to the rejection of the null hypothesis. Thus, there was a significant difference between the pre and post test results of the students who use the Four Corner and a Diamond Graphic Organizer.

This implies that the students who were exposed to the Four Corners performed in the performance test better than the students who were not exposed to the organizer. The standard deviation of the control group was higher than the standard deviation of the experimental group, which means that the scores of the students under the control group are most scattered around its respective mean than the score of the students under the experimental group. These results are consistent with other researcher Guanno(2007) who found the effectiveness of advance organizer and there is a significant difference in the use of Advance Organizer on student achievement in General College Chemistry.

Table 5 shows the comparison between the pretest mean scores of the control and experimental groups in the Mathematics Performance Test.

Table 5. Comparison Between the Pretest Mean Scores of the Control and Experimental Groups in the Mathematics Performance Test.

	Mean	SD	Mean Difference	df	t-value	p-value	Interpretation
Experimental	13.52	4.360	1.85	61	0.039	0.968	Not Significant
Control	15.37	4.958					

The findings revealed that the differences between the pretest scores of both groups in the Mathematics Performance Test are not significant. These results clearly indicate that the students in the control group are comparable with the students in the experimental group in terms of the performance test in mathematics.

Table 6 shows the comparison between the posttest mean scores of the control and experimental groups in the Mathematics Performance Test.

Table 6. Comparison Between the Posttest Mean Scores of the Control and Experimental Groups in the Mathematics Performance Test.

	Mean	SD	Mean Difference	df	t-value	p-value	Interpretation
Experimental	20.15	4.611	4.85	59	-3.955	0.000	Significant
Control	15.37	4.958					

The findings of the posttest revealed that both groups' mean score increased. However, the score of the posttest of the experimental was higher than the control group. This implies that the students who were exposed to the Four Corners and a Diamond Graphic Organizer performed in the mathematics achievement test are better than the students who were not exposed to the organizer.

These results supported the findings of Zollman (2009) who found that the use of graphic organizer on math problems significantly improved performance for all levels of the students.

Problem 3: How do the students perceive the use of four corners and a diamond graphic organizer?

To answer the question on the perception on the use of the Four Corner and a Diamond Graphic Organizer, thirty three students under the experimental group were asked to answer on a perception questionnaire on how they find the Graphic Organizer as part of their lesson in Math.

Table 5. Distribution of Percentage and Mean on Students' Perception on the Use of Four Corners and a Diamond Graphic Organizer

Indicators	Mean	Descriptive Rating
1. The use of Graphic Organizer helps explain clearly the concepts presented in Mathematics,	4.12	Agree
2. The Graphic Organizer helps provide enough information to teach the relationship among the concepts in Mathematics.	4.03	Agree
3. The use of Graphic Organizer facilitates learning in Mathematics	4.58	Strongly Agree
4. The use of Graphic Organizer motivates students to clearly understand the concepts being taught in the lesson	4.36	Strongly Agree
5. The Graphic Organizer is easy to follow compared to the other strategies used in teaching Mathematics.	4.88	Strongly Agree
Over-all Mean	4.40	Strongly Agree

An overall mean of 4.40 was computed which indicates that majority of the students strongly agree that the Graphic Organizer help facilitate learning in Mathematics.

Table 6 shows the interview results on the perception of the experimental group towards graphic organizer.

Table 6. Interview Results on the Perception of the Experimental Group towards Graphic Organizer

Interview Questions	Positive Response		Neutral		Negative Response	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
1. Do you think that the Four Corners and a Diamond Graphic Organizer has helped you in learning mathematics?	28	84.85%	3	9.09%	2	3.03%
2. Do you think that the Four Corners and a Diamond Graphic Organizer has improved your ability to communicate mathematically?	25	75.76%	5	15.15%	3	9.09%
3. Do the Four Corners and a Diamond Graphic Organizer allows you demonstrate what you know mathematically?	26	78.79%	6	18.18%	1	3.03%
4. Do you think that the Four Corners and a Diamond Graphic Organizer is an effective tool in learning?	28	84.85%	3	9.09%	2	3.03%
Average	27	81.06%	4	12.88%	2	4.54%

An average of 27 out of 33 students or 81.06% responded positively on the use of graphic organizer in the conduct lessons in mathematics. This implies that majority of the students perceived that the use of graphic organizer can helped them learn mathematics better. On the other hand, an average of 4 out of 33 students or 12.88% were neutral on the use of graphic organizer, and an average of 2 out of 33 students responded negatively to the use of graphic organizer. According to the interview results, students do find that graphic organizer improved their ability to communicate mathematically. Zollman(2009) support the findings that graphic organizer helped students to construct content and strategic knowledge; improved their mathematical communication skills. Most of the students indicated that the four corners and a diamond graphic organizer is an effective tool in learning. This result was supported by Clark (2007) who found that graphic organizer was not only enable students to record and categories information, but also help students to understand difficult concepts, generate thoughts, and identify connections between ideas.

CHAPTER V

Summary, Conclusion and Recommendation

This chapter discusses the summary of the study, the conclusions derived from the findings, and the corresponding recommendations.

Summary

The objective of the study is to develop the students' performance in mathematics using the four corners and graphic organizer on the mathematics achievement of the selected first year students of STI Ortigas-Cainta. The study used the four corners and a diamond graphic organizer as an instrument strategy employing the quasi-experimental design specifically the non equivalent control group design.

The study introduced and utilized the Four Corners and a Diamond Mathematics Graphic Organizer devised by Zollman (2009) to a group of First Year College of STI-Ortigas Cainta. A total of 63 freshmen students enrolled in College Algebra during the first semester of S.Y. 2014-2015 from two sections were the participants of the study.

The different instruments that were used in this research study are Mathematics Performance Test, interview guide, reflective journal, students' work sample, surveys, daily quizzes and Mathematics Graphic Organizer. Data on the students' mathematics performance test and students' perception on the use of the Four Corners and a

Diamond Graphic Organizer were computed and analysed through the use of SPSS version of the software and Microsoft Excel.

Findings

The following are the findings of the study.

1. The mean mathematics performance of the experimental group in the pretest is lower than the control group. This means that the experimental and control groups are comparable.
2. The mean mathematics performance of the experimental group in the posttest was higher than the control group. This implies that the students who were exposed to the Four Corners and a Diamond Graphic Organizer performed in the Mathematics Achievement test is better than the students who were not exposed to the organizer.
3. There is no significant difference between the performance of the students and the pre and post test results of the students who did not use the Four Corner and a Diamond Graphic Organizer.
4. There is a significant difference between the performance of the students and the pre and post test results of the students who use the Four Corner and a Diamond Graphic Organizer.
5. Majority of the students perceived that the graphic organizer helps them consolidate their ideas in certain mathematical concepts. The students agreed on the idea that the use of the graphic organizer helped them recall what they had

learned in the past and increase their confidence in mastering important concepts. Furthermore, the students also felt that using graphic organizer makes learning mathematics more meaningful.

6. Majority of the students responded positively on the use of graphic organizer in the conduct lessons in mathematics. This implies that majority of the students perceived that the use of graphic organizer can helped them learn mathematics better.

Conclusions

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

1. The use of the Four Corners and Graphic Organizer is an effective assessment to improve the mathematics achievement of the students.
2. Both the traditional learning situation and the used of the Four Corners and Graphic Organizer can develop students' performance in mathematics. However, the increase in the mean score of the students under graphic organizer is greater than that of the control group.
3. The use of the Four Corners and a Diamond Graphic Organizer can improve students' perception toward mathematics.

Recommendations

The results presented the significant effect on developing students in mathematics using the four corners and a diamond graphic organizer. Referring to the findings of this study, the following implementations are recommended.

1. Continue to use the graphic organizer in developing the students' performance in mathematics. Graphic organizer work to make mathematics learn better and therefore are valuable tools.
2. Teacher must be encouraged to use the graphic organizer as one of their teaching strategies to improve the performance the students in learning Mathematics.
3. Researchers may conduct studies relating on the effect of graphic organizer to the students performance in Mathematics.
4. Further studies can be conducted to investigate the effectiveness of graphic organizers, self-esteem and academic motivation for different subjects.

BIBLIOGRAPHY

Abalon, C.(1998). *P*roceedings of Society for Information Technology & Teacher Education International Conference 2012 (pp. 4574-4579. Retrieved from http://www.editlib.org/noaccess/40332/

Adcock, A. (2000). Effects of cognitive load on processing and performance. Retrieved January 23, 2005, from University of Memphis Instructional Media Lab Web site: http://aimlab.memphis.edu/amyscogpaper.pdf

Alonso, F., Lopez, G., Manrique, D., & Vines, J. M. (2005). An instructional model for web-based e-learning education with a blended learning process approach. British Journal of Educational Technology, 36(2), 217-235

Ben-David, R. (2002). Enhancing comprehension through graphic organizers. (ERIC Document Reproduction Service No. ED461907)

Boon, R. T., Fore III, C., & Hagan-Burke, S. (2006). Improving student content knowledge in inclusive social studies classrooms using technology-based cognitive organizers: A systematic replication. Learning Disabilities, 4(1), 1-17.

Boulineau, T., Fore III, C., Hagan-Burke. S., & Burke, M. D. (2004). Use of story-mapping to increase the story-grammar text comprehension of elementary students with learning disabilities. Learning Disability Quarterly, 27, 105-121.

Brookbank, D., Grover, S., Kullberg, K., &Strawser, C. (1999). Improving student achievement through organization of student learning. (ERIC Document Reproduction Service No. ED435094)

Carr, S. B. (2008, February). Scaffolding student learning: Providing support for future success. Paper presented at the Communities in Schools of Georgia Performance Learning Centers. 2008 Winter Conference, Savannah, GA.

Carroll, L., & Leander, S. (2001). Improving student motivation through the use of active learning strategies. (ERIC Document Reproduction Service No. ED455961)

Cesarone, B. (2007). Concept mapping in early childhood and primaryeducation. Childhood Education,83, 191-192.

Cooper, G. (1998). Research into cognitive load theory and instructional design at NSW. Retrieved January 30, 2005, from University of New South Wales Web site: http://www.arts.unsw.edu.au/education/CLT_NET_Aug_97.HTML

Culbert, E., Flood, M., Windler, R., & Work, D. (1998). A qualitative investigation of the use of graphicorganizers. (ERIC Document Reproduction Service No. ED418381)

Chang, K., Sung, Y., & Chen, I. (2002). The effect of concept mapping to enhance text comprehension and summarization. Journal of Experimental Education, 71(1), 5-23.

Clark, A. (2007). GOs and the school library program. University of Alberta Department of Elementary Education.

Dawson, T. E., (1997). *A primer on experimental and quasi-experimental design*. Paper presented at the Annual Meeting of the Southwest Educational Research Association, Austin, TX.

DiCecco, V., & Gleason. M. (2002). Using graphic organizers to attain relational knowledge from expository text. Journal of Learning Disabilities, 35(4), 306-320.

Drapeau, P. (1999). Great Teaching with Graphic Organizers. Scholastic Inc. Retrieved from http://www.iosrjournals.org/iosr-jrme/papers/Vol-4%20Issue-5/Version-1/F04513742.pdf

Dye, G.A (2000). Graphic Organizer to rescue! Teaching Exceptional Children, 32(3), 72-76

Ellis, E. (2004). *What's the big deal about graphic organizers?*Retrieved July 7, 2003, from http://www.Graphic Organizers.com

Fisher, A. L. (2001). Implementing graphic organizer notebooks: The art and science of teaching content. Reading Teacher, 55(2), 116-120.

Gallavan, N. P., &Kotter, E. (2007). Eight types of graphic organizers for empowering social studies students and teachers. Social Studies, 98(3), 117-128

Gil-Garcia, A, & Villegas, J. (2003). Engaging minds, enhancing comprehension and constructing knowledge through visual representations.Proceedings of the Conference on word association for case method research and application.

Githua and Nyabwa, (2007). Malaysian Jounal Educational Technology. Retrived from http://www.mjet-meta.com/resources/2%20-%20V10N1%20-%20Syaza%20-%20GRAPHIC%20ORGANIZER%20-%20Online.pdf

Gould, J., & Gould, E. (1999).*Four square writing method for grades 1–3*. Carthage, IL: Teaching and Learning Company

Goeden, J. (2002). Using comprehension frames (graphic organizers) to impact students' reading comprehension. Unpublished thesis. Black Hills State University.

Guastello, E.F., Beasley, T. M. & Sinatra, R. C.(2000). Concept mapping effects on science content comprehension of low-achieving inner-city seventh graders. Remedial and Special Education, 20(6), 356-364.

Guanco,M. (2007). The Effectiveness of Advance Organizer on the students' General College Chemistry. Theses and dissertation. DLSU Library.

Guanno, C. (2007). How to create and use analogies effectively in teaching science concepts. Science Activities44, 69-72.

Gribbons and Herman, (1997). *Experimental and quasi-experimental designs for research.* Chicago: Rand McNally College Pub. Co.

Griffon, C., Malone, L., &Kameenui, E. (2001).Effects of graphic organizer instruction on fifth-grade students. The Journal of Educational Research,89(2), 98-107

Greenstein, (2010). Assessing 21st Century Skills. A guide to evaluating the mastery and authentic learning, 8-24.

Hoffman, J.(2003). Students-Created Graphic Organizers Bring Complex Material to Life. College Teaching, 51(3), 105.

Hollingworth, A. (2004). Constructing visual representations of natural sciences:The roles of short-and long-term visual memory. Journal of Experimental Psychology, 30(3), 519-537.

Hutchinson, C.B.,& Padgett II, B. L. (2007). How to create and use analogies effectively in teaching science concepts. Science Activities44, 69-72

Ibe, (2005). Effective Pedadogy in Mathematics. Retrieved from http://www.ibe.unesco.org/fileadmin/user_upload/Publications/Educational_Practices/EdPractices_19.

Ives (2007) Ives, B. (2007). Graphic Organizers Applied to Secondary Algebra Instruction for Students with Learning Disorders. *Learning Disabilities Research & Practice (Blackwell Publishing Limited)*, 22(2), 110-118.

Illinois interactive report card. (2011, November 05). Retrieved from http://iirc.niu.edu/School.aspxsource=School_Profile &school ID=050162070170003&level=S

Ilman, A. (2009). Students use graphic organizers to improve mathematical problem-solving communication. Middle School Journal

Keel, M. C., Dangel, H. L., & Owens, S. H.(1999). Selecting instructional intervention for students with mild disabilities in inclusive classrooms: Focus on Exceptional Children, 31,1-16

Kim, A., Vaughn, S., Wanzek, J., & Wei, S. (2004). Graphic organizers and their effects on the reading comprehension of students with LD: A synthesis o f research. Journal of Learning Disabilities, 37(2), 105-118.

Kinniburg, L. & Shaw, E. (2007). Building fluency in elementary science through reader's theatre. Science Activities44, 16-22.

Leary study on Thinking Maps, (1999). The Effect of Thinking Maps on Students' Higher Order Thinking Skills. Retrieved fromhttp://www.thinkingfoundation.org/research/action_research/pdf/Action_Research_Paper-Weis.pdf

Marzan, (2007). Retrived from http://echd611-2012.wikispaces.com/file/view/Theories_of_Developmental_Psychology,_5th_Edition_%281429216344%29.pdf

Marzano, R, Pickering, D, & Pollock, J. (2001). Classroom instruction that works: research-based strategies for increasing student achievement. Alexandria, VA: Ascd.

Marzano, R. (2007). The art and science of teaching: a comprehensive framework for effective instruction. Alexandria, VA: Ascd.

Mendoza, S.(2004). Development and evaluation of instructional materials integrating graphic organizers in elementary algebra.Unpublished Master's Thesis, Philippine Normal University, Manila.

Merkley, D. M., & Jefferies, D. (2000). Guidelines for implementing a graphic organizer. Reading Teacher, 54(4), 350. Retrieved from EBSCOhost.

Miller, G.A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychology Review, 63, 81-97.

Monroe, E. E., & Pendergrass, M. R. (1997).Effects of mathematical vocabulary instruction on fourth grade students.BYU Public School Partnership Symposium on Education.

McElroy, L. T., & Coughlin, C. N. (2009). The other side of the story: Using graphic organizer as cognitive learning tools to teach students to construct effective counter-analysis. Unpublished thesis University of Baltimore Law Review

Nyabwa, R. and Githua, B. (2008). Effects of advance organizer strategy during instruction on secondary school students' mathematics achievement. Retrieved on August

Oliver, K. (2009). An investigation of concept mapping to improve the reading comprehension of science text. Journal Science Educational Technology (18), pp. 402 414.

Pantziara, M., Gagatsis, A., &Elia, I. (2009). Using diagram as tools for the solution of non-routinemathematical problems. Educational Study Math (72), pp. 39-60.

Pavio, A. (1986). Mental Representations. New York: Oxford University Press. Pithers, R. T., & Sodden, R. (2000). Critical thinking in education: a review. Educational Research in Education, 42(3), 237-249.

Piaget, J. (1951). Egocentric thought and sociocentric thought. *J. Piaget, Sociological studies*, 270-286.

Prater, J. M. (1983). An analysis of selected statistical techniques utilized in quasi-experimental designs. Paper presented at the Annual Meeting of the Mid-South Educational Research Association, November 16–18, Nashville, TN.

Rasmussen, C. & Marrongelle, K. (2006). Pedagogical Content Tools: Integrating Student Reasoning and Mathematics in Instruction. Journal for Research in Mathematics Education*, 37 (5)*, 388-420

Robinson, D., Corlis, S., Bush, A., Bera, S., &Tomberlin, T. (2003). Optimal presentation of GOs and text: A case study for large bites? ETR&D, 51 (4), pp. 25-41.

Robinson, D. H., Katayama, A. D., Beth, A., Odom, S., Ya-Ping, H., &Vanderveen, A. (2006). Increasing text comprehension and graphic note taking using a partial graphic organizer. Journal of Educational Research, 100(2), 103-111.

R.C Anderson, (1998). On using concept maps to assess the comprehension effects of reading expository text. (Technical Report No. 483).Urban Champaign: Center for the Studying of Reading, University of Illinois at Urban-Champaign. (ERIC Document Reproduction Service No. ED 310 368)

Saavedra, L. (1999). Dual coding theory: A theoretical foundation of learning with graphics. Retrieved January 15, 2005, from George Mason University Web site: http://chd.gse.gmu.edu/immersion/knowledgebase/strategies/cognitivism/DualCodingTheory.htm

Saritas, M. (2004). Instructional Design in Distance Education (IDDE): Understanding the Strategies, Applications, and Implications. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2004* (pp. 681-688). Chesapeake, VA: AACE.

Sorrel, A.L. (1990). Three reading comprehension strategies: TELLS, story mapping, and QARs. Academic Therapy, 25, 359-368.

Shmaefsky, B. (2007). E-concept mapping. Journal of College Science Teaching36 (4), 14-15.

Strangman, N., Hall, T., & Meyer, A. (2003). Graphic organizers and implications for universal design for learning: Curriculum enhancement report(Cooperative Agreement No. H324H990004). Washington, DC.

Ueseka, Y., Manalo, E., & Ichikawa, S. (2007). What kinds of perceptions and daily learning behaviors promote students’ use of diagram in Mathematics problem solving? Learning and Instruction, 17, pp. 322-335.

Ward, (2005). Using Children's Literature to Inspire K–8 Preservice Teachers' Future Mathematics Pedagogy, pp. 132-143

Williams, J. P., Nubla-Kung, A.M., Pollini, S., Stafford, K.B., Garcia, A., & Snyder, A. E. (2007). Teaching course effect text structure through social studies content to at-risk second graders. Hammill Institute on Disabilities (40), pp. 111-120.

Winn, W., & Snyder, D. (1996). Cognitive perspectives in psychology. In D. H. Jonassen(Ed.), Handbook of research for educational communications and technologypp.115-122.

Willerman, M., & Mac Harg, R. A. (1991). “The concept map as an advance organizer”. Journal of Research in Science Teaching, 28 (8), 705-712.

Zollman, A. (2009). Students use graphic to improve mathematical problem-solving communications. Retrieved on August 30, 2010 from

Zollman A. (2009b). Students using graphic organizers to improve a problem solving, Middle School Journal,41(3), 4-12

http://www.coastal.edu/education/lsod/uploads/42_Attachment.docx

http://www.geo.hunter.cuny.edu/.../PP192013Southwest%20Border%20Area.pdf

http://www.ample.org/Publications/MiddleSchoolJournal/Articles/Novemeber2009/Article4/tabid/2083/Default.aspx

Philippine Normal University
National Center for Teacher Education

Appendix A

LETTER OF APPROVAL

September 1, 2014

Katherine P. Aporo
Deputy School Administrator
STI –OrtigasCainta

Dear Madam:

Iam graduate student taking up Master of Arts in Teaching Mathematics at the Philippine Normal University-Manila. I am currently working on my seminar paper entitled: "Developing Students performance using the Four Corners and a Diamond Graphic Organizer". In line with this, I would like to ask permission from your good office to conduct my study at STI Ortigas-Cainta.

I intend to have the students in BT102A and BT102P as the sample respondents in my research study.

I am hoping for your consideration regarding this matter.

Respectfully yours,

Ma. Kristina G. Garcia

Noted:

Dr. Rene R. Belecina
Seminar Paper Adviser

Ruby B. Reyes
Academic Head

Approved:

Katherine P. Aporo
Deputy School Administrator

Philippine Normal University
National Center for Teacher Education

Appendix B

Mathematics Performance Test
(First Draft)

Directions: Choose the correct answer. Write the letter of your choice before the number.

________1. Which of the following is a monomial?

a. $\frac{1}{x}$ b. $\sqrt{x}$ c. r^3x^2 d. $\frac{1}{x}+1$

________2.What is the degree of -2^3?

a. 0 b. 1 c. 2 d. 3

________3.Which of the following is a polynomial?

a. $x-\frac{1}{x}$ b. $x+\sqrt{x}$ c. $x^2+x-\frac{1}{2}$ d. $x^{\frac{1}{3}}$

________4.What is the difference when -3x+5y is subtracted from -4x -5y?

a. x b. $-x$ c. $-x-10y$ d. $-x+10y$

________5. Which of the following is a square of $(3x-2)$?

a. $9x^2-6x+4$ b. $9x^2-4$ c. $9x^2+4$ d. $9x^2-12x+4$

________6. What is common monomial factor of $9xy^6$ and $27x^4y$?

a. $3xy$ b. $3x^6y^4$ c. $9xy$ d. $9xy^4$

________7. Which of the following can be a product of sum and difference of two numbers?

a. x^2-125 b. x^2-4x+4 c. x^2-149 d. $16x^2-25$

________8. Which of the following is a perfect square trinomial?

a. $x^2 - x + 4$ b. $x^2 - 2x - 4$ c. $x^2 + 4x + 4$ d. $x^2 - 4$

________9.What kind of factoring is applicable to $(x+4)(x-4)$?

a. Cube of a binomial
b. Square of a binomial
c. Sum and difference
d. Perfect square trinomial

________10. What is the common monomial factor of $5x^2 + 5y^2$?

a. x b. y c. 5 d. -5

________11. What is the product of $(2x-y^2)$ $(x+3y^2)$?

a. $2x^2+5xy^2-3y^4$
b. $2x^2-5xy^2+3y^4$
c. $2x^2-5xy^2-3y^4$
d. $4x^2-5xy^2-3y^4$

________12. What is the quotient and the remainder of $(x^2 + 3x + 5) \div (x - 3)$?

a. $x + 6$ r.23
b. $x + 6$ r.13
c. $x + 6$ r.-13
d. $x + 6$ r.-26

________13.What are the factors of $x^2 - 9$?

a. $(x+3)^2$ b. $(x-3)^2$ c. $(x+3)(x-3)$ d. $x(x+3)$

________14. What is the difference when $-x^2+5x$ from $6x^2+x-2$?

a. $-5x^2 + 6x + 2$
b. $5x^2 + 6x - 2$
c. $5x^2 + 6x$
d. $-7x + 4x + 2$

________15.Factor $42a^2b + 48b^3$ completely.

a. $7a^2b$
b. $7b^2$
c. $14b^2$
d. $14ab$

________16. What is the product of $(2x-5y)(8x+7y)$?

a. $16x^2+26xy-35y^2$
b. $16x^2+54xy-35y^2$
c. $16x^2-26xy-35y^2$
d. $16x^2-54xy-35y^2$

________17. What are the factor of $6x^2$-4ax-9bx+6ab?

a. (6x2-4ax)(9bx-6ab)
b. (2x-3b)(3x-2a)
c. (2x-2a)(3x-3b)
d. (2x+2a)(3x+3b)

________18. What are the factors of $x^2+11x+18$?

a. $(x-2)(x+9)$
b. $(x+2)(x+9)$
c. $(x-2)(x-9)$
d. $(x+2)(x-9)$

________19.Which of the following statement is true for a perfect square trinomial?

I. The first is a perfect square
II. The middle term is twice the product of the 1^s and last term
III. The middle term is the product of the 1st and last Term
IV. The last term is a perfect square

a. I,II,III
b. I,II,IV
c. I,III,IV
d. II and IV only

________20. What do you call a two term polynomial?

a. Binomial
b. Monomial
c. trinomial
d. Multinomial

________21.What is the simplest form of $\frac{4a^2b}{2a}$?

a. 2
b. 2a
c. 2b
d. 2ab

________22.What is the reduced term of $\frac{15x^2y}{48y^3}$?

a. $\frac{5x}{16y}$
b. $\frac{5x^3}{16y}$
c. $\frac{5x^3}{48y^3}$
d. $\frac{15x}{48y}$

Philippine Normal University
National Center for Teacher Education

________23.The side of a square is $6x+4$.What is its area?

a. $36x^2-48x-16$ c. $36x^2+48x-16$
b. $36x^2-48x+16$ d. $36x^2+48x+16$

________24.Which of term completes the mathematical sentence
$(xy-1)(xy+1)=x^2y^2+\_\_\_-1$

a. 0xy b. xy c. 2xy d. $2x^2y^2$

________25. What is the simplest form of $\frac{15x+25y+5}{5}$?

a. $3x+5y$ b. $3x+5y+1$ c. $3x+5$ d. $15x+5y+1$

________26. The area of the rectangle is x^2+6x+5, whose length is x+5, what is its width?

a. x+1 b. x+2 c. x-2 d. x+4

________27. What is the simplest form of $\frac{24xy+12y+6y^2}{-3y}$?

a. $-8x+4y$ b. -$8x-4-3y$ c. $3x+5$ d. $8x+5y+1$

________28. What is the product of 3(2y+3)(2y -3) ?

a. $4y^2-9$ b. $8y^2+27$ c. $12y^2-27$ d. $24y^2-27$

________29.What kind of factoring is applicable to $8x^3-60x^2y+150xy^2-125y^3$?

a. Cube of a binomial
b. Factoring quadratic trinomial
c. Perfect square trinomial
d. Square of a binomial

________30.What is the sum of $(5ab^2c+2d^3)$ and $(3b^2ac-d^3)$?

a. $2a^2bc$ b. $2ab^2c-d^3$ c. $8ab^2c-d^3$ d. $8a^2bc-3d^3$

________31. What is the common factor of 9a(x-2) + 5(x-2)?

a.
b. 9 b. 9a c. 2a d. (x-2)

________32. Which of the following is true?

a. $a^2 - 2ab + b^2 = (a+b)^2$
b. $a^2 - b^2 = (a-b)^2$
c. $a^3 - b^3 = (a+b)(a^2 - ab + b^2)$
d. $a^2 + ab^2 = a(a^2 + b^2)$

________33.What is the sum of (3x -2y)and (-3x -2y)?

a. -4y b. -6x+ 4y c. -6x -4y d. 4y

________34. What is the product in multiplying two monomials?

a. Binomial
b. monomial
c. Trinomial
d. Multinomial

________35. What are the factors of $9x^2 - 121$?

a. $(3x+11)^2$
b. $(3x+11)(3x-11)$
c. $(3x^2 - 11)(x+11)$
d. $(3x-11)(3x-11)$

Appendix C

Mathematics Performance Test
(Final Draft)

Directions: Choose the correct answer. Write the letter of your choice before the number.

________1. Which of the following is a monomial?

a. $\frac{1}{x}$ b. $\sqrt{x}$ c. r^3x^2 d. $\frac{1}{x}+1$

________2.What is the degree of -2^3?

a. 0 b. 1 c. 2 d. 3

________3.Which of the following is a polynomial?

a. $x-\frac{1}{x}$ b. $x+\sqrt{x}$ c. $x^2+x-\frac{1}{2}$ d. $x^{\frac{1}{3}}$

________4.What is the difference when -3x+5y is subtracted from -4x -5y?

a. x b. $-x$ c. $-x-10y$ d. $-x+10y$

________5. Which of the following is a square of $(3x-2)$?

a. $9x^2-6x+4$ b. $9x^2-4$ c. $9x^2+4$ d. $9x^2-12x+4$

________6. What is common monomial factor of $9xy^6$ and $27x^4y$?

a. $3xy$ b. $3x^6y^4$ c. $9xy$ d. $9xy^4$

________7. Which of the following can be a product of sum and difference of two numbers?

a. x^2-125 b. x^2-4x+4 c. x^2-149 d. $16x^2-25$

________8. Which of the following is a perfect square trinomial?

a. x^2-x+4 b. x^2-2x-4 c. x^2+4x+4 d. x^2-4

Philippine Normal University
National Center for Teacher Education

________9.What kind of factoring is applicable to $(x+4)(x-4)$?

a. Cube of a binomial
b. Square of a binomial
c. Sum and difference
d. Perfect square trinomial

________10. What is the common monomial factor of $5x^2+5y^2$?

a. x
b. y
c. 5
d. -5

________11. What is the quotient and the remainder of $(x^2+3x+5)\div(x-3)$?

a. $x+6$ r.23
b. $x+6$ r.13
c. $x+6$ r.-13
d. $x+6$ r.-26

________12.What are the factors of x^2-9?

a. $(x+3)^2$
b. $(x-3)^2$
c. $(x+3)(x-3)$
d. $x(x+3)$

________13. What is the difference when $-x^2+5x$ from $6x^2+x-2$?

a. $-5x^2+6x+2$
b. $5x^2+6x-2$
c. $5x^2+6x$
d. $-7x+4x+2$

________14.What is the sum of $(5ab^2c+2d^3)$ and $(3b^2ac-d^3)$?

a. $2a^2bc$
b. $2ab^2c-d^3$
c. $8ab^2c-d^3$
d. $8a^2bc-3d^3$

________15. What are the factors of $x^2+11x+18$?

a. $(x-2)(x+9)$
b. $(x+2)(x+9)$
c. $(x-2)(x-9)$
d. $(x+2)(x-9)$

________16.Which of the following statement is true for a perfect square trinomial?

I. The first is a perfect square
II. The middle term is twice the product of the 1st and last term
III. The middle term is the product of the 1st and last term
IV. The last term is a perfect square

a. I,II,III
b. I,II,IV
c. I,III,IV
d. II and IV only

_________17. What do you call a two term polynomial?

a. Binomial
b. Monomial
c. trinomial
d. Multinomial

_________18.What is the simplest form of $\frac{4a^2b}{2a}$?

a. 2 b. 2a c. 2b d. 2ab

_________19. What is the reduced term of $\frac{15x^2y}{48y^3}$?

a. $\frac{5x}{16y}$ b. $\frac{5x^3}{16y}$ c. $\frac{5x^3}{48y^3}$ d. $\frac{15x}{48y}$

_________20.The side of a square is $6x+4$. What is its area?

a. $36x^2-48x-16$
b. $36x^2-48x+16$
c. $36x^2+48x-16$
d. $36x^2+48x+16$

_________21.Which of term completes the mathematical sentence
$(xy-1)(xy+1)=x^2y^2+\_\_\_\_-1$

a. 0xy b. xy c. 2xy d. $2x^2y^2$

_________22. What is the simplest form of $\frac{15x+25y+5}{5}$?

b. $3x+5y$ b. $3x+5y+1$ c. $3x+5$ d. $15x+5y+1$

_________23. The area of the rectangle is x^2+6x+5, whose length is x+5, what is its width?

a. x+1 b. x+2 c. x-2 d. x+4

_________24. What is the product of 3(2y+3)(2y -3) ?

a. $4y^2-9$ b. $8y^2+27$ c. $12y^2-27$ d. $24y^2-27$

_________25.What kind of factoring is applicable to $8x^3-60x^2y+150xy^2-125y^3$?

a. Cube of a binomial
b. Factoring quadratic trinomial

c. Perfect square trinomial
d. Square of a binomial

________26. Which of the following is true?

a. $a^2-2ab+b^2=(a+b)^2$
b. $a^2-b^2=(a-b)^2$
c. $a^3-b^3=(a+b)(a^2-ab+b^2)$
d. $a^2+ab^2=a(a^2+b^2)$

________27.What is the sum of (3x -2y)and (-3x -2y)?

a. -4y b. -6x+ 4y c. -6x -4y d. 4y

________28. What is the product in multiplying two monomials?

a. Binomial
b. monomial
c. Trinomial
d. Multinomial

________29. What are the factors of $9x^2-121$?

a. $(3x+11)^2$
a. $(3x+11)(3x-11)$
c. $(3x^2-11)(x+11)$
d. $(3x-11)(3x-11)$

________30. What is the product of $(2x-5y)(8x+7y)$?

a. $16x^2+26xy-35y^2$
b. $16x^2+54xy-35y^2$
c. $16x^2-26xy-35y^2$
d. $16x^2-54xy-35y^2$

Appendix D

Table of Specification for the Mathematics Performance Test

Topics	Remembering	Understanding	Applying	Total
Basic Concept on polynomials	1,2,3,17,28			5
Operations on polynomials • Addition • Subtraction • Multiplication • Division		4,18,19	11,13,14, 22,24,27	9
Special Products • Product of two binomials • Square of a binomial • Product of sum and difference • Cube of a binomial	9,25	5,12	20,23,30	7
Factoring • Common monomial • Difference of two squares • Perfect square trinomial • Sum and difference of two cubes	7,8,16	6,10,21,26	15,29	9
Total	10	9	11	30

Philippine Normal University
National Center for Teacher Education

Appendix E

ITEM ANALYSIS

ITEM ANALYSIS

No of students = 28

Item #	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
	Students																											
	Lower														Upper													
1	1			1	1	1	1						1															
2	1	1		1	1		1					1		1														
3		1		1																								
4	1	1			1		1							1														
5	1		1	1	1		1										1											
6		1	1					1		1																		
7		1		1			1						1	1														
8	1	1	1	1	1		1				1			1			1						1				1	
9		1	1	1				1					1	1														
10	1	1	1										1															
11		1			1		1										1					1	1					
12	1			1		1														1						1		
13		1	1	1	1							1								1				1				
14	1		1		1	1		1			1	1																
15	1	1											1		1		1		1		1					1		
16	1		1	1		1		1				1										1						
17					1				1						1				1					1				
18		1	1	1		1		1			1												1					
19	1			1				1	1	1					1			1										
20	1		1	1	1	1			1		1											1				1		
21	1	1	1	1					1						1	1												
22						1		1		1		1								1	1							
23		1						1		1				1				1						1				
24	1	1	1					1		1	1			1											1			
25		1		1	1	1						1				1		1			1							1
26	1								1			1		1					1								1	
27	1		1	1			1									1	1		1						1			
28	1									1	1		1					1	1									
29	1	1		1		1	1			1		1					1											
30	1		1						1							1				1	1	1						1
31	1	1					1				1		1			1						1	1		1			
32	1	1	1			1	1		1	1		1																
33	1	1			1	1			1		1				1	1								1				
34		1	1			1	1						1															
35	1	1	1		1				1	1	1																	
Score	12	13	18	18	22	23	23	26	26	26	26	26	27	27	30	29	29	31	30	31	31	30	31	31	32	32	33	33

Test Item Analysis

Ns of ∑c	Df	Dc	Item #	Decision
26	93	6	1	R
22	79	7	2	R
26	93	2	3	R
23	82	5	4	R
22	79	4	5	R
24	86	4	6	R
23	82	5	7	R
17	61	5	8	R
22	79	6	9	R
24	86	4	10	R
22	79	0	11	D
23	82	1	12	R
21	75	3	13	R
21	75	7	14	R
20	71	-2	15	D
21	75	5	16	R
23	82	-1	17	D
21	75	5	18	R
21	75	3	19	R
19	68	5	20	R
21	75	3	21	R
22	79	2	22	R
22	79	2	23	R
20	71	6	24	R
19	68	1	25	R
22	79	2	26	R
20	71	0	27	D
22	79	2	28	R
20	71	6	29	R
20	71	-2	30	D
20	71	1	31	R
19	68	8	32	R
20	71	3	33	R
19	68	5	34	R
23	82	7	35	R

Ns	Number of succesful students
∑c	sum of the total credits
Df	difficulty index
Dc	dicrimination index

Appendix F

CRITERIA TO VALIDATE THE MATHEMATICS PERFORMANCE TEST

Direction: Indicate how much you agree or disagree with each of the following statements by checking the appropriate number. Use the following scale for rating.

Legend: 5= Strongly Agree

4= Agree

3= Undecided

2= Disagree

1= Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The test items reliably and validity measured the learning objective set for the specific topic in Mathematics.					
2. The test items are appropriate to the comprehension of the students.					
3. The test items sufficiently measured the skills and knowledge possessed by students.					

Comments/Suggestions on the Test for further revision and improvement____
____

Name of Evaluator:____________________________________

Appendix G

SAMPLE CRITERIA TO VALIDATE THE MATHEMATICS PERFORMANCE TEST

CRITERIA TO VALIDATE THE MATHEMATICS ACHIEVEMENT TEST

Direction: Indicate how much you agree or disagree with each of the following statements by checking the appropriate number. Use the following scale for rating.

Legend: 5= Strongly Agree

4= Agree

3= Undecided

2= Disagree

1= Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The test items reliably and validity measured the learning objective set for the specific topic in Mathematics.					✓
2. The test items are appropriate to the comprehension of the students.					✓
3. The test items sufficiently measured the skills and knowledge possessed by students.					✓

Comments/Suggestions on the Test for further revision and improvement Consistency of sentence construction

Aquino

Name of Evaluator: Anna Carmela B. Aquino

CRITERIA TO VALIDATE THE MATHEMATICS ACHIEVEMENT TEST

Direction: Indicate how much you agree or disagree with each of the following statements by checking the appropriate number. Use the following scale for rating.

Legend:
- 5= Strongly Agree
- 4= Agree
- 3= Undecided
- 2= Disagree
- 1= Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The test items reliably and validity measured the learning objective set for the specific topic in Mathematics.					✓
2. The test items are appropriate to the comprehension of the students.				✓	
3. The test items sufficiently measured the skills and knowledge possessed by students.				✓	

Comments/Suggestions on the Test for further revision and improvement____________________

Name of Evaluator: Edna E. Figurasin

CRITERIA TO VALIDATE THE MATHEMATICS ACHIEVEMENT TEST

Direction: Indicate how much you agree or disagree with each of the following statements by checking the appropriate number. Use the following scale for rating.

Legend: 5= Strongly Agree

4= Agree

3= Undecided

2= Disagree

1= Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The test items reliably and validity measuared the learning objective set for the specific topic in Mathematics.				✓	
2. The test items are appropriate to the comprehension of the students.				✓	
3. The test items sufficiently measured the skills and knowledge possessed by students.				✓	

Comments/Suggestions on the Test for further revision and improvement______________________________

Name of Evaluator: GARY PAAT

Appendix H

STUDENTS' PERCEPTION QUESTIONNAIRE

In order to understand how you feel and think about the use of Advance Organizer, please respond to each of the following statements. Kindly answer the following honestly as possible.

Legend: 5 = Strongly Agree

4 = Agree

3 = Undecided

2 = Disagree

1 = Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The use of the Graphic Organizer helps explain clearly the concepts presented in Mathematics					
2. The graphic Organizer helps provide enough information to teach the relationship among the concepts in Mathematics.					
3. The use of the graphic organizer facilitates learning in Mathematics.					
4. The use of the Graphic Organizer motivates students to clearly understand the concepts being taught in the lesson.					
5. The Graphic Organizer is easy to follow compared to others strategies used in teaching Mathematics.					

Appendix I

SAMPLE ANSWER SHEETS STUDENTS' PERCEPTION

STUDENTS' PERCEPTION QUESTIONNAIRE

In order to understand how you feel and think about the use of Advance Organizer, please respond to each of the following statements. Kindly answer the following honestly as possible.

Legend:
5 = Strongly Agree
4 = Agree
3 = Undecided
2 = Disagree
1 = Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The use of the Graphic Organizer helps explain clearly the concepts presented in Mathematics					✓
2. The graphic Organizer helps provide enough information to teach the relationship among the concepts in Mathematics.					✓
3. The use of the graphic organizer facilitates learning in Mathematics.				✓	
4. The use of the Graphic Organizer motivates students to clearly understand the concepts being taught in the lesson.				✓	
5. The Graphic Organizer is easy to follow compared to others strategies used in teaching Mathematics.					✓

SAMPLE ANSWER SHEETS STUDENTS' PERCEPTION

In order to understand how you feel and think about the use of Advance Organizer, please respond to each of the following statements. Kindly answer the following honestly as possible.

Legend:
5 = Strongly Agree
4 = Agree
3 = Undecided
2 = Disagree
1 = Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The use of the Graphic Organizer helps explain clearly the concepts presented in Mathematics				✓	
2. The graphic Organizer helps provide enough information to teach the relationship among the concepts in Mathematics.					✓
3. The use of the graphic organizer facilitates learning in Mathematics.				✓	
4. The use of the Graphic Organizer motivates students to clearly understand the concepts being taught in the lesson.					✓
5. The Graphic Organizer is easy to follow compared to others strategies used in teaching Mathematics.				✓	

STUDENTS' PERCEPTION QUESTIONNAIRE

In order to understand how you feel and think about the use of Advance Organizer, please respond to each of the following statements. Kindly answer the following honestly as possible.

Legend:
- 5 = Strongly Agree
- 4 = Agree
- 3 = Undecided
- 2 = Disagree
- 1 = Strongly Disagree

Criteria	1 (SD)	2 (D)	3 (U)	4 (A)	5 (SA)
1. The use of the Graphic Organizer helps explain clearly the concepts presented in Mathematics				✓	
2. The graphic Organizer helps provide enough information to teach the relationship among the concepts in Mathematics.				✓	
3. The use of the graphic organizer facilitates learning in Mathematics.					✓
4. The use of the Graphic Organizer motivates students to clearly understand the concepts being taught in the lesson.					✓
5. The Graphic Organizer is easy to follow compared to others strategies used in teaching Mathematics.					✓

Appendix J

INTERVIEW GUIDE

1. Do you think the Four Corners and a Diamond Mathematics Graphic Organizer has helped you in learning mathematics?

____
____
____
____
____

2. Do you think that the Four Corners and a Diamond Mathematics Graphic Organizer has improved your ability to communicate mathematically?

____
____
____
____
____

3. Do you think that the four corners and a diamond mathematics organizer is an effective tool in learning?

____
____
____
____
____

Appendix K

SAMPLE STUDENTS RESPONSE IN INTERVIEW GUIDE

Ma. Luwelyn J. Are

INTERVIEW SHEET

1. Do you think the Four Corners and a Diamond Mathematics Graphic Organizer has helped you in learning mathematics?

   Yes, because it has helped me organize my thoughts and processing as well as it has provided a clear picture of the whole topic coverage.

2. Do you that the Four Corners and a Diamond Mathematics Graphic Organizer has improved your ability to communicate mathematically?

   Yes, because through this organizer, I was able to express myself confidently and comprehensively without (being) having the feeling of nervousness during board works.

3. Do you think that the four corners and a diamond mathematics organizer is an effective tool in learning?

   Yes, because it has not only enhanced our mathematical abilities but has also touched our emotional dimension and critical thinking skills through application.

Caisey Nina D. Barrot

1. Do you think the Four Corners and a Diamond Mathematics Graphic Organizer has helped you in learning mathematics?

I think so. Learning in Mathematics has become more engaging and interesting. It made me realize that the subject is not difficult, only we have to know the proper organization and relationships of Mathematical expressions.

2. Do you that the Four Corners and a Diamond Mathematics Graphic Organizer has improved your ability to communicate mathematically?

Yes, of course. With difficulty explaining mathematical concepts and expressions, the use of graphic organizer has helped me present solutions and relationships visually. I believe that I communicate mathematically through this.

3. Do you think that the four corners and a diamond mathematics organizer is an effective tool in learning?

Based on my experience, the organizer is very effective in my learning. I learn easily and effectively through the use of the said organizer.

JOHN RENDELL Q. DE LUMEN

INTERVIEW SHEET

1. Do you think the Four Corners and a Diamond Mathematics Graphic Organizer has helped you in learning mathematics?

YES. WITH THE USE OF THE FOUR CORNERS AND A DIAMOND MATHEMATICS GRAPHIC ORGANIZER ~~IT BECAME~~ LEARNING MATHEMATICS BECOME EASY. :)

2. Do you that the Four Corners and a Diamond Mathematics Graphic Organizer has improved your ability to communicate mathematically?

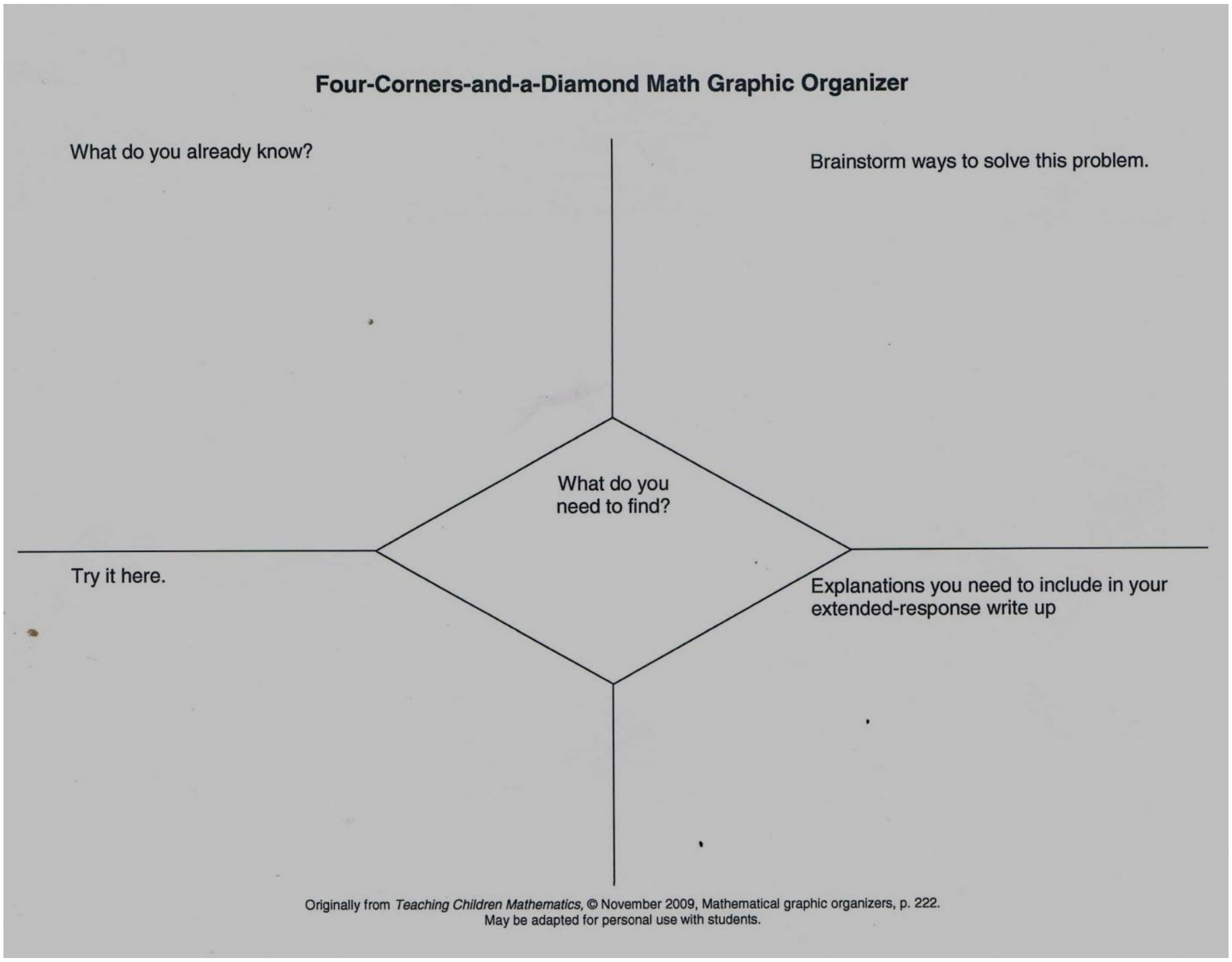
YES INDEED THAT GRAPHIC ORGANIZER REALLY HELPED ME A LOT IN IMPROVING MY ABILITY TO COMMUNICATE MATHEMATICALLY. :)

3. Do you think that the four corners and a diamond mathematics organizer is an effective tool in learning?

YES. THE EFFICIENCY OF THAT TOOL IS REALLY AMAZING. :)

Appendix L

GRAPHIC ORGANIZER MODEL



Appendix M

Result of the Mathematics Performance Pretest and Posttest

	Control Group				Experimental	
SN	Pre-test	Post-test		SN	Pre-test	Post-test
1	15	15		1	12	16
2	12	10		2	10	18
3	18	21		3	11	13
4	12	11		4	18	20
5	19	12		5	15	23
6	20	15		6	18	25
7	11	18		7	17	24
8	10	11		8	16	25
9	9	11		9	15	23
10	7	13		10	21	30
11	17	21		11	11	18
12	6	8		12	18	25
13	23	21		13	21	22
14	12	18		14	11	20
15	13	15		15	12	20
16	4	8		16	9	15
17	5	10		17	8	18
18	15	13		18	17	24
19	20	21		19	10	18
20	13	14		20	4	12
21	15	18		21	6	15
22	13	20		22	15	18
23	18	12		23	13	20
24	10	14		24	15	23
25	8	13		25	12	20
26	15	17		26	12	23
27	26	28		27	10	12
28	25	25		28	21	26
29	12	17		29	20	25
30	4	11		30	15	26
31				31	14	20
32				32	10	13
33				33	9	15
34						

Appendix N

SPSS Print Out

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q1	33	3	5	4.12	.485
Q2	33	3	5	4.03	.684
Q3	33	3	5	4.58	.663
Q4	33	4	5	4.36	.489
Q5	33	3	5	4.88	.415
Valid N (listwise)	33				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q1	33	3	5	4.12	.485
Q2	33	3	5	4.03	.684
Q3	33	3	5	4.58	.663
Q4	33	4	5	4.36	.489
Q5	33	3	5	4.88	.415
Valid N (listwise)	33				

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PreControl	30	4	26	13.57	5.864
Post Control	30	8	28	15.37	4.958
PreExperiemental	33	4	21	13.52	4.360
PostExperimental	33	12	30	20.15	4.611
Valid N (listwise)	30				

Statistics

		Q1	Q2	Q3	Q4	Q5
N	Valid	33	33	33	33	33
	Missing	0	0	0	0	0

Frequency Table

Q1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	2	6.1	6.1	6.1
	4	25	75.8	75.8	81.8
	5	6	18.2	18.2	100.0
	Total	33	100.0	100.0	

Q2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	7	21.2	21.2	21.2
	4	18	54.5	54.5	75.8
	5	8	24.2	24.2	100.0
	Total	33	100.0	100.0	

Q3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	3	9.1	9.1	9.1
	4	8	24.2	24.2	33.3
	5	22	66.7	66.7	100.0
	Total	33	100.0	100.0	

Q4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	21	63.6	63.6	63.6
	5	12	36.4	36.4	100.0
	Total	33	100.0	100.0	

Q5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	1	3.0	3.0	3.0
	4	2	6.1	6.1	9.1
	5	30	90.9	90.9	100.0
	Total	33	100.0	100.0	

t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	15.36667	20.15152
Variance	24.58506	21.25758
Observations	30	33
Hypothesized Mean Difference	0	
df	59	df
t Stat	-3.955	t
P(T<=t) one-tail	0.000104	
t Critical one-tail	1.671093	
P(T<=t) two-tail	0.000208	p
t Critical two-tail	2.000995	

t-Test: Two-Sample Assuming Equal Variances — Experimental Group

	Variable 1	*Variable 2*
Mean	13.51515	20.15152
Variance	19.00758	21.25758
Observations	33	33
Pooled Variance	20.13258	
Hypothesized Mean Difference	0	
df	64	
t Stat	-6.0079	
P(T<=t) one-tail	4.91E-08	
t Critical one-tail	1.669013	
P(T<=t) two-tail	9.82E-08	
t Critical two-tail	1.99773	

t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	15.36667	20.15152
Variance	24.58506	21.25758
Observations	30	33
Hypothesized Mean Difference	0	
df	59	df
t Stat	-3.955	t
P(T<=t) one-tail	0.000104	
t Critical one-tail	1.671093	
P(T<=t) two-tail	0.000208	p
t Critical two-tail	2.000995	

t-Test: Two-Sample Assuming Equal Variances
Control Group

	Variable 1	*Variable 2*
Mean	13.56667	15.36667
Variance	34.39195	24.58506
Observations	30	30
Pooled Variance	29.48851	
Hypothesized Mean Difference	0	
df	58	
t Stat	-1.28378	
P(T<=t) one-tail	0.102161	
t Critical one-tail	1.671553	
P(T<=t) two-tail	0.204323	
t Critical two-tail	2.001717	

Students Perception Questionnaire							
QN	1 (SD)	2(D)	3(U)	4(A)	5(SA)		
							total
1			2	25	6		33
2			7	18	8		33
3			3	8	22		33
4				21	12		33
5			1	2	30		33

Appendix O

Selected Graphic Organizer Outputs

Name: Kimberly Mae S. Reyes **Section:** BT102a

Exploration

$ax + ay = a(x+y)$

What have you noticed on the given example?

1. The expression is binomial.
2. ax and ay have a common in letter a.

Discussion

1. $24x^2 - 18x^3$
2. $3x - 6y$
3. $2m - 5n$
4. $34x^3y^4 - 51y^3x$

Which of the following is not factorable? Explain.

Answer: Number 3. Because there is no common factor between 2m and 5n

How are you going to simplify CMF?

Answer: In simplifying CMF, you need to find their common monomial factor then divide each term by the CMF.

Common Monomial Factoring (CMF)

Seatwork

1. $10x^3y - 15xy^2 = 5xy(2x^2 - 3y)$
2. $60ab^5 - 105a^2b^4 = 15ab^4(4b - 7a)$
3. $30x^{m+1} - 84x^{n+1} = 6x(5x^m - 14x^n)$
4. $28a^2b^4c^5 - 42a^3b^2c^4 + 56ab^3c^3$
$= 14ab^2c^3(2ab^2c^2 - 3a^2c + 4b)$

Journal

I learned that I can solve expression using common monomial factoring. I was surprised that I can now distinguish the expression if it is factorable or not. I noticed that I am careless in dealing with signed numbers. I discovered that I improved in terms of finding the factors of numbers.

EXPLORATION

Multiply these binomials without a table. Describe patterns in the problems or answers.

a. $(x-1)(x-1)$
b. $(a+3)(a-3)$

a. $(x-1)(x-1)$
$= x^2 - x - x + 1$
$\boxed{= x^2 - 2x + 1}$

b. $(a+3)(a-3)$
$= x^2 - 3a + 3a - 9$
$\boxed{= x^2 - 9}$

Part a is the squares of binomials. The answer always starts and ends with a perfect square.
The middle term is twice the terms in one binomial factor.
Part b is in the form of $(a-b)(a+b)$. The answers are binomials containing the differences of square terms. The middle term add to zero and drop out.

DISCUSSION

a. Multiply the binomials using the table method.
$(5x+3)(2x-1) = \boxed{10x^2 + x - 3}$

	$5x$	$+3$
$2x$	$10x^2$	$6x$
-1	$-5x$	-3

b. Which terms in the table are like terms, and what is their sum = diagonal 6x and 5x = -x

c. Write a few sentence and indicate the position of the like terms when you use the table method to multiply binomials = like terms on lower left to upper right diagonal

SPECIAL PRODUCTS AND FACTORING

SEATWORK.
Multiply the ff.
1. $(3x-2)(x+2) = 3x^2 + 4x - 4$
2. $(3x+y)(3x-y) = 9x^2 - y^2$
3. $(m+2)(m+2) = m^2 + 4m + 4$
4. $(3x^2+4y)(3x^2-4y) = 9x^2 - 16y^2$
5. $(7ab+2c)(7ab+2c) = 49a^2b^2 + 28abc + 4c^2$

JOURNAL

I learned that I can multiply binomial easily using table method. I was surprised that I can now identify the types of special product and factoring. I can now use the factoring easily. I noticed that the topic was too easy if you focus on it. I discovered that I can now deal with the different problem in Math involving factoring ;)