2012

The Effects Of Journaling And Vocabulary Strategies On Elementary Students' Attitudes Towards Mathematical Performance

Renee Marie Janzen
University of Central Florida

THE EFFECTS OF JOURNALING & VOCABULARY STRATEGIES ON ELEMENTARY STUDENTS' ATTITUDES TOWARDS MATHEMATICAL PERFORMANCE

by

RENEE MARIE ROLOFF JANZEN
B.S. University of Central Florida, 2007

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the Department of Teaching, Learning and Leadership
in the College of Education
at the University of Central Florida
Orlando, Florida

Spring Term
2012

ABSTRACT

In an attempt to examine the effects of journaling and vocabulary strategies on elementary students' attitudes towards mathematical performance, I embedded reflective journaling and vocabulary strategies into my fourth grade mathematics curriculum. The mathematics content focused on whole number place value, multiplication, and division. My study revealed the positive effects these interventions can have on elementary students' attitudes towards mathematics.

I dedicate this thesis to those that educate and inspire people every day.

ACKNOWLEDGMENTS

I would like to thank all of the influential and inspiring people in my lives that have helped me throughout this process. First (and foremost), I'd like to give thanks to God. You have provided and given me the strength and courage to finish this tedious task.

I would also like to thank my wonderful family and friends who have supported and believed in me during this entire process. Special thanks to my husband, Travis, for having patience with me all those long nights (and dinner on the table). Without your support it would have been a very long two years. Thank you for providing me with lots of laughs along the way.

Finally, my Lockheed Martin Academy cohort, we have encouraged one another no matter what obstacles we faced. There was never a dull moment when we were together and I appreciate each and every one of your talents and gifts you shared with me. Special thanks to my chair, Dr. Regina Harwood Gresham, and my committee members, Dr. Erhan Seluck Haciomeroglu and Dr. Sherron Killingsworth Roberts, your input and dedication were greatly appreciated. Without each and every one of you, this process could not have happened.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

Rationale for the Study

An old Chinese proverb once said, tell me and I'll forget; show me and I may remember; involve me and I'll understand. When students are involved in the lesson, they are more likely to become engaged and motivated in the task (Daniels, Steineke, & Zemelman, 2007). Involving the students through the process of journaling allows for this to occur. Several researchers indicated that when students are able to effectively communicate their process of thinking it solidifies their knowledge of conceptual understanding (Daniels, et. al, 2007; Murray, 2004; Sipka, 1982).

Strengthening a student's confidence level in their thinking process will only improve their attitude towards mathematics. Involvement in the lesson will give them the opportunity to build this foundation. Discovering new and creative ways to allow students to effectively communicate should not be overlooked. This "visible thinking" is the key to success in student learning in a mathematics classroom (Hull, Balka, & Miles, 2011). Along with communicating, the background knowledge and experiences students bring to the study of mathematics affect more than their understanding and problem solving; it also plays a major role in whether students have a productive disposition toward mathematics, as do, of course, their experiences in learning mathematics (Donovan & Bransford, 2005).

Over the past two years, my style of teaching has shifted from a positivist (traditional) style to a constructivist style; Thus, allowing my students to become the teachers, too. The constructivist style of teaching creates the bridge between new information the student discovers, and prior experience and knowledge. Intertwining this style within my mathematics classroom provides an opportunity for the students to become actively involved in the creation of their own knowledge (Foote, Vermette, & Battaglia, 2001). In addition, classrooms that make journaling or writing part of their routine encourage students to take control of their learning. This writing can serve as the foundation for vocabulary and conceptual growth (Murray, 2004).

The research, professional development, and classroom experience has helped create my research study. As a student, I was enthusiastic about learning mathematics and enjoyed being engaged and challenged. Year after year, students have walked through my door with a negative attitude towards mathematics, yet have rarely had the opportunity to truly voice how they felt or explain what would help them achieve success. As a result, this research supports a communication tool and strategy that I believe will allow elementary students to have a positive attitude towards mathematics.

Purpose of the Study

The purpose of this action research was to determine if students' attitudes towards mathematics were affected when exposed to journaling and vocabulary strategies. Both qualitative and quantitative data were used to further investigate this topic. Visible thinking was further examined by having my fourth grade students use journaling throughout the research process. I used journaling as a means to determine how students felt, what they used to aid in

their understanding, and what they were thinking as they were exposed to and learning mathematical content.

Specifically, this action research study examined the effects of journaling and vocabulary strategies on students' mathematics attitudes towards whole number place value, multiplication, and division. Students' attitudes were assessed using a modified version of the Modified Fennema-Sherman Mathematics Attitude Scale, journals and teacher field notes. Student performance on whole number place value, multiplication, and division was assessed using the *Go Math: Big Idea Benchmark Assessment 1A*. Go Math is the mathematics series adopted by my school district.

Research Questions

My research was designed to answer two specific questions pertaining towards mathematics:

Question #1:

> Will the use of journaling & vocabulary strategies affect students' attitudes towards whole number place value, multiplication and division?

Question #2:

> Will the use of journaling & vocabulary strategies affect students' mathematical performance?

Definitions

Terms applicable to this research were defined as follows:

Attitudes: Attitudes are students' beliefs about mathematics. Attitudes were measured using a pre- and post attitude survey, student journals, and teacher field notes.

Constructivist/Constructivism Approach: The teaching style that allows students the chance to be the teachers. Students are in charge of creating connections between new knowledge and their background knowledge.

Common Core Standards: Clear expectations of what students will learn according to each grade level.

Cooperative groups: A small, heterogeneous group of students (approx. 3-5 students) who work together to solve a problem or discuss their thinking process.

Division: Division of whole numbers is represented in the physical world by partitioning and by measurement.

Intellectual/Educational Domain: One of three domains that is associated with the development of math anxiety. It is based on knowledge and skills an individual has or obtains.

Invented Algorithm: A strategy students implement which suites their style of learning.

KIM Chart: A vocabulary strategy that associates a new word with something that students are already familiar with. The chart is broken into three parts: Key Idea, Information, Memory Clue.

Math Anxiety: A student's feeling of tension and apprehension when performing and understanding mathematics.

Multiplication: Multiplication of whole numbers is represented in the physical world by unioning multiple sets of equal cardinality.

Personal Word Wall: A vocabulary strategy that uses a smaller scale word wall that students maintain to keep their own vocabulary words and definitions in order.

Psychological/Emotion Domain: One of three domains that is associated with the development of math anxiety. It is reflective on a students' emotional history.

Social/Motivational Domain: One of three domains that is associated with the development of math anxiety. Behavior is impacted by the attitudes of family, friends, and the society.

Student Journaling: Student journals were spiral notebooks where students would write, draw or model their response to reflective questions and/or problems.

Teacher field notes: Teacher field notes were anecdotal records kept by the researcher. These field notes were in relation to the observations during student journaling activities.

Visible Thinking: form of communication through writing, drawing, or models reflective on one's understanding of the concepts addressed.

Vocabulary Strategies: A process that helps students to create connections and establish meaning with vocabulary terms.

Whole Number Place Value: Also known as, base-ten positional number systems. For whole numbers, the digit furthest to the right is the ones place. Moving to the left, each digit has a place value 10 times the value of the place to its right.

Word Origins: A vocabulary strategy that links common language roots to the vocabulary term.

Significance of the Study

It is important for our schools, teachers, and students' parents to become an active component in revitalizing mathematics for the children of today. The first step towards achieving this is by the adoption of the Common Core Standards, which have been adopted by 45 states including Florida (as of January 2012). Meaningful change results when effective, research-based, instructional strategies are used regularly and supported (Hull et. al, 2011). Stopping the achievement gap from becoming too large is not only a priority, but also a necessity in creating mathematically-ready members of society.

True mathematical learning, as identified through a number of reports by the National Council of Teachers of Mathematics (NCTM) and the National Research Council (NRC), requires visible thinking. Visible thinking holds the key to mathematical learning and success. When students communicate, whether its through pictures, dialogue, models, or even writing, they are able to develop and form their own metacognition. Developing this process of thinking allows for their level of understanding to strengthen and bridge the gap between misconceptions that may be formed (Foote, Vermette & Battaglia, 2001).

Assumptions

Through my experiences, not only as a teacher, but as a student, I have obtained and developed two assumptions prior to researching this topic further. The first assumption was to see if students' attitudes would be affected by having them journal during mathematics. The

second assumption was to see if students' attitudes would be affected by incorporating vocabulary strategies within my mathematics instruction. Both assumptions were based on my two research questions and through a review of related literature.

Question #1:

> Will the use of journaling & vocabulary strategies affect students' attitudes towards whole number place value, multiplication and division?

Question #2:

> Will the use of journaling & vocabulary strategies affect students' mathematical performance?

Furthermore, the results of this action research will emphasize the importance of journaling and incorporating vocabulary strategies as a part of the mathematical instruction.

Summary

In the following chapter, I investigated the layout of the constructivists' theory and the way it plays a vital role in teaching mathematics. I also identified the importance of journaling and vocabulary strategies along with their role when exploring students' visible thinking processes. Finally, I specifically discussed the three areas of mathematics in order to gain a greater understanding about the content that students would be encountering within this study.

CHAPTER TWO: LITERATURE REVIEW

Introduction

There is a surplus of research which suggests writing helps students become actively engaged in the subject matter (Daniels, et. al, 2007; Cowley, 2004; Murray, 2004; Whitin, 2000; Langford, 1989). Research also indicates writing serves as a platform for vocabulary and conceptual growth (Murray, 2004). Furthermore, students' attitudes towards mathematics have an impact on students' abilities to understand the subject (Ashcraft & Kirk, 2001).

According to Phi Delta Kappan (1994), students have learned to distrust their own thinking. Students who are discouraged from thinking will construct less knowledge than those who are confident and do their own thinking. Strawderman (2010) has proposed three domains which influence students' mathematical attitude; social/motivational domain, intellectual/educational domain, and psychological/emotion domain. These three domains can be simplified into terms of emotions, expectations, and values.

This action research will focus on embedding journaling and vocabulary strategies into the mathematics content-area and the effects they have on students' attitudes towards mathematics. The following summary of the literature reviews the key elements involved with writing in the mathematics content area, implementing vocabulary strategies into the mathematics instruction, and the profound influence these learning tools have on student attitudes towards whole number place value, multiplication, and division.

Constructivism

Constructivism is a theory of learning but not a theory of teaching. This theory was established in the 1920/1930 era. Piaget, like Constructivist, view learning as information we connect to information we already have. When he discussed how you reshape your previous understanding and create new knowledge once you encounter new information he was describing constructivism. Several researchers see it [constructivism] as a way for students to create an individual sense of understanding or construct generalizations (Azly, 2004; Spivey, 1997; Constance & DeClark, 1985). Unlike traditional teaching styles, constructivism creates active participants who construct their own knowledge and understanding through experience and reflection. Students learn how to integrate information, not simply passively obtaining information (Rahman, 2004).

The traditional setting places the teacher as the sole operator of exchanging information and filling the students' minds with information. On the contrary, constructivism places a greater emphasis on students' abilities to become actively involved in the creation of their own knowledge (Foote, Vermette & Battaglia, 2001). The teacher, still a valuable asset to the students' learning, guides the students in activities through questioning and builds on their pre-existing knowledge. Additionally, teachers promote problem solving techniques, student reflections, and group discussions as a way to create a better understanding and more knowledge (Rahman, 2004).

Today, within our American society, classrooms are frequently composed of a diverse population of students who bring a variety of cultural and linguistic experiences (Whitin, 2000).

It is through these experiences students begin to reshape their understanding of content being taught in the classroom. Teachers are facilitators who "nudge" each child's reshaping of content into a form of understanding (Foote, Vermette & Battaglia, 2001). Interactions between individual students develop their abilities to think about other points of view compared to their own. They can do this in a variety of ways, journaling, discussing or experimenting. Constructivists want to promote autonomous thinkers. When teachers promote students' wrong ideas instead of dismissing them, they [teachers] recognize children's wrong answers or ways of thinking are not errors needing to be eliminated but relationships wanting to be explored at a higher or next level (Kamii & DeClark, 1985).

Tompkins (1998) supports constructivism in the classroom. She believed by establishing constructivism it places a healthy emphasis on the purpose of meta-cognition in learning. Students who can think on their own, can learn on their own, by formatting their experiences to their understanding and knowledge. Furthermore, Thompkins, like Constructivist, supported student journaling as a means for reflecting, predicting, and exploring topics. Through the act of journaling, students were directly involved with their learning.

Journaling

Writing across the curriculum began flourishing in classrooms and educators thoughts well before the turn of the century. In fact, since the 1960s, a great deal of research and debate has taken place concerning the relationship between language and learning in mathematics. Research from Vygotsky's (1962) work highlights two reasons writing needs to be a part of mathematics:

1) The act of writing necessarily involves processes that are fundamental to learning that otherwise are not necessarily engaged.
2) The process of writing mirrors the process of learning and can be seen as supportive of it.

Teachers continue to use and see writing in the mathematics content area as a learning tool. Writing allows students to generate ideas, express concerns, and admit confusion (Sterrett, 1982). Recent research from Hull et al. (2011) states, "when visible thinking is present in classrooms, students are consciously aware of their current understanding of the mathematical concepts being discussed" (p. 3). Thus, twenty-first century students need to develop a personal voice in mathematics through writing and/or talking. Utilizing a personal voice allows students the chance to develop a deeper understanding of mathematics (NCTM, 1991). It is through personal voice the development of metacognition can start to form. "Metacognition is the process of thinking about one's own thinking" (Foote, Vermette & Battaglia, 2001, p. 69). Figuring out your style of learning, what enables you to recall facts, and/or effective strategies are examples of metacognition.

Recording the process of metacognition can take place using a journal. Journaling serves as a tool which encourages self-examination of a student's thinking in regard to a learning task no matter the subject (Foote, Vermette & Battaglia, 2001, p. 69). When students are aware their journals are a safe place to explore and make mistakes without paying penalties, then the journal becomes a communication resource between the teacher and the student (Talman, 1982). Teachers are able to use these journals as a resource to conduct spot on investigations and realize their students' misconceptions. These investigations allow for immediate response to avoid a

child falling behind in a subject area especially math where concepts are built atop one another (Hull et. al, 2011).

Emphasizing communication in a mathematics class shifts the classroom from an environment in which students are totally dependent on the teacher to one in which students assume more responsibility by validating their own thinking (NCTM, 1989). Furthermore, Piaget believed students need to build their autonomy in order to think for themselves and become independent members of society. Journaling builds upon this autonomous skill students need to strive for. When journaling is an informal writing assignment, content is the key component. Teachers can access their students' thinking process in a journal.

Research shows, in a mathematic classroom, visible thinking is apparent during discussions, explanations, demonstrations, drawing and, writing, in which students and teachers are able to convey their ideas (Hull et. al, 2011). Several researchers indicated when students are able to effectively communicate their process of thinking, their knowledge of conceptual understanding is solidified (Murray, 2004; Sipka, 1982). When a teacher creates a journaling ritual (daily or weekly writings) in their classroom students are encouraged and required to take control of their learning. Thus, allowing students the chance to recognize they can discover new ideas in the process of communicating (Whitin, 2000). American educationist, Edgar Dale, developed the Cone-of-Experience model (1969). The model accentuates the importance of communicating in order to learn. Dale briefly illustrates this importance of communicating by stating that people generally remember

10% of what they read
20% of what they hear

30% of what they see
50% of what they see and hear
70% of what they say and write
90% of what they say as they do a thing

Today, learners must still act on information in order to remember and use it. Hence, writing to learn. When students do not have the opportunity to communicate during mathematics they often remember less of what they are being taught. Therefore, when students are provided with the opportunity to reflect and journal on activities or lessons more is retained (Dale, 1969).

Research also indicates writing serves as a platform for vocabulary and conceptual growth (Murray, 2004). Students who merely regurgitate information are not demonstrating the mathematical thinking process or building upon their conceptual mathematical understanding. When students are actively communicating with their teacher or peers the use of math terminology is more affluent, which helps students to communicate their understanding of mathematical concepts. Whether the student is a high-achieving or a low-achieving student, writing [journaling] can benefit them (Kostos & Shin, 2010). Research from Baxter, Woodward, & Olson, (2005) explored the notion that low-achieving students were more willing to share their thinking in a journal. The research evidence proved that journaling allowed low-achieving students the opportunity to communicate their mathematical thinking through pictures, words, and symbols.

Vocabulary Strategies

Marzano (2005) strongly believes learning vocabulary has a powerful influence on a student's education. Throughout Marzano's work he found, "teaching specific terms in a specific

way is the strongest actions a teacher can take to ensure students have the academic background knowledge they need to understand the content they will encounter throughout their schooling" (p.1). Building vocabulary directly requires specific vocabulary activities (Murray, 2004). The three vocabulary strategies that this literature review focuses on are the KIM (Key Idea, Information, Memory Clue) Chart, Word Origins, and Personal Word Wall.

KIM Chart

This vocabulary strategy uses a method of associating a new word with something that students are already familiar with. Piaget believed this accommodation was how learning occurred. When new information connects with prior knowledge or experience, learning becomes more engaging. When students build off of their experiences students begin to develop a sense of ownership. An example of the KIM Chart is presented in Figure 1. Students need the opportunity to make the connections between language and their thoughts. Thus, helping them construct their own understanding of concepts (Talman, 1982).

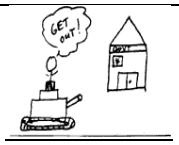
K - Key idea	I - Information	M - Memory Clue
1. drought	Little or no rain over a period of time	
2. coup	Takeover of government by military	
3. sovereignty	Political independence	

Figure 1: K.I.M. Chart

Word Origins

A word origin is a strategy that links to common language roots to the vocabulary term. This is important when establishing a connection for students. Word Origins support the understanding of mathematical vocabulary by linking it with English words. For example, the mathematical term "estimate" comes from the Latin word appraise. Establishing this link creates a connection from the mathematical term to students' everyday lives. According to Rubenstein's (2002, p. 243), "links promote students' general vocabulary development, as well as mathematical fluency." If students do not fluently understand mathematics, then they will encounter problems when they engage in problem solving activities (Thornton, 1990). The following are benefits when word origins are integrated into the curriculum:

1. The main advantage is that mathematical terms often mean precisely what they say. When we recognize the Latin, Greek, Indo-European, Arabic, or other language roots form which words stem, their meanings are clearer.
2. Students who are verbal learners often find verbal connections particularly helpful in gaining access to the mathematics.
3. The study of word origins provides the opportunity for teachers to collaborate across disciplines.
4. Finally, word origins are fun! Learning how seemingly unrelated words in our lives are connected is often surprising and exciting (Rubenstein, 2002, p. 247).

The goal of learning and teaching vocabulary is to create a fun atmosphere where students can learn to enjoy language and vocabulary building. This goal is critical when striving towards effective direct vocabulary instruction (DeVries, 2004).

Personal Word Walls

A classroom word wall is a large display of current vocabulary terms. It provides a visual map to help children form connections between words. Often, word walls include the definition and/or a pictorial representation. Sometimes word walls can pertain to a specific topic (i.e. mathematics). Most often a word wall is displayed on a classroom bulletin board where all students can see it. A personal word wall is a smaller scale word wall in which students are able to take ownership. Their personal word wall allows the students to decide which mathematical terms, definitions, and visual elements they want to add to their word wall. Personal word walls are scaled down to a single sheet of paper that students keep in their (math) folders. They can refer to it at any time.

When students lack understanding of these basic terms, it can seriously hinder their ability to perform word problems which include terms. Providing the students with the opportunity to create their own word wall allows them to take pride in their work and form their own connections. Simply having students memorize terms without the aid of a definition, visual cue, or within context, is not a productive practice. Simply memorizing the terms will not allow students a chance to apply it within the context or make connections between other terms. Students need to be able to recognize math concepts and generalizations (Sherman, Richardson, & Yard, 2005). "It is making the connections between the context, the mathematics and other contexts which makes mathematics so powerful" (Griffiths & Clyne, 1994, p. 34). Therefore, when students learn a new term they need the visual cues or context clues to help them form these generalizations. A personal word wall becomes a safe place where they can create these connections and learn new terms.

Students' Attitudes

"I am not a math person," has become a socially acceptable sentence in today's society. A student's belief about mathematics (attitude) is influenced by many factors. Some people believe their lack of mathematics achievement is due to factors that are beyond their control (i.e. innate mathematical inability or level of intelligence). In contrast, Norwood (1994) believed a negative attitude did not appear to have a single cause, but is a result of many different factors combined, such as truancy, low self-esteem, teacher attitude, and student's mathematical understanding. In recent research by Strawderman (2010), he proposed three domains which influence students' mathematical attitudes; social/motivational domains, intellectual/educational

domains, and psychological/emotion domains. These three domains can be simplified into terms of emotions, expectations, and values which may lead to a negative or positive attitude towards mathematics.

Narrow and negative mathematical views are not only the product of a school experience, but a home expreience. Mathematics expectations and values extend from parents, siblings, and even the community when manipulating a child's attitude and belief toward mathematics (Griffiths & Clyne, 1994). Fostering the belief that all students can succeed in mathematics is not only the job of our schools, and our teachers, but our students' parents as well (Rowan & Bourne, 1994). Students look to their parents and guardians for their current values on mathematics when forming their own interest.

Attitudes can also be influenced by a student's level of understanding. If a student does not understand mathematics, then in turn receives a poor grade, they will likely begin to dislike mathematics (Langford, 1989). Griffiths and Clyne (1994) discuss how students' confidence and competence in mathematics can be developed simultaneously, and how teaching and learning in context strengthens both aspects. In a study entitled, Jennison and Beswick (2010) found that when students have the chance to interact with their work in a relaxed and supportive environment, improvements with their understanding of mathematics were seen, as well as, increased confidence of their own abilities.

Giving students easy problems is not a way to build their confidence. "Confidence does not mean always getting it right, but nor does it mean going ahead blindly," as stated by Griffith and Clyne (1994, p. 7). Providing students the opportunity to build their confidence through the

process of creating, constructing, and discovering mathematics is the key to unlocking the power of learning. With this power of learning students are able to recognize their true potential and gain confidence. As this becomes part of a students' routine, they become more proficient, and capable of developing and executing their plan. Cowley (2004, p. 3) states, "Being able to think clearly, logically and also creatively is fundamental to a successful approach to life." She continues by saying, thinking removes the rote way of learning and causes students to approach problems in a "conscious" way. Students need to think on their own to construct knowledge and build confidence within themselves.

Teachers hold the key for establishing classroom environments that engage and encourage students.

> "If, as teachers, we can demonstrate the interest, relevance, and excitement of mathematics in our classrooms, and engage children in active exploration of mathematics in a range of contexts, we will be contributing to changing children's perceptions. The classroom environment and the contexts for teaching and learning contribute to the development both of confidence and of positive attitudes to mathematics." (Griffiths & Clyne, 1994, p. 29)

When this approach becomes the norm in the classroom students develop self-esteem and social skills essential for a teacher as they try to promote an environment where alternative ways of thinking are acceptable (Sherman, Richardson, & Yard, 2005). Classroom climates [environments] can establish the precedent for the quality of thinking too. Students' thinking feeds off of teacher expectations and feedback (Cowley, 2004). Dewey, an educational reformer, believed students need to take charge of their learning, and recognized that teachers should support classroom environments where creative activity could flourish (Foote, Vermette, & Battaglia, 2001).

Whole Number Place Value

Place value, often called base-ten positional number systems, is one of the most important concepts imbedded in the elementary and middle school mathematics curriculum. Within whole number place value, each digit represents a group or base of ten (Sherman, Richardson, & Yard, 2005). For whole numbers, the digit furthest to the right is the ones place. Moving to the left, each digit has a place value 10 times the value of the place to its right. Remembering to focus on this pattern in place value during instruction helps students build understanding (Houghton Mifflin Harcourt, 2011).

The Next Generation Sunshine State Standards for Fourth Grade requires students to use and represent numbers through the millions. According to Baroody (1990), misunderstandings and errors are evident in student work when place value concepts and procedures are learned, isolated from previous knowledge and with little meaning. Common errors may include, but are not limited to, ignoring "0" as a placeholder or misrepresenting numbers in the translation from word form to standard form (Sherman, Richardson, & Yard, 2005). Conceptual and procedural errors may require the use of manipulative materials to support a student's understanding of the place value system. Using commercial or homework base-ten blocks requires students to connect place value to computation since they are working with hundreds, tens, and ones.

Multiplication

Multiplication of whole numbers is represented in the physical world by unioning multiple sets of equal cardinality (Sherman, et. al, 2005). Multiplication equations can also

represent repeated addition equations. When students are learning multiplication they should be encouraged to choose their own strategies (invented algorithms), as long as they understand the strategy and it makes sense mathematically. Choosing a form of computation requires both number sense and operation sense. Multiplication problems completed with little understanding are quickly forgotten and confusion quickly occurs. Students have the opportunity to choose their own invented algorithm giving them the chance to build a personal set of strategies which will work when solving problems and checking their computation (Houghton-Mifflin Harcourt, 2011).

The Next Generation Sunshine State Standards for fourth grade requires students to use and describe various models for multiplication, as well as, describe multiplication relationships using expressions, equations, and visual representations. Fourth grade students are also required to multiply multi-digit whole numbers through four digits fluently. Research indicates a student's progress through a sequence of procedures when learning multiplication. Typically, the student begins to form equal groups and counting, then continues through finding patterns and using other thinking strategies (Kilpatrick, Swafford, & Findell, 2001). Teaching students to use the multiplication table to identify patterns is a helpful strategy when trying to teach them multiplication facts.

Division

Division of whole numbers is represented in the physical world by partitioning and by measurement (Sherman, et. al, 2005). Division equations can also represent repeated subtraction equations or the inverse of multiplication. Representing division in one of these two ways

eliminates anxiety and allows students to focus on the meaning of division (Fuson, 2003a; Kilpatrick, Swafford, & Findell, 2001). Allowing students to visualize that division involves the breaking of a set into parts is important when teaching children division. In addition, using models to act out division problems can benefit student understanding of the concept of division. These strategies will evolve over time once a child has a conceptual understanding of division.

The Next Generation Sunshine State Standards for fourth grade requires students to use various models to represent division. Division models are represented in three different ways. First, starting with the inverse of multiplication, this division model allows students the chance to utilize their basic multiplication facts in order to assist them in their understanding of division. The second model is partitioning, or sharing. The unknown for this model is how many are in each group. On the contrary, the third model, successive subtraction, or measurement division, focuses on the unknown of how many groups can be created. Partitioning does not lend itself to repeated subtraction because the number of each group is not known. It is important that students recognize that the strategies they use to solve division problems is related to the context of the problem (Houghton-Mifflin Harcourt, 2011).

Conclusion

Albert Einstein once said, "Any fool can know. The point is to understand." His message seems loud and clear since research indicates that in order for learners to understand and remember ideas, they must act upon them. (Daniels, Steineke, & Zemelman, 2007). Griffiths and Clyne (1994) also agree that learning should be active. They state, "the learner needs to be actively involved, more than being physically active or using concrete materials; thinking, planning,

implementing, practicing, evaluating, and reflecting" (p.116) are all requirements for children to make sense of number sense and mathematics. I believe if the mathematics studied in Grades three through five is interesting and understandable, the increasingly sophisticated mathematical ideas at this level can maintain students' engagement and enthusiasm. But if their learning becomes a process of simply mimicking and memorizing, they can soon begin to lose interest. Instruction at this level must be active and intellectually stimulating and must help students make sense of mathematics (NCTM, 2000)

CHAPTER THREE: METHODOLOGY

Introduction

During my five years of teaching, I have noticed negative feelings towards mathematics has become prevalent among my fourth grade students. Although the negativity does vary from student to student, it is still clearly evident and appears to affect their mathematical performance within my classroom. Therefore, I conducted this study to determine if journaling and vocabulary strategies affected students' attitudes towards whole number place value, multiplication, and division. The purpose of this nine-week study was to reflect on my own practice of utilizing reflective and responsive journaling and incorporating vocabulary strategies into my lessons in order to help improve my students' mathematical performance and attitudes toward the subject. Quantitative and qualitative methods were used in this study. Multiple sources were used to collect the data for this research including, pre- and post mathematics assessment, pre- and post attitude survey, reflective journaling, vocabulary strategies, and teacher field notes.

Design of the Study

Mills (2007), described the purpose of action research and the intent for collecting data. Mills states, "The information is gathered with the goals of gaining insight, developing reflective practice, effecting positive changes in the school environment (and on educational practices in general), and improving student outcomes and the lives of those involved" (p. 5). The reflective

practices that I acquired from this study will aid my decision in future strategies and techniques implemented within my classroom. Quantitative and qualitative methods were used when collecting data for the following research questions:

Question #1:

> Will the use of journaling & vocabulary strategies affect students' attitudes towards whole number place value, multiplication and division?

Question #2:

> Will the use of journaling & vocabulary strategies affect students' mathematical performance?

The quantitative data included a pre- and post math assessment and a pre- and post attitude survey. The math assessment used was the *Big Idea Benchmark Assessment 1A from the GO Math Houghton Mifflin Harcourt Series*. The attitude survey, modified from the Fennema-Sherman Mathematics Attitude Scale was administered after the math assessment in order to reveal students immediate attitude towards whole number place value, multiplication, and division. The qualitative data included students' journals and teacher field notes. The journal prompts and problems related to the topic of interest were used to aid in the investigation of the students' attitudes. The topics pertained to vocabulary strategies used or items that were taught in the classroom that day. Teacher field notes were collected while the students wrote in their journals.

Assumptions

This study was approached with the assumption that, by utilizing reflective journals and incorporating vocabulary strategies, students' mathematics attitudes about whole number place value, multiplication, and division would improve. This assumption was based on extensive review of related literature and my professional experience. It was also assumed that students understood they were in a risk-free environment when writing in their journals, completing their math assessment, and attitude survey.

Setting

School Setting

This study took place in an elementary school located in Central Florida. The school offers services for three year old Autistic students, Exceptional Student Education classes, and regular education classes for kindergarten through fifth grades. This school was identified as a Title1school during the 2011-2012 school year. The total population is approximately 563 students; 247 (43%) females and 316 (56%) males. More than half of the population (55%) is on free and reduced lunch. Subgroups within the school are comprised of 326 (57%) white, 72 (12%) black, 127 (22%) Hispanic, 103 (18%) Exceptional Student Education (ESE), and 22 (3%) English Language Learner (ELL) students.

Classroom Setting

This study was conducted in a self-contained, fourth grade classroom consisting of 21 students over a nine-week period. In addition to the mathematics instruction, I also taught writing, reading, science, and social studies. Mathematics took place at the beginning of the day and lasted 60-70 minutes with a break of 45 minutes for specials afterwards (Art, Music, Science, or P.E.).

Curriculum covered in this study consisted of whole number place value up to the millions, multiplication, division, and algebra concepts and facts. Whole number place value was taught for three weeks. Multiplication and division facts and concepts were taught for three weeks. Algebra expressions, equations, and patterns were taught for three weeks. The time frames are approximations and covered half of the Mathematics Big Idea 1: Whole Number Place Value, Multiplication, and Division.

Of the 21 students assigned to this class, 13 were males and 8 were females. One of the male students was gifted and attended the gifted program on Tuesdays (all day). The population consisted of 67% white, 19% Hispanic, & 14% black. Economically disadvantaged students consists of 47% of the total class population. All students returned the Parental Consent Letter, therefore all were able to participate in this research study.

Data Collection

Prior to beginning the study, permission was sought and obtained from the University of Central Florida Institutional Review Board (IRB) (See Appendix A). Approval was obtained

from the school board (See Appendix B) and school principal (See Appendix C). Permission from the *Go Math Houghton Mifflin Harcourt series* was obtained to reproduce their assessment (See Appendix D). The modified Fennema-Sherman Mathematics Attitude Scale was approved to use (See Appendix E). Approval was additionally sought and obtained from parents/guardians for each participating student using the Parental Consent Letter (See Appendix F). During Open House, I explained the requirements to the parents. The Parental Consent Letter was sent home which also explained the requirements of the study. In class, I explained the study requirements to the students where I allowed them to ask questions. Once permission was obtained from all the parents/guardians and students, I initiated the research for this study. To ensure confidentiality, students were assigned numbers. Thus, all materials were numbered when turning them in.

Lessons and activities followed a pattern; the lesson started out whole group, moved into brief independent work, and then finished with group activities. Students usually worked with their math group which was determined by the pre-math assessment at the beginning of the study. However, sometimes students had the opportunity to choose who they wanted to work with or work independently. Response journals were filled out independently at the end of the lesson on Tuesdays and Thursdays.

Teacher field notes were taken during the study noting student responses, questions, or behaviors during the time students were asked to respond to the question in their journals. Journal prompts and problems related to the topic being addressed. Students were asked questions related to how they were feeling about a specific math topic. When a problem was

provided, the students were asked to explain their thinking. Vocabulary strategies were also tied into their journals. Students had to fill out and complete their vocabulary KIM (Key Word, Information, Memory Clue) Chart.

The quantitative data collection included a pre- and post math assessment and a pre- and post attitude survey. The qualitative data collection included students' journals and teacher field notes. Each instrument used in this study to collect data is further explained in the next section.

Instruments

Pre- and Post Math Assessment

The pre- and post math assessment was obtained from the Go Math Houghton Mifflin Harcourt series (See Appendix G). The assessment was titled Big Idea 1A, which covered whole number place value, multiplication, and division. The assessment consisted of 25 multiple choice questions. The students had 60 minutes to complete the assessment. Directions or problems were read for the student if they asked for help, but no other actions took place. During the ninth week of research, students took the post math assessment. The same testing conditions applied during the assessment. This method of data collection was used to compare their pre-existing mathematical knowledge (the pre-assessment) and the mathematical gains made on the post-assessment, with their mathematical attitudes towards whole number place value, multiplication, and division.

Pre- and Post Attitude Survey

The pre- and post attitude survey was a modified version of a pre-modified Fennema-Sherman Mathematics Attitude Scale (See Appendix H). It consisted of eleven statements which students answered in a Likert-scale format: A= Strongly Agree, B= Sort of Agree, C= Not sure, D= Sort of Disagree, E= Strongly Disagree. Students took the pre- and post attitude survey after they took the pre- and post math assessment. This order of operation was pertinent since the goal of the study was to obtain students' attitudes towards whole number place value, multiplication, and division, which is what the problems of the pre- and post math assessment related to.

Reflective Journals

For organization, individual spiral notebooks were used to keep students' thought processes, vocabulary strategies, and reflections. They were labeled with each student's number and the title "Math". On the front inside cover, a list of all of the vocabulary terms were posted for Big Idea 1. Students used the journals on Tuesdays and Thursdays for nine weeks. Questions asked pertained to the topic of study during that particular time (See Appendix I). Journals were collected and housed and locked in the researcher's filing cabinet when not being used. The purpose of the journals was for the researcher to gain an insight into the mind of the students thinking process, as well as a way to identify if the students felt confident about the material. Students were also encouraged to use them during classroom mathematical activities and assessments.

Student Interviews

Once data was gathered from the pre- and post attitude survey the results were analyzed. Questions that caused a high volume of a negative or positive attitude change between students were closely examined. These particular students who had a change in attitude were further questioned on why their results changed. A series of questions (See Appendix J) were posed to the student, while the student verbally responded. Interview questions were derived from mixed sources. Three of the questions were created by the researcher. Two questions were created from the research questions. By asking these questions to further probe the students' thoughts, I was able to validate the data source. Students' responses to the interview questions were recorded as teacher field notes, which were used as an additional data source.

Teacher Field Notes

While students wrote in their journal, the researcher collected field notes about how students responded to the questions and if they needed assistance when answering the questions. This form of data collection assisted in the creation of additional questions during the study. Field notes also aided in the discovery of how students felt about particular topics and were then used to drive instruction for the following day.

Data Analysis Procedures

Pre- and Post Math Assessment

The 25 multiple choice item pre- and post math assessments were completed by all participants in the study. The attitude survey was stapled to the back of the assessment in order to receive immediate feedback in regards to students' mathematical attitudes towards whole number place value, multiplication, and division. Assessing them in this particular order allowed for more accurate attitude results.

When the assessment began students were instructed to put their secret number on their paper. Questions for the math assessment was not permitted, however, students could ask questions and receive help for the survey. The survey was shown to them ahead of time, but they were instructed to fill out the survey after the math assessment. If they were unsure of a problem they were told to skip the question and then come back to it. Students had 60 minutes to complete the assessment. Students' pre- and post mathematical assessment scores were compared to one another to note any increases or decreases in scores. The total points for the assessment were figured out of 100 (each problem being worth 5 points).

Aligning this score with the county's grading scale resulted in two ranges, a score of 70% or higher was passing. A score of 69% or lower was scored as not passing. Scores were kept on a spreadsheet to evaluate later on with additional pieces of data. Once all of the data was collected the pre- and post math assessment were correlated with the pre- and post attitude survey, teacher field notes, and student journals in order to conclude if students' attitudes were affected.

Pre- and Post Attitude Survey

The evaluation process consisted of a point system in relation to the type of question (positive or negative). For example, if it was a positive statement then students earned 5 points for choice A, 4 points for choice B, 3 points for choice C, 2 points for choice D, and 1 point for choice E. If it was a negative statement then students earned 5 points for choice E, 4 points for choice D, 3 points for choice C, 2 points for choice B, and 1 point for choice A. Once the points were added up they were compared with three ranges. Each range related to having a positive, negative or neutral attitude towards mathematics. A positive attitude was noted for scores $55 \geq x > 33$. A neutral attitude was noted for scores of 33. Negative Attitudes were noted for scores $33 > x \geq 11$. Pre- and post attitude survey results were compared together. Scores were also compared with the other multiple pieces of data that were conducted and collected throughout the study.

Reflective Journals

Students answered various questions and activities that related to vocabulary strategies, whole number place value, multiplication, or division. Every Tuesday and Thursday students would answer the questions in their journal at either the beginning or the end of a lesson. The determining factor was the type of prompt or activity. If it was a vocabulary strategy, then students answered them before the lesson. If it was a prompt that wanted students to express their understanding or feelings then it was presented at the end of the lesson. The prompts were pre-typed and glued into the journals ahead of time. All prompts were read aloud to the students once before the journals were handed out and then once again after each student had their journal. If

students had responded to a question earlier in the week then they were encouraged to read back over the comments that I wrote to them. After reading the question, students were provided ample time for them to thoroughly respond to the prompt. Once collected, journals were read and closely monitored to identify students' attitudes towards whole number place value, multiplication, and division. Vocabulary terms used in the journals, along with the attitudes students expressed, were noted and compared with the pre- and post- mathematical assessment and pre- and post- attitude surveys.

Teacher Field Notes

Teacher observations were made while the students responded in their journals. Field notes were taken to reflect the observations. These were then compared to the student journals, pre- and post- math assessment, and pre- and post- attitude survey.

Summary

Various types of data were collected during this study. The pre- and post attitude survey, teacher field notes, and student journals, were recorded and analyzed to show the effect that journals and vocabulary strategies had on students' attitudes towards whole number place value, multiplication, and division. The pre- and post math assessment was analyzed to identify students' overall mathematical performance towards whole number place value, multiplication, and division.

CHAPTER FOUR: DATA ANALYSIS

Introduction

This action research study investigated students' attitudes towards whole number place value, multiplication, and division in a fourth grade classroom. An action research design was selected since it assured contribution to knowledge, and successful change (Dick, 1997). My interest in this topic developed over the past several years as I continued to strengthen my love, enthusiasm, and appreciation of mathematics particularly while I was teaching elementary students. As a teacher, when you are passionate about something you want your students to feel the same passion and drive that you have about a particular subject. While teaching, it was evident that many of my students did not exhibit positive attitudes about mathematics. Therefore, I decided to find ways to change their attitudes to more positive ones regarding the subject content. This chapter discussed the effects of journaling and vocabulary strategies on students' attitudes towards mathematics.

Data collection methods for this study were students' journals, student interviews, teacher field notes, pre- and post mathematics assessment, and pre- and post attitude survey. Using multiple data resources allowed for triangulation of data throughout the study. The research questions for this study were:

Question #1:

Will the use of journaling & vocabulary strategies affect students' attitudes towards whole number place value, multiplication and division?

Question #2:

Will the use of journaling & vocabulary strategies affect students' mathematical performance?

Data were collected from multiple sources that related to students' attitude and performance in order to correlate with the findings. The analyzed data was from pre- and post math assessment, pre- and post attitude survey, student journals, student interviews, and teacher field notes. The process of examining pre- and post survey and math assessments, reading student journals, notes from the interviews, and field notes revealed some pertinent themes from the data. The following themes emerged and will be discussed.

A paired-samples t-test (See Table 1 below) was used to compare the mean scores for the same number of participants (N on two different occasions. Students' attitudes for the pre-attitude survey were labeled as Attitude1 and the students' attitudes for the post-attitude survey were labeled as Attitude2. The means are almost the same (increased 0.14). They had positive attitudes ($M = 41.43 > 33$) initially, and their attitudes remained positive and did not change significantly after the intervention.

Table 1: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Attitude1	41.43	21	9.261	2.021
	Attitude2	41.57	21	10.642	2.322

Upon starting and finishing the research, students completed the pre- and post mathematics assessment that provided data on their mathematics performance related to whole number place value, multiplication, and division. In addition, students completed the pre- and post attitude survey that provided data on their mathematics attitude. Students wrote in their mathematics journals. Feedback was written in student journals as a way to let them know I appreciated their feedback or to clarify and misconceptions. Most responses said, "Thank you for being honest." Responses did not critique student writing or work because I wanted to maintain the risk-free environment that was established at the beginning. The focus was on the "thinking process" rather than the mechanics of writing (see Figure 2). Teacher field notes were also used in the triangulation of attitudinal data. According to students' pre- and post attitude survey and math assessment results select individuals participated in one-on-one interviews with the researcher to gather further attitudinal data. These brief interviews concluded the data collection process. The following section presents an overview of a typical mathematics class period and the data analysis aligned according to research questions used in this action research study.

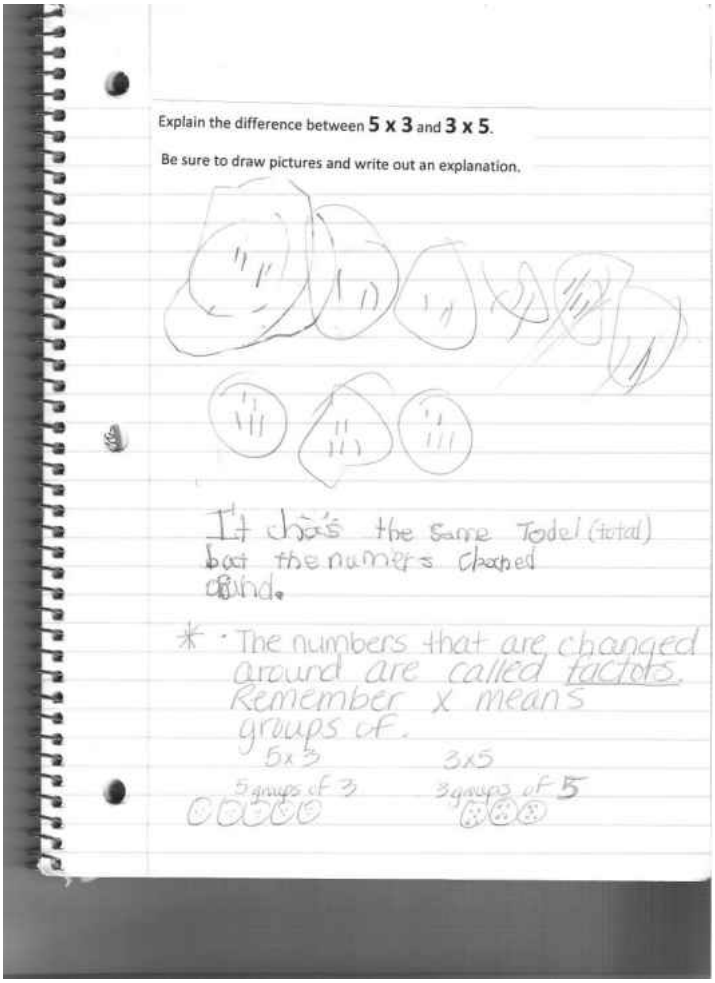


Figure 2: Student Journaling & Teacher Responses

A Typical Mathematics Class

A typical mathematics class period for my fourth grade students involved cooperative groups or independent work using the mathematics journal and vocabulary strategies. The three units taught during the conducted research were whole number place value, multiplication, and division. The first unit, whole number place value, included using and representing numbers

through the millions and finding relationships between numbers. The second unit, multiplication, included constructing and using models, regrouping, recalling basic facts, and multiplying one-digit by two-digit whole number problems. The third unit, division, included constructing and using models, recalling basic facts, and applying inverse operations.

During the lessons and activities, students were allowed to use their mathematics journal and/or vocabulary strategies at any time to assist them during a discussion or activity. The lessons started out by stating the essential question of the lesson then moving into a whole group problem that would include, but not limited to, a discussion. Then, they would end with independent work related to the presented material. On Tuesdays and Thursdays, students would use their mathematics journals to answer mathematics questions pertaining to the subject matter taught or a reflective question to inform the teacher about the students' feelings regarding the subject matter taught. These questions were asked at the end of the mathematics class period. Vocabulary strategies were embedded in a number of lessons, depending upon their presence in the math context. They were also incorporated into some of the journaling time.

Overall, my fourth grade students had limited to no experience with journaling in the mathematics content area. According to my students, they only used journals during the writing block time in past experiences. In that case, journaling was strictly used for them to jot down their answers for the provided prompts. In this case, journaling was a way for students to express their mathematical feelings (positive or negative), mathematical understanding of a particular unit, and receive feedback from their teacher. Since journaling was used in this fashion, I did not provide a model of a journal entry. This was intentional because I did not want my students to

feel obligated to conform to my model. As the use of journals and vocabulary strategies progressed during this study, I became extremely interested in the overall outcome of the students' mathematical performance and their attitude towards mathematics.

Students' Attitude

To analyze students' mathematics attitudes when combining mathematics instruction with journaling and vocabulary strategies, I cross-examined students' journal entries, pre- and post attitude survey, student interviews, and teacher field notes. Cross-examining data sources entitled looking for any similarities for individual participant responses to journal questions, pre- and post survey results, and interview responses, as well as, whole group correlations between data sources. More specifically, I was looking for repetitive responses or words spoken or written by the students. Such as, "math is my favorite subject", "this is fun", "it is sometimes easy", "I do not understand math", "math is hard", and/or "it is boring".

The first question asked to students, "What are your feelings about math? Be specific." was also the very last question asked, When students answered this question the first time 52% (11 out of 21) of the students responded in a positive manner towards mathematics. After reading the comments, of those who had a negative feeling towards mathematics, it was very clear why they did not like mathematics. Most responses were very repetitive among the entries. Some students' responses are as follow:

- Math makes my head hurt.
- Inside I'm sooooo frustrated and angry and say to myself stuff like I HATE math and I can't do this I want to go home but outside I try to keep cool.
- It all depends upon my grade in math.

- It is boring.
- Math is hard.

At the conclusion of the study, students were asked the first question again in their mathematics journal and 57% (12 out of 21) of the students responded in a positive manner towards mathematics. Student 13 said, "I do not like math because it is hard for me to find the (ancer) answer." Like Student 13, Student 4 also felt negative towards math by writing, "I feel like it's VERY hard because sometimes I just can't understand it no matter what I do I just can't let it sink in." On the opposite spectrum, Student 22 said, "It can be fun or might cause a lot of thinking when you are stuck. I only get stuck on some problems, but I'll figure them out." Student 18 wrote, "I feel like I can do math really well because I'm good at multiplication and division." Student 11 shared mixed feelings about math by stating, "Math to me has gotten easier and harder for me along 4^{th} grade. I'm not so fond of the patterns, but I do like multiplication."

A modified Fennema-Sherman Mathematics Attitude Survey was conducted at the beginning and conclusion of the research. The survey was stapled to every students' pre- and post mathematics assessment. Students were instructed to complete the survey after they finished the mathematics assessment. The survey was placed after the mathematics assessment so that the survey results would reflect students' immediate feelings towards whole number place value, multiplication, and division. The 11-item pre- and post attitude survey was written to assess students' mathematics attitude. Items on the survey were answered by a range of responses from strongly agree to strongly disagree. Students recorded their responses on their individual surveys. Once the results were calculated they were transferred to an Excel spreadsheet.

Configuring the students' attitude score required a few steps. First, the researcher identified the total number of points received for each statement. Positive statements (numbers 1, 4, 7, 9, 10, 11) received 5 points for A, 4 points for B, 3 points for C, 2 points for D, and 1 point for E. Negative statements (numbers 2, 3, 4, 5, 6, 8) received 1 point for A, 2 points for B, 3 points for C, 4 points for D, and 5 points for E. Then, the total points were added. The total score was located on the score range key, which also identified if the students' attitude was positive, neutral, or negative. The following score range was used to identify if the students had a positive, neutral, or negative mathematics attitude, $55 \geq x > 33$ (positive), $33 = x$ (neutral), and $33 > X \leq 11$ (negative).

Pre-Survey Results

On the pre-survey, 76% (16 out of 21) of the students surveyed had a positive attitude towards mathematics, 4% (1 out of 21) of the students had a neutral attitude, and 19% (4 out of 21) students surveyed had a negative attitude towards mathematics. Figure 3 represents the scores from the pre- attitude survey.

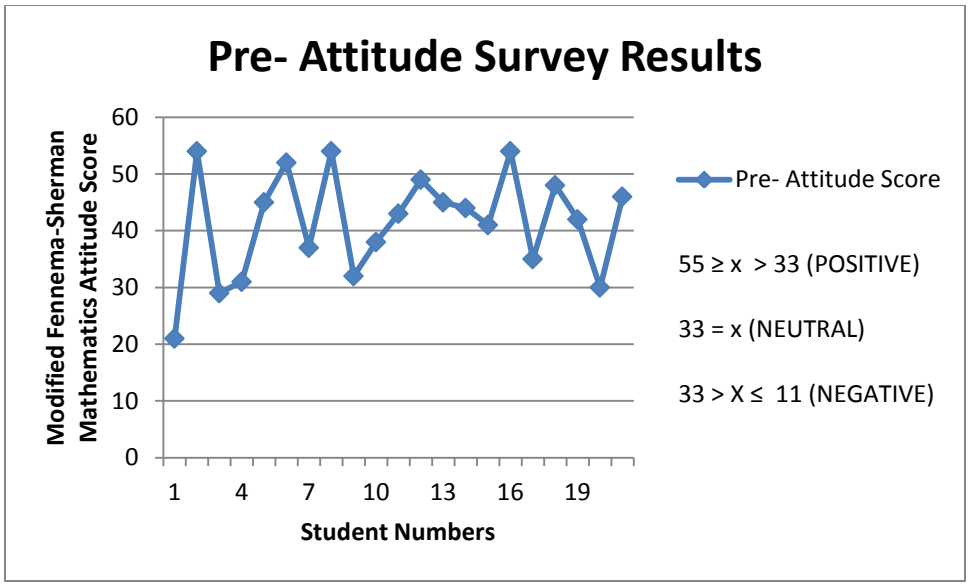


Figure 3: Pre- Attitude Survey Results

Further analysis of the pre-attitude survey, student journals, and teacher field notes, at the beginning indicated that Student 1 and 3 had the most negative attitudes in our classroom about mathematics. Student 1 often commented, "I don't like math because it is hard. I'm not confident in math because I'm not good at it [math]." In contrast, Students 2, 6, 8, and 16 had the most positive attitudes in our classroom about mathematics. According to the journal responses of Student 2, "Math is my favorite subject. If I don't understand something I ask for help." The most negative and most positive students were consistent in their journal responses about how they felt about mathematics.

Post Survey Results

On the post-survey, 81% (17 out of 21) of the students surveyed had a positive attitude towards mathematics, and 19% (4 out of 21) students surveyed had a negative attitude towards mathematics. Figure 4 represents the scores from the post attitude survey.

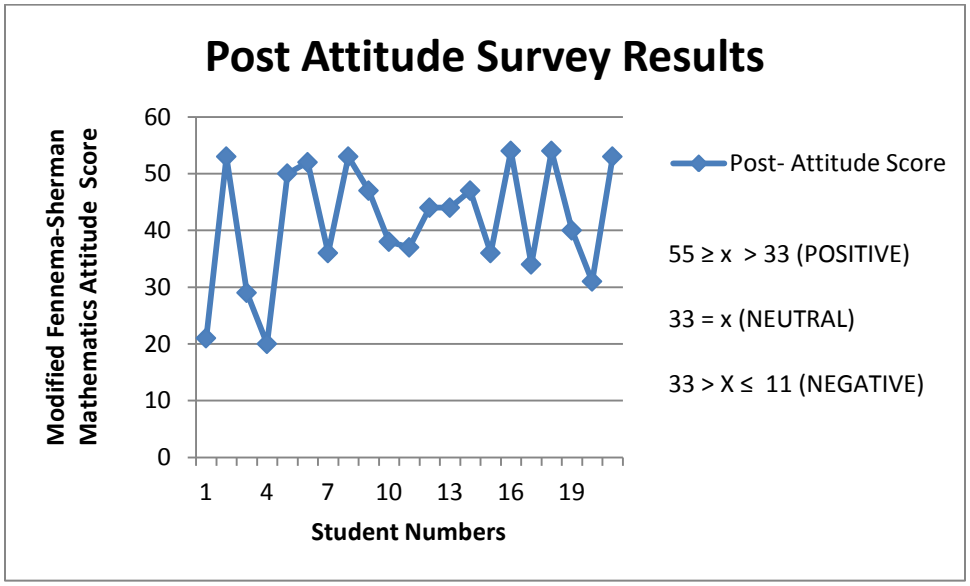


Figure 4: Post Attitude Survey Results

Further analysis of the post attitude survey, student journals, and teacher field notes, at the conclusion of the study indicated that Student 1 and 4 had the most negative attitudes about mathematics. Student 4 often commented, "I get confused. My parents sometimes don't

understand it so I can't get help at home." In contrast, Students 2, 8, 16, 18, and 22 had the most positive attitudes about mathematics. According to the journal responses of Student 18, "I feel like I can do math well because I am good at multiplication, division, and drawing the pictures." The most positive students were consistent in their journal responses about how they felt about mathematics.

Pre- and Post Survey Analysis

The purpose of the pre- and post attitude survey, used within this study, was to measure changes in students' mathematics attitude based on the use of journaling and vocabulary strategies in the mathematics instruction specific to whole number place value, multiplication, and division. The pre- attitude survey was administered at the beginning of the study, journaling and vocabulary strategies were embedded into the mathematics instruction for nine weeks and the post attitude survey was administered once more at the end of the study to measure a change in students' mathematics attitudes. After cross-examining the pre- and post attitude survey, more data was accumulated to discuss students' attitudes towards mathematics. 29 % (6 out of 21) of the students surveyed showed an increase in their score which indicates a more positive attitude towards mathematics. 47% (10 of the 21) of the students surveyed showed a decrease in their score which indicates a more negative or not as high of a positive attitude towards mathematics. 24 % (5 out of 21) of the students surveyed showed a consistent score which indicates their attitude towards mathematics stayed positive or negative. The results of the pre- and post attitude surveys are overlapped in Figure 5.

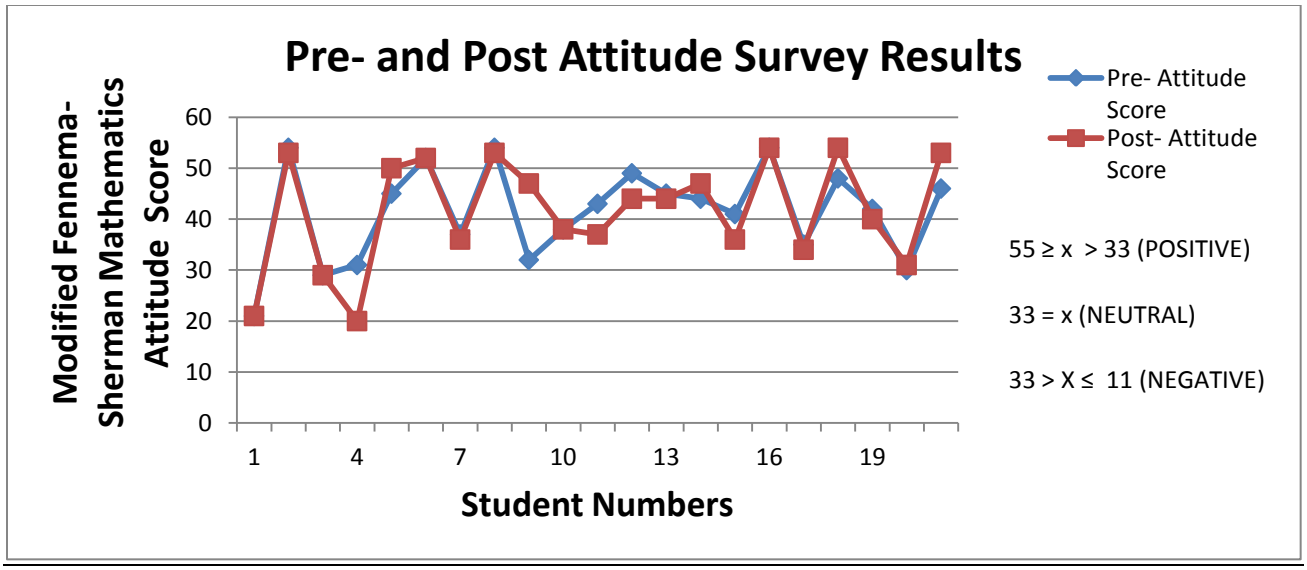


Figure 5: Pre- and Post Attitude Survey Results

Further cross-examination of the pre-and post survey responses resulted in individual student interviews. When students were interviewed, they were read the statement again and their pre- and post responses were shared with them. Then each interviewee was asked five questions (See Appendix J). Students were reminded that their response would not get them in trouble or affect their grade. I indicated I would be recording their responses in my notebook while they answered. Four of the eleven statements had significant student response changes. Three of those four statements were positive statements.

For statement 4, "I am sure of myself when I do math", 38 % (8 out of 21) of the students changed their response. All of the changes in response indicated a decrease in students' attitude towards mathematics. From the 8 students, 75% (6 out of 8) of the students changed their

response by decreasing one point (A to B or B to C). The other 2 students who had a larger decrease in their response both stated that multiplication was hard and it got harder as we went through the chapters.

For statement 6, “Math has been my worst subject”, 33 % (7 out of 21) of the students changed their response. The change in response indicated both a decrease and increase in students’ attitude. From the 7 students, 86% (6 out of 7) of the students changed their response to indicate a more positive response. The overall reason for why they felt more confident and positive towards mathematics was related to journaling. Student 1 stated, “Journaling helped me, it made me be able to remember the math stuff. It was getting easier, but was still hard.”

For statement 10, “I know I can do well in math”, 33 % (7 out of 21) of the students changed their response. The change in response indicated a decrease in students’ attitude. From the 7 students, 71% (5 out of 7) of the students changed their response by decreasing one point (A to B or B to C). The other 2 students who had a larger decrease in their response both stated that they were getting bad grades and they didn’t think they could do well in math.

For statement 11, “I am sure I could do advanced work in math”, 38 % (8 out of 21) of the students changed their response. All of the changes in response indicated a decrease in students’ attitude towards mathematics. From the 8 students, 75% (6 out of 8) of the students changed their response by decreasing one point (A to B or B to C). The other 2 students, whose responses changed by 2 or 3 points, had similar comments. These students indicated that multiplication was hard and math got harder as we went through the chapters.

One theme emerged after I interviewed students. Based on data analysis from the pre- and post attitude survey results, the journaling and vocabulary strategies were helpful, but ultimately if students did not know their multiplication facts it resulted in students finding mathematics to be hard and eventually having a negative attitudes towards mathematics.

Students' Performance

Data collected on the students' performance was from the *Go Math: Big Idea Benchmark Assessment 1A*. This assessment covered chapters 1, 2, and 3 in the Go Math series. The three chapters covered content about whole number place value, multiplication, and division. Students had 60 minutes to answer 25 questions. Two types of questions, multiple choice (22 of the questions) and on your own (3 of the questions). Before the pre- and post assessment was handed out, students received privacy folders which were set up in between desks to block out neighbors' papers. Students were also informed that this assessment was not graded and to try their best. Students recorded their responses on their individual assessments. The results were calculated to find a percent and transferred to an Excel spreadsheet.

Pre-Assessment Results

On the pre- math assessment, 38% (8 out of 21) of the students had a passing score (70% or higher), and 62% (13 out of 21) of the students scored below a 70%. Figure 6 represents the scores from the pre- math assessment.

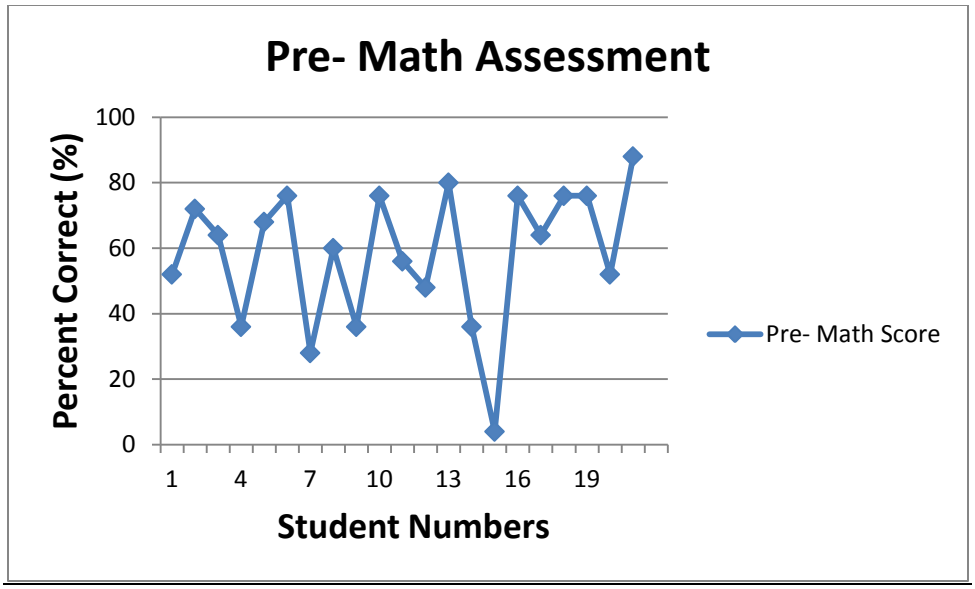


Figure 6: Pre Math Assessment

Further analysis of the pre- math assessment, student journals, and teacher field notes, at the beginning of the study indicated that Student 7 and 15 received the lowest percent on their assessment. Teacher field notes indicated that when these students worked independently they generally had similar statements, "I don't understand." when they needed help. In their math journals they responded with a little bit more specific direction in order to explain their frustration such as, "The variables confuse me in this problem." In contrast, Students 13 and 22 received the highest percent on their assessment. In their math journals, they both had similar responses regarding the vocabulary strategies for the KIM chart and personal word wall. The KIM chart was helpful when trying to remember the definition of the words (see Figure 7), but the personal word wall was not helpful. Despite their drastic scores on the pre- math assessment,

all 4 students had a positive attitude towards mathematics on their pre- attitude survey which they took after this pre- math assessment.

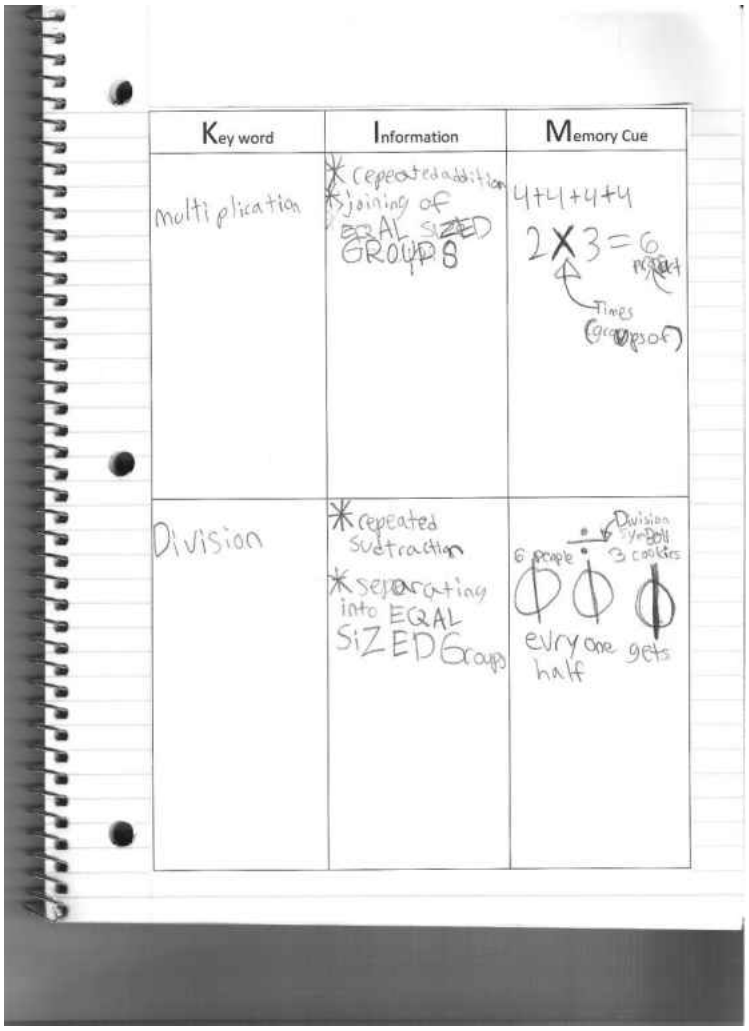


Figure 7: Student example of the K.I.M. Chart

Post-Assessment Results

On the post- math assessment, 67% (14 out of 21) of the students had a passing score (70% or higher), and 33% (7 out of 21) of the students scored below a 70%. Figure 8 represents the scores from the post- math assessment.

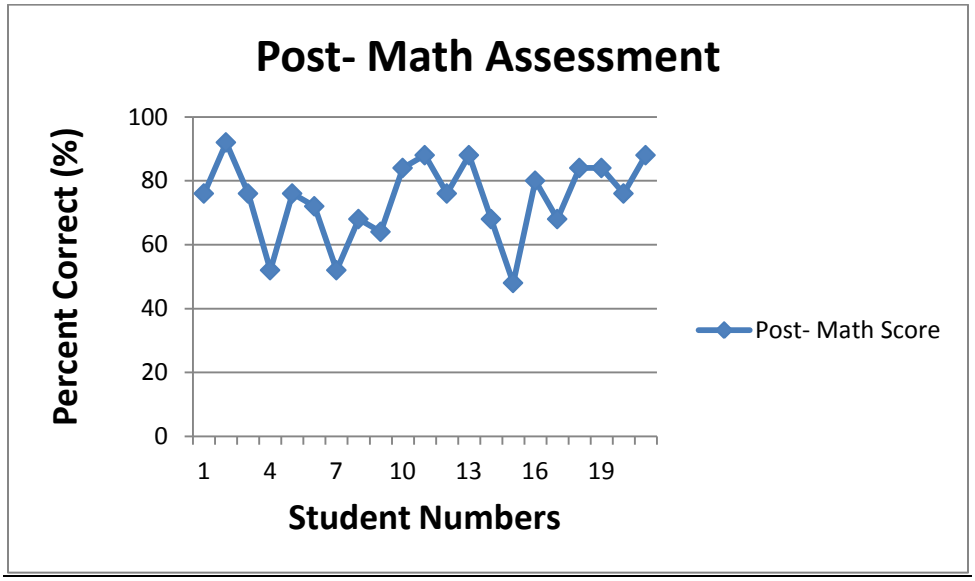


Figure 8: Post Math Assessment

Further analysis of the post math assessment, student journals, and teacher field notes, at the end of the study indicated that Student 4, 7 and 15 received the lowest percent on their assessment. Student journals indicated that all 3 of the students found the mathematics journal

and vocabulary strategies to be helpful resources. Student 7 wrote, “I like the journal because I get to show what I use in math and on the KIM chart I can use it to help me know what the word means.” In contrast, Student 2, 11, 13 and 22 received the highest percent on their assessment. They too found the journal and vocabulary strategies to be helpful resources. Student 11 wrote, “The KIM Chart makes it easy to find what the meaning of the specific math term.” Despite their drastic scores on the post- math assessment, 86% (6 out of the 7) students had a positive attitude towards mathematics on their post attitude survey which they took after this post math assessment.

Pre- and Post Assessment Analysis

The purpose of the pre- and post mathematical assessment, used within this study, was to measure changes in students’ mathematics abilities based on the use of journaling and vocabulary strategies in the mathematics instruction specific to whole number place value, multiplication, and division. The pre- mathematical assessment was administered at the beginning of the study, journaling and vocabulary strategies were embedded into the mathematics instruction for nine weeks and the post mathematical assessment was administered once more at the end of the study to measure a change in students’ mathematics abilities. After cross-examining the pre- and post mathematical assessment more data was accumulated to discuss students’ mathematics abilities, 90% (19 out of 21) of the students showed an increase, 5% (1 of the 21) of the students was consistent, and 5 % (1 of the 21) of the students showed a decrease. The results of the pre- and post attitude surveys are overlapped in Figure 9.

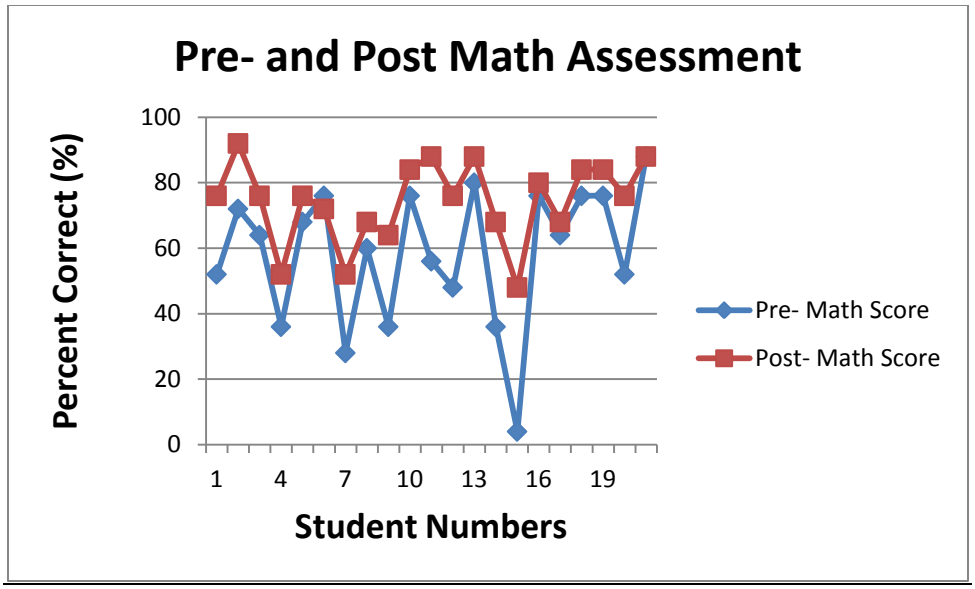


Figure 9: Pre- and Post Math Assessment

Further cross- examination of the pre-and post math assessment percentages resulted in individual student interviews. When students were interviewed they were read the statement again and their pre- and post responses were shared with them. Then each interviewee was asked 5 questions (See Appendix J). Students were reminded that their response would not affect their grade and that I would be recording their responses in my notebook while they answered. If students received a score lower than 70% (not a passing score) on their pre- math assessment and then increased their score to a passing score (70% or higher) on their post math assessment they were further interviewed. This was 29% (6 out of 21) of the students assessed. Zero percent of the students dropped from a passing score on their pre- math assessment to a non-passing score

on their post math assessment. Student 15 was also interviewed due to the significant increase in percent, 4% to 48%.

After interviewing the students who increased their score from a non-passing score to a passing score, I heard some of the same comments about their feelings towards mathematics. Most responses were very repetitive amongst the entries. Some students' responses were as follows:

- I'm confidente (confident) about math.
- Math to me has gotten easier and harder for me along 4th grade.
- I can learn a lot from it [math].
- I don't like math because I always getting F or D. I can never get an A or B on an actual test.

These mixed comments showed me how math attitudes varied from student to student. Upon hearing how they felt about mathematics, I was also interested in their comments regarding their feelings towards the vocabulary strategies that were embedded into the lessons. Since all of the students interviewed increased their score and showed a passing score, I was curious if they found the vocabulary strategies helpful during lessons. Some students' responses are as follow:

- Sometimes they [vocabulary strategies] are good to use.
- The KIM Chart helped me the most because it helped me know what something means.
- The math dictionary in our journal was helpful to look back at the definitions.
- The KIM Chart was the most helpful because once you did it got stuck inside your head. It was fun too!

Despite the diversity of students' feelings towards math, I was surprised to find that the students I interviewed had similar feelings about the vocabulary strategies we used during our

lessons. They found the vocabulary strategy of the KIM Chart to be the most helpful vocabulary strategy that we used during the research study.

Analysis of data revealed a couple of themes about students' mathematics attitudes while embedding journaling and vocabulary strategies in the mathematics content area. The first theme emerged was that using student journals and vocabulary strategies continued to maintain positive student attitudes. Student responses in their journals indicated that they liked using the journal and vocabulary strategies while learning mathematics. A few of the comments were as follows:

- It [vocabulary strategies] makes everything easier to understand.
- KIM Chart was most helpful because it got stuck in your head.
- It [journaling] made me be able to remember the math stuff. It was getting easier, but was still hard.

After cross-examining the student journals, student interviews, and teacher field notes the second theme became apparent. The second, and final theme emerged was students' negative attitudes towards mathematics was related towards the feeling that math was getting harder and not knowing basic multiplication facts. One particular student cried a few times when interviewed. Others stated comments such as the following:

- Math got harder because I don't know my multiplication facts.
- Multiplication was tricky.
- I kinda knew my multiplication facts, but then forgot them. Work was harder because I needed to know my facts.
- Multiplication was the hardest part.

The themes that emerged from this research study raise some interest in what needs to take place in the immediate future. In chapter five a further discussion regarding what action occurs after this research study and the relevant themes that emerged are addressed.

Summary

The purpose of this study was to examine if journaling and vocabulary strategies affected students' attitudes towards whole number place value, multiplication, and division. Interpreting the data from students' mathematical journal responses, student interviews, teacher field notes, pre- and post attitude surveys, and pre- and post mathematical assessments revealed these fourth grade students had maintained their attitude towards mathematics while they improved their mathematical understanding. Journal writing and vocabulary strategies had little effect on students' attitude towards mathematics. Students showed improvements on their mathematical performance while using journaling and vocabulary strategies.

CHAPTER FIVE: CONCLUSION

Introduction

The objective of this study was to determine if implementing journaling and vocabulary strategies into the mathematics content area would affect students' attitudes towards whole number place value, multiplication, and division. Students who are in classrooms that promote meaningful strategies will in turn use these strategies and construct them independently (Carpenter, Fennema, Franke, Levi, & Empson, 1999). During the research, a variety of data were collected to measure students' overall mathematics attitude, using a modified Fennema-Sherman Mathematics pre- and post Attitude Scale, student journals, student interviews, and teacher field notes. Data to evaluate students' mathematics academic performance was collected with the Big Idea Benchmark pre- and post Assessment 1A from the GO Math Houghton Mifflin Harcourt Series.

All pieces of data, including pre- and post math assessment, pre- and post attitude survey, teacher field notes, and student journals, were recorded and analyzed to show the affect that journals and vocabulary strategies had on students' attitudes towards whole number place value, multiplication, and division. Overall, the students in my fourth grade classroom showed an increase in their attitude and mathematical performance with the inclusion of journaling and vocabulary strategies within the mathematics content area. Conclusions regarding the research questions, emergent themes, limitations, and recommendations are discussed below.

Conclusions

The action research conducted in my fourth grade classroom embedded journaling and vocabulary strategies within the mathematics content area during a nine-week time frame. Students' journals provided an insight into how they really felt and what they were thinking during the mathematics lessons and activities. Reading the journals allowed me to identify students who were struggling or were not being challenged with the material presented in the classroom. Over the course of the nine weeks, students were reminded frequently to be honest and specific when writing in their journals. It was important for some students to know that their grades would not suffer due to their reflections or responses in their journals. While students were journaling in the classroom, it was important to create an open-minded and positive atmosphere in order to accumulate accurate testimonies regarding how they felt towards mathematics. Journaling allowed my students the chance to reflect on their learning process (see Figure 10). Reflection helps students install learning more fully in their minds, places it in a larger context, and asks them to value it more deeply (Daniels, Zemelman, & Steineke, 2007).

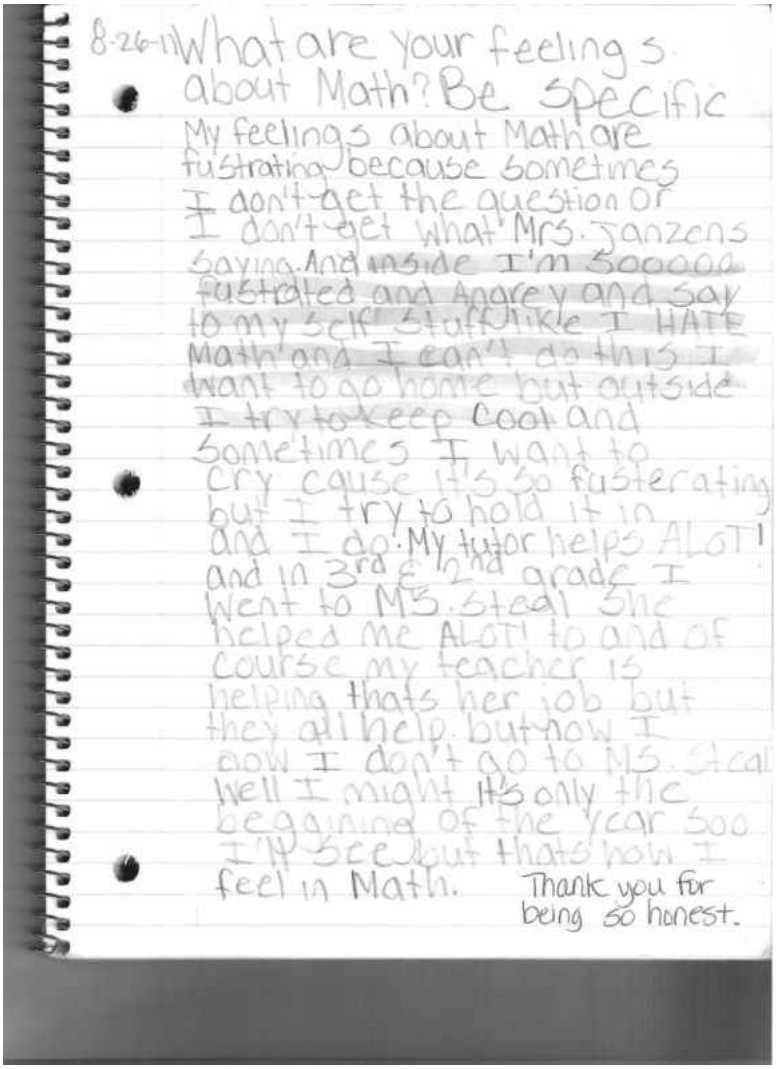


Figure 10: Example of student journal response

After reviewing the collected data further, I cross- examined the pre-and post survey responses to distinguish individual students to interview. Speaking individually with the students provided me with more of an understanding of why some of their responses changed from the beginning of the study to the end. I discovered that once students realized they could openly

share their feelings and frustrations with me without being categorized by a letter grade, they shared their true emotions. This insight allowed me to alter my teaching practices in order to fit the needs of my students.

The first research question was "Will the use of journaling & vocabulary strategies affect students' attitudes towards whole number place value, multiplication and division?" The second research question was "Will the use of journaling & vocabulary strategies affect students' mathematical performance?" Both research questions used the modified Fennema-Sherman Mathematics Attitude Scale to measure students' attitudes towards mathematics.

The modified Fennema-Sherman Mathematics Attitude Scale was administered at the beginning (pre-survey) and end (post-survey) of the research. After cross-examining the pre- and post attitude surveys more data were accumulated to discuss students' attitudes towards mathematics. Of the 21 students who took the pre- and post attitude survey, 29 % (6 out of 21) of the students showed an increase in their score which indicates a more positive attitude towards mathematics, 47% (10 of the 21) of the students showed a decrease in their score which indicates a more negative or not as high of a positive attitude towards mathematics, and 24 % (5 out of 21) of the students showed a consistent score which indicates their attitude towards mathematics stayed positive or negative. The pre- and post attitude surveys were further examined by splitting the negative and positive statements for each student and totaling the results of increases for negative and positive comments. Data revealed that 57% (12 out of 21) of the students showed students' mathematical attitudes improved from the pre- attitude survey compared with their post attitude survey for the negative statements. Positive statements increased indicated that 43% (9

out of 21) of the students showed students' mathematical attitudes improved from the pre-attitude survey compared with their post attitude survey for the positive statements. Overall, students had positive attitudes initially, and their attitudes remained positive and did not change significantly after the intervention. Several researchers have shown that a student's attitude towards mathematics is associated with his or her achievement in the subject (Fonseca, 2007; Hannula, 2002).

Hence, both research questions used performance data to further investigate if the result of journaling and vocabulary strategies had any affect on student attitudes towards mathematics. The math assessment used was the Big Idea Benchmark Assessment 1A from the GO Math Houghton Mifflin Harcourt Series. This assessment covered chapters 1, 2, and 3 in the Go Math series. The three chapters covered content about whole number place value, multiplication, and division. Students were assessed at the beginning (pre- assessment) and end (post assessment) of the study. After reviewing the pre- and post assessments, 90% (19 out of 21) of the students showed an increase, 5% (1 of the 21) of the students was consistent, and 5 % (1 of the 21) of the students showed a decrease. Data support that with the slight overall increase in students' attitudes and embedding journaling and vocabulary strategies in the mathematics content area, a larger increase occurred in students' overall mathematical performance.

Student interviews were conducted to further examine changes in their responses. The theme that emerged after I interviewed students, based off of the data analysis from the pre- and post attitude survey results, was that the journaling and vocabulary strategies were helpful, but ultimately if students did not know their multiplication facts it resulted in students finding

mathematics to be hard and eventually demonstrating a negative attitude towards mathematics. This prominent theme was a bit frightening especially since mathematics is a continuous uphill spiral that builds upon previous content. Students in fifth grade, sixth grade, and so on would need to know their multiplication facts. If students were showing signs of a negative attitude in fourth grade because of multiplication, then there would be a strong possibility this would linger on if there was no immediate action pursued.

During this study, data revealed an increase in students' mathematical performance during the inclusion of journaling and vocabulary strategies. These results, with the ability to have honest and specific student reflections, has encouraged me to continue using the journals and vocabulary strategies in my mathematics content area. Students' honest journal responses allowed me to provide immediate feedback and at times, allowed me to make immediate changes to the way I presented material or introduced a strategy. Balancing teaching and strategies can be helpful to teach mathematics lessons in a meaningful way where learning takes place (Belbase, 2010).

Limitations

There were limitations to this study that affected the correlation of the findings to other classrooms. One limitation was the student sample size. The target population of all fourth grade students was condensed to an obtainable population of fourth grade students assigned to the teacher researcher's fourth grade classroom in Winter Springs, Florida. This student sample size was comprised of 21 students. Another limitation was the students' participation in every journal writing session and vocabulary strategy activity used in this study. Students were absent on

occasion, pulled out for individualized educational programs, and/or inconsistent in participating in journaling, activities, and lessons, which effected the consistency of the data. Students were not required to make up the assigned journal questions following an absence. A final limitation of this action research study was the length of time this research took place. Students participated in this study starting on the second week of school and continuing nine full weeks. The short amount of time did not provide ample opportunity for students to fully take control over the journaling or vocabulary strategies presented during this study.

Recommendations

Upon finishing this action research study, a further need to research students' attitudes towards whole number place value, multiplication, and division while embedding journaling and vocabulary strategies is evident. I recommend choosing either journaling or vocabulary strategies when researching to see if they have an impact on students' attitudes toward mathematics. By narrowing your choices down to one option, it allows for a deeper and more thorough study to occur.

This action research study narrowed the broad field of mathematics down to whole number place value, multiplication, and division. Using these specific math strands, another recommendation would be to survey the students' attitudes during each specific math area. Frequent attitude surveys would help to target students' attitudes relating specifically to that math strand. For instance, after each chapter mid-point assessment teachers could give students the attitude survey. The data collected from this mid-point attitude surveys could help to strategically group or differentiate instruction for the remaining portion of the content.

Considering my fourth grade students had limited to no experience with journaling in the mathematics content area it was really important that I set a few guidelines for their journals. The following guidelines are recommended when using reflective journaling with elementary students. Remind them frequently of these guidelines so they become familiar with them. One of the most important guidelines I told my students was that they needed to be honest and they would not get in trouble with their answers. Remember to also inform students that grades will not be taken on their journals. Since the reflective journaling was a way for students to express their mathematical feelings (positive or negative), mathematical understanding of a particular unit, and receive feedback I did not provide a model of a journal entry. This was intentional because I did not want my students to feel obligated to conform to my model.

Discussion

Speer (1997) accentuates, "Children do not learn by doing….They learn by thinking, discussing, and reflecting on what they have done" (NCSM, II-H-16). During my research, I was able to incorporate journaling and vocabulary strategies into my mathematics content area to measure if they affected students' attitudes towards whole number place value, multiplication, and division. By incorporating these tools [journaling and vocabulary strategies] into the mathematics content area students were able to maintain positive attitudes towards mathematics.

This action research study provided me the opportunity to experience how valuable teachers are when creating a positive learning experience. Using student journals in the mathematics content area also emphasized how important it is for students to learn how to communicate (with their peers or teacher) and take charge of their learning process. Stenmark

(1986) believed that the capability and willingness of students to assess their own progress and learning is one of the greatest gifts students can develop. He also believed that mathematical power comes with knowing how much we know and what to do to learn more.

The outcome of my action research study has piqued my curiosity to further embed journaling in the future. Instead of focusing on just three of the strands (whole number place value, multiplication, and division) when journaling, I believe the impact on utilizing journaling for the rest of the math strands will benefit not only me as the teacher, but also support the students' growth in communicating mathematically effectively. I learned that students communicate openly when they know that you [the teacher] will only read their reflections (not to the whole class) and will not assign a grade to them.

The vocabulary strategies used throughout the study functioned as a bridge to help create connections and mathematical number sense for students. Although the vocabulary terms were more scarce in some chapters than others, the strategies allowed the students the ability to evaluate their mathematical understanding of the term(s). The use of the KIM (Key word, Information, Memory Clue) Chart captured the majority of the students' interest. The structured graphic organizer allowed the students to think on their own when developing the "M" (memory clue) of the chart. Students enjoyed connecting the term with something they would remember it by, either a picture, word, or even a number sentence.

The inclusion of journaling and vocabulary strategies in the mathematics content area verified the use of reflection as a tool to maintain positive student attitudes towards whole number place value, multiplication, and division in my fourth grade classroom. When other

teachers read this research, hopefully they will find these strategies easy to incorporate within their mathematics classroom. The capabilities of what journaling and vocabulary strategies can do for your students are endless. This action research has been a reflective process for me. It has heightened my awareness of the importance of student accountability. When students are making sense of their work and reflecting on it, they are learning and gaining new knowledge. I believe that I am a better teacher and will continue to strive to enhance my teaching practices, so that I may meet the needs of all of my students.

APPENDIX A:
IRB APPROVAL

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Renee M.R. Janzen**

Date: **August 12, 2011**

Dear Researcher:

On 8/12/2011, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Making Sense of Number Sense & Students' Attitudes Towards Mathematics
Investigator:	Renee M.R. Janzen
IRB Number:	SBE-11-07800
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Kendra Dimond Campbell, MA, JD, UCF IRB Interim Chair, this letter is signed by:

Signature applied by Joanne Muratori on 08/12/2011 10:48:58 AM EDT

IRB Coordinator

APPENDIX B:
SEMINOLE COUNTY APPROVAL

SEMINOLE COUNTY
PUBLIC SCHOOLS

BILL VOGEL, Ed.D.
Superintendent

Educational Support Center
400 E. Lake Mary Boulevard
Sanford, Florida 32773-7127

July 28, 2011

Ms. Renee M. R. Janzen
Layer Elementary
4201 SR 419
Winter Springs, FL 32708

Dear Ms. Janzen,

I am in receipt of the proposal and supplemental information that you submitted for permission to conduct research in the Seminole County Public Schools. After review of these documents, it has been determined that you are granted permission to conduct the study described in these documents under the conditions described herein.

Your school principal has the authority to decide if he wishes to participate in your study. Therefore, please contact Ms. Staats and explain your project and seek permission to conduct the research. You are expected to make appointments in advance to accommodate the administration and/or staff for research time. Please do not use SCPS email or courier mail to disseminate your research information.

Please forward a summary of your project to my office upon completion.
Good Luck!

Sincerely,

Anna-Marie Cote

Anna-Marie Cote, Ed.D.
Deputy Superintendent
Instructional Excellence and Equity

AMC/jr
cc: Gloria Staats

Visit Our Web Site
www.scps.k12.fl.us

APPENDIX C:
PRINCIPAL APPROVAL LETTER

Layer
Elementary School

4201 S.R. 419
Winter Springs, FL 32708
Phone: 407-871-8050
Fax: 407-871-8099

July 13, 2011

Instructional Review Board
University of Central Florida

To Whom It May Concern:

I am presenting this letter to you as notification of my receipt of the proposal prepared for you by Renee Janzen. Having observed the instructional practice of this teacher over the last few years, I am very comfortable making a recommendation that this proposal be approved by your Board since I know she strives for excellence.

The title of her investigation is "Making Sense of Number Sense & Students' Attitudes towards Mathematics." The topic will investigate the use of journaling and vocabulary strategies affecting students' attitudes towards whole number place value, multiplication and division. It is my understanding her research will be conducted over a nine week period at Layer Elementary in her classroom after she receives permission from the parents of her students allowing their participation. The details of the proposal seem to be very thorough.

If I can be of any further assistance in the consideration of this topic for Renee's thesis, please feel free to contact me.

Respectfully,
Gloria R. Staats
Gloria R. Staats

SEMINOLE COUNTY
PUBLIC SCHOOLS

Visit Our Web Site
www.scps.k12.fl.us

APPENDIX D:
MATH APPROVAL

HOUGHTON MIFFLIN HARCOURT

9400 South Park Center Loop
Orlando, Florida 32819
August 2, 2011

Ms. Renee Janzen
Layer Elementary
4201 State Road 419
Winter Springs, FL 32708-2629

Dear Ms. Janzen:

Thank you for your inquiry dated July 26, requesting permission to include Big Idea Benchmark Assessment 1A, pages 85-94 from *GO MATH!*, Florida, Grade 4, Assessment Guide in your research for your master's thesis titled "Does/Will the use of journaling and vocabulary strategies affect students' attitudes towards whole number place value, multiplication, and division?" for submission to University of Central Florida website.

We are pleased to grant your request on a one-time, nonexclusive, and nontransferable basis as stated, provided that you agree not to portray our copyrighted material in a negative manner, and that no deletions from, additions to, or changes in the material will be made without prior written approval of Houghton Mifflin Harcourt Publishing Company. This license only applies to use of our copyrighted material specified above as examples in your dissertation, and does not authorize mechanical or electronic reproduction in any form. Permission granted herein is limited to material owned by Houghton Mifflin Harcourt Publishing Company.

Any copies produced of your dissertation will be distributed on a gratis basis. Should you wish to formally publish your dissertation, please re-apply to Houghton Mifflin Harcourt Publishing Company for authorization to include our content prior to publication, and include a copy of this grant of permission. All rights not specifically mentioned herein are reserved to Houghton Mifflin Harcourt Publishing Company.

The following credit line must be included in each copy of your dissertation on the page in which the material appears:

> From *GO MATH!,* Florida, Assessment Guide, Grade 4. Copyright © by Houghton Mifflin Harcourt Publishing Company. All rights reserved. Included by permission of the publisher.

Thank you for your interest in our publications.

Sincerely,

Mary Rodriguez

Mary Rodriguez
Contracts Associate

APPENDIX E:
ATTITUDE SURVEY APPROVAL

Print Close

RE: Permission to Modify/Use the Fennema-Sherman Attitude Scale

From: **Webmaster** (webmaster@woodrow.org)
Sent: Thu 7/21/11 3:50 PM
To: Renee Janzen (reneejanzen424@knights.ucf.edu)

Dear Ms. Janzen,

Thank you for your email regarding your wish to use the modified Fennema-Sherman Attitude Scale found at http://www.woodrow.org/teachers/math/gender/08scale.html.

This modified scale was produced by a group of K-12 teachers taking part in a 1993 professional development institute hosted by the Woodrow Wilson National Fellowship Foundation. Please therefore be sure to attribute the scale to Diana Doepken, Ellen Lawsky, and Linda Padwa, as posted at the URL above by the Woodrow Wilson National Fellowship Foundation, 1993; please also clearly indicate that your survey has been adapted from this model.

Finally, please bear in mind that no commercial publication or use is permitted, and that full responsibility for completeness, accuracy, and appropriate citations rests with the team who prepared these materials for the Leadership Program for Teachers.

Sincerely,

Antoinette Marrero

==========

Antoinette Marrero
Webmaster

The Woodrow Wilson National Fellowship Foundation
street address: 5 Vaughn Drive, Suite 300 | Princeton, NJ 08540
mailing address: P.O. Box 5281 | Princeton, NJ 08543-5281
telephone: 609-452-7007 x131 | fax: 609-452-0066
www.woodrow.org

Follow the Foundation:

Save a tree.
Please don't print this e-mail unless it's necessary.

==========

From: Renee Janzen [mailto:reneejanzen424@knights.ucf.edu]
Sent: Monday, July 18, 2011 8:59 PM
To: Webmaster
Subject: Permission to Modify/Use the Fennema-Sherman Attitude Scale

To Whom It May Concern-

My name is Renee Janzen. I am currently a graduate student at the University of Central Florida working on my masters in K-8 Mathematics & Science. Upon completion in the program I am working on an action research thesis. My research question is "Does/Will the use of journaling and vocabulary strategies affect students' attitudes towards whole number place value, multiplication and division?" The attitude scale that I located was a Modified Fennema-Sherman Attitude Scales found on your website: http://www.woodrow.org/teachers/math/gender/08scale.html. I have further modified the survey (see attached). With your permission I would like to use this modified scale I have attached as a pre and post attitude scale during my research. In addition, I would like permission to publish my modified version in my thesis.

I look forward to hearing from you.

Sincerely,
Renee Janzen

APPENDIX F:
PARENTAL CONSENT FORM

PARENTAL CONSENT FORM

The information provided on this form is presented to you in order to fulfill legal and ethical requirements for The University of Central Florida (UCF) and the Department of Health and Human Services (HHS) regulations for the Protection of Human Research Subjects.

The dissertation committee at UCF, the Research Review Committee of Seminole County Public Schools, and our Principal, Mrs. Staats, have all given approval to conduct this study, "Making Sense of Number Sense & Students' Attitudes Towards Mathematics." The purpose of this study is to determine if/will journaling and vocabulary strategies affect students' attitudes towards whole number place value, multiplication and division (concepts in Go Math Big Idea 1).

Your child will be involved in this study by way of the following:

1. Pretest on their attitude towards math.
2. Pretest on Math Big Idea 1.
3. Journaling/Vocabulary Strategies over the course of the study.
4. Posttest on their attitude towards math.
5. Posttest on Math Big Idea 1.

This process will take place over the course of the first nine weeks. There are no foreseeable risks to the students involved. In addition, the parent or researcher may remove the student from the study at any time with just cause. Specific information about individual students will be kept *strictly confidential* and will be obtainable from the teacher if desired. The results that are published publicly will not reference any individual students since the study will only analyze relationships among groups of data.

The purpose of this form is to allow your child to participate in the study, and to allow the researcher, Mrs. Janzen, to use the information already available at the school or information obtained from the actual study to analyze the outcome of the study. Parental consent for this research study is strictly voluntary without undue influence or penalty. The parent signature below also assumes that the child understands and agrees to participate cooperatively.

If you have any additional questions regarding the study, the rights of subjects, or potential problems, please call the researcher, Mrs. Janzen, at 407-871-8012 or email her at renee_janzen@scps.k12.fl.us

_____ _____ _____

Student's Name Signature of Parent/Guardian Date

APPENDIX G:
BIG IDEA BENCHMARK ASSESSMENT 1A

Name _____

Big Idea Benchmark Assessment 1A

Use the space on the page to do your work. Then mark the answer you have chosen. If you change your answer, be sure to erase completely.

1 The United States saw a decrease of 13,000 in the number of farms from 2006 to 2007. In 2007, there were 2,076,000 farms. What digit is in the ten thousands place in the number of farms the United States had in 2006?

Ⓐ 6
Ⓑ 7
Ⓒ 8
Ⓓ 9

2 The softball team held a car wash to raise money for new equipment. Only 6 girls from the team were able to wash cars. By the end of the car wash, each girl had washed 8 cars.

Which of the following could be used to find how many cars the team washed all together?

Ⓕ $6 + 8$
Ⓖ 6×8
Ⓗ $8 - 6$
Ⓘ $8 \div 6$

3 Jay has 5 packs of markers. Each pack has 4 different-color markers. He takes one marker out of each pack. Which expression shows this situation?

Ⓐ $(5 \times 4) + 5$
Ⓑ $(5 \times 5) - 4$
Ⓒ $(5 \times 4) - 5$
Ⓓ $(5 \times 4) \times 5$

4 Rita has 35 gold beads to use to make bracelets. She uses 7 gold beads for each bracelet. How many bracelets can she make?

Ⓕ 5
Ⓖ 7
Ⓗ 28
Ⓘ 42

5 Randy has 24 stickers. He gives each of his 4 friends 6 stickers.

Which of the following belongs to the same fact family as $24 \div 4 = 6$?

Ⓐ $24 \div 3 = 8$
Ⓑ $3 \times 8 = 24$
Ⓒ $4 \times 6 = 24$
Ⓓ $24 - 6 = 18$

6 There are 18 students in Mr. Wilson's art class. More students join the class. Which expression shows the number of students now in the art class?

Ⓕ $18 - a$
Ⓖ $18 + a$
Ⓗ $a - 18$
Ⓘ $18 \div a$

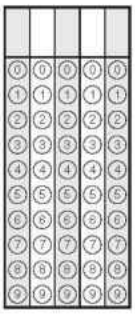
7 The United States experienced a milestone on October 17, 2006. On that date, the nation's population reached 300,000,000. What is the value of the digit 3 in the number 300,000,000?

Ⓐ three hundred million
Ⓑ thirty million
Ⓒ three million
Ⓓ three hundred thousand

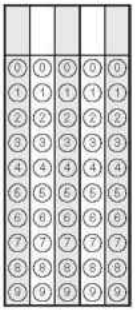
8 Selena has a basket of 15 pears. Some are green, g, and 8 are brown. Which equation can be used to find how many pears are green?

Ⓕ $g - 8 = 15$
Ⓖ $8 \times g = 15$
Ⓗ $8 - g = 15$
Ⓘ $8 + g = 15$

9 Ellen's cat weighs 2 times as much as her sister's kitten. Together the cat and kitten weigh 9 pounds. How much does the kitten weigh?



10 In 2006, Miami International Airport (MIA) had an estimated 32,500,000 passengers traveling through the airport. Which digit in the number 32,500,000 has a place value of ten millions?



11 So far this year, the aquarium has welcomed 4,325,960 visitors. Which estimate is closest to the total number of visitors at the aquarium?

Ⓐ 5,000,000
Ⓑ 4,000,000
Ⓒ 300,000
Ⓓ 6,000

12 Jason makes this number pattern.

89, 76, 63, 50, 37, 24

Which of the following can be used to describe a rule for this pattern?

Ⓕ Subtract 3.
Ⓖ Add 3.
Ⓗ Subtract 13.
Ⓘ Add 13.

13 Karl has 40 trading cards that he shares with 4 of his friends. He gives each of his friends the same number of cards, and keeps 4 cards for himself. Which numerical expression shows how many each friend receives?

Ⓐ $(40 + 4) \div 4$
Ⓑ $(40 - 4) \div 4$
Ⓒ $40 + (4 \div 4)$
Ⓓ $40 + (4 \times 4)$

14 Erica plays the piano 3 days each week at the Senior Center. She plays for 3 hours each day. How many hours will she play the piano at the center in 4 weeks?

Ⓕ 9
Ⓖ 12
Ⓗ 18
Ⓘ 36

15 Juan is thinking of a nine-digit whole number. The number is halfway between three hundred forty million and five hundred forty million. What is the number in standard form?

Ⓐ 640,000,000
Ⓑ 540,000,000
Ⓒ 440,000,000
Ⓓ 44,000,000

16 Emily and Dora each are knitting a 30-inch scarf. So far, Emily has knitted 5 inches of her scarf. Dora has knitted 3 times as much of her scarf. How many inches of her scarf has Dora knitted?

Ⓕ 15
Ⓖ 30
Ⓗ 60
Ⓘ 90

17 Adriana wrote a number puzzle for the class. Below are the clues for one of the numbers in the puzzle.

> The number has:
>
> - 5 hundred millions
> - 7 thousands
> - 9 ones
> - 1 million
> - 3 hundred thousands
> - 4 hundreds

What is the number described by the clues?

Ⓐ 570,310,049

Ⓑ 501,730,904

Ⓒ 501,307,409

Ⓓ 579,134

18 Which rule works for the table below?

Input	x	48	42	36	30
Output	y	8	7	6	5

Ⓕ Multiply x by 6.

Ⓖ Multiply y by 8.

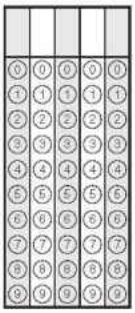
Ⓗ Divide x by 6.

Ⓘ Divide x by 8.

19 Jack mows lawns after school. He mows lawns 2 hours each day. So far, Jack has worked 20 hours. How many days has Jack mowed lawns?

Ⓐ 5
Ⓑ 10
Ⓒ 18
Ⓓ 22

20 Bart makes the pattern below. He asks Mandy to draw the sixth row in the pattern. How many stars should Mandy draw?



21 Eli's Sporting Goods saw a decrease in the number of water bottles sold from 2007 to 2008. In 2008, there were 1,184,000 water bottles sold. What is the value of the digit 8 in the number 1,184,000?

Ⓕ eighty thousand

Ⓖ eighty million

Ⓗ eight hundred thousand

Ⓘ eight hundred

22 Mario has 36 baseball cards. He gives each of his 9 friends 4 cards.

Which of the following belongs to the same fact family as $36 \div 9 = 4$?

Ⓐ $36 \div 6 = 6$

Ⓑ $4 \times 9 = 36$

Ⓒ $12 \times 3 = 36$

Ⓓ $36 - 9 = 27$

23 Gabriella's puppy weighs half as much as her dog. The dog and the puppy weigh 75 pounds combined. How much does the puppy weigh?

Ⓕ 75 pounds
Ⓖ 73 pounds
Ⓗ 50 pounds
Ⓘ 25 pounds

24 Mr. Cho has 28 postcards that he shares with his 9 grandchildren. He gives each of his grandchildren the same number of postcards, and keeps 1 card for himself. Which expression shows how many postcards each grandchild receives?

Ⓐ $(28 - 1) \div 9$
Ⓑ $28 + (1 \times 9)$
Ⓒ $28 + (9 - 1)$
Ⓓ $(28 + 1) \div 9$

25 Kara has a box filled with 24 DVDs. Nine of the DVDs are thrillers, and the rest are comedies, c. Which equation can be used to find how many DVDs are comedies?

Ⓕ $24 \div 9 = c$

Ⓖ $9 \times 24 = c$

Ⓗ $c - 9 = 24$

Ⓘ $c + 9 = 24$

APPENDIX H:
ATTITUDE SURVEY

NAME:_____**DATE**:_____

Mathematics Survey

Directions: Read the statement below. Then circle the letter that best responds to the statement.

A= Strongly Agree

B= Sort of Agree

C= Not sure

D= Sort of Disagree

E= Strongly Disagree

I am sure that I can learn math.	A	B	C	D	E
I don't think I could do advanced math.	A	B	C	D	E
Math is hard for me.	A	B	C	D	E
I am sure of myself when I do math.	A	B	C	D	E
I'm not the type to do well in math.	A	B	C	D	E
Math has been my worst subject.	A	B	C	D	E
I think I could handle more difficult math.	A	B	C	D	E
Most subjects I can handle OK, but I just can't do a good job with math.	A	B	C	D	E
I can get good grades in math.	A	B	C	D	E
I know I can do well in math.	A	B	C	D	E
I am sure I could do advanced work in math.	A	B	C	D	E

APPENDIX I:
QUESTIONS ASKED IN JOURNALS

1. What are your feelings about math?
2. What do you think about the KIM Chart?
3. What can I do to help you understand math better?
4. You have been using the vocab. strategies of a KIM Chart, Personal word wall, and the print out of all of the vocabulary words for this big idea. What do you think about the strategies? Why? Please be specific.
5. What are your feelings about math?

APPENDIX J:
INTERVIEW QUESTIONS

1) Why did your results change from the first time to the second time you took the survey?
2) What particular part about math (place value, multiplication, or division) caused the change?
3) What makes math hard?
4) Did the journal cause the change?
5) Did the vocabulary strategies cause the change?

REFERENCES

Ashcraft, M., H., & Kirk, E., P. (2001). The relationships among working memory, math anxiety and performance. *Journal of Experimental Psychology*, *130(2)*, 224-237.

Baroody, A. J. (1990). How and when should place value concepts and skills be taught? *Journal for Research in Mathematics Education*, *21(4)*, 281-286.

Belbase, S. (2010). *Images, anxieties and attitudes toward mathematics* (Master's thesis). Retrieved from ERIC. (ED513587)

Baxter, J. A., Woodward, J., & Olson, D. (2005). Writing in mathematics: Communication for academically low-achieving students. *Learning Disabilities Research & Practice, 20(2)*, 119-135.

Carpenter T. P., Fennema E., Franke, M. L., Levi L., & Empson S. B. (1999). Children's mathematics: Cognitively guided instruction. Portsmouth, NH: Heinemann.

Cowley, S. (2004). *Getting the buggers to think*. New York, NY: Continuum.

Daniels, H., Steineke, N., & Zelmelman, S. (2007). *Content-area writing: Every teacher's guide*. Portsmouth, NH: Heinemann.

DeVries, B.A. (2004). *Literacy assessment and intervention for the elementary classroom*. Scottsdale, AZ: Holcomb Hathaway.

Dick, B. (1997). *Approaching an action research thesis: an overview*. Available from http://www.scu.edu.au/schools/gcm/ar/arp/phd.html

Donovan, M. S., & Bransford, J. D. (2005). *How students learn: Mathematics in the classroom.* United States: National Research Council.

Edgar, D. (1969). Audiovisual methods in teaching, *third edition*. NY: The Dryden Press; Holt, Rinehart and Winston.

Foote, C. J., Vermette, P. J., & Battaglia, C. F. (2001). *Constructivist strategies: Meeting standards and engaging adolescent minds*. Larchmont, NY: Eye on Education.

Fuson, K. C. (2003). Developing mathematical power in whole number operations. In J. Kilpatrick, W. G. Martin, & D. Schifter (Eds.), *A research companion to principles and standards to school mathematics* (pp. 68-94). Reston, VA: National Council of Teachers of Mathematics.

Griffiths, R., & Clyne, M. (1994). *Math makes sense: Teaching and learning in context*. Portsmouth, NH: Heinemann.

Houghton Mifflin Harcourt. (2011). *Go math! Florida*. Orlando, FL: Houghton Mifflin Harcourt.

Hull, T. H., Balka, D. S., & Miles, R. H. (2011). *Visible thinking in the k-8 mathematics classroom.* Thousand Oaks, CA: Corwin.

Jennison, M., & Beswick, K. "Student Attitude, Student Understanding and Mathematics Anxiety." *Shaping the future of mathematics education: Proceedings of the 33rd annual conference of the Mathematics Education Research Group of Australasia MERGA*. (2010)*: 280-288*. Print

Kamii, C. K., Clark, F. B., & Dominick, A. (1994). The six national goals: A road to disappointment. *Phi Delta Kappan*, *75(9)*, 672-677.

Kamii, C. K., & DeClark, G. (1985). *Young children reinvent arithmetic: Implications of Piaget's theory*. New York, NY: Teachers College Press.

Kilpatrick, J., Swafford, J., & Findell, B. (2001) *Adding it up: Helping children learn mathematics*. Washington, DC: National Academies Press.

Kostos, K., & Shin, E. (2010). Using math journals to enhance second graders' communication of mathematical thinking. *Early Childhood Education*, *38*: 223-231.
Doi: 10.1007/s10643-010-0390-4

Langford, P. (1989). *Children's thinking and learning in the elementary school*. Lancaster, PA: Technomic Publishing Company, Inc.

Marzano, R., & Pickering, D. (2005). *Building academic vocabulary*. Alexandria, VA: Association for Supervision and Curriculum Development.

Murray, M. (2004). *Teaching mathematics vocabulary in context*. Portsmouth, NH: Heinemann.

National Council of Teachers of Mathematics (NCTM). (2002). *Reflecting on NCTM's principles and standards in elementary and middle school mathematics*. Reston, Virginia: NCTM.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics.* Reston, VA: NCTM.

National Council of Teachers of Mathematics (NCTM). (1991). *Professional standards for school mathematics*. Reston, VA: NCTM.

National Council of Teachers of Mathematics (NCTM). (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: NCTM.

Norwood, K. S. (1994). The effects of instructional approach on mathematics anxiety and achievement. *School Science and Mathematics*, *94*, 248-254.

Rahman, A. (2004). Constructivism as a paradigm for teaching and learning. *Concept to Classroom: A Series of Workshops*. Educational Broadcasting Corporation. Available from http://www.thirteen.org/edonline/concept2class/constructivism/index.html

Rowan, T., & Bourne, B. (1994). *Thinking like mathematicians: Putting the k-4 NCTM standards into practice*. Portsmouth, NH: Heinemann.

Rubenstein, R. (2002). Word origins: Building communication connections. In NCTM (Ed.), *Reflecting on NCTM's principles and standards in elementary and middle school mathematics*. (p243-247) Reston, VA: NCTM.

Sherman, H. J., Richardson, L.I., & Yard, G.J. (2005). *Teaching children who struggle with mathematics: A systematic approach to analysis and correction*. Upper Saddle River, NJ: Pearson Education.

Sipka, T. (1982). Writing in mathematics: A plethora of possibilities. In A. Sterrett (Ed.), *Using writing to teach mathematics*. (p.11-16) United States of America: Mathematical Association of America.

Spivey, N. N. (1997). *The constructivist metaphor: Reading, writing, and the making of meaning*. San Diego, CA: Academic Press.

Sterrett, A. (1982). *Using writing to teach mathematics*. United States: Mathematical Association of America.

Talman, L. A. (1982). Weekly journal entries: An effective tool for teaching mathematics. In A. Sterrett (Ed.), *Using writing to teach mathematics*. (p107-112) United States: Mathematical Association of America.

Thornton, C. A. (1990). Strategies for the basic facts. In J. N. Payne, (Ed.), *Mathematics for the Young Child*, (p132-151) Reston, VA: National Council of Teachers of Mathematics.

Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: MIT Press.

Whitin, D. J., & Whitin, P. (2000). *Math is language too: Talking and writing in the mathematics classroom*. Urbana, IL: National Council of Teachers of English.