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The use of a Visual Instructional Plan to Promote Student Motivation and Achievement Within the Classroom

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The Use of a Visual Instructional Plan to Promote Student Motivation and Achievement Within the Classroom

by

Todd K. Fleming

August 2008

A thesis submitted to the
Department of Education and Human Development of the
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The Use of a Visual Instructional Plan to Promote Student Motivation

and Achievement within the Classroom

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Chapter I

Introduction

Over the years educational leaders have made many changes to the math curriculum in order to address the problem that students are struggling to comprehend math concepts due to the No Child Left Behind Act (NCLB). The NCLB aimed to improve the performance of U.S. primary and secondary schools by increasing the standards of accountability for states, school districts and schools, as well as providing parents more flexibility in choosing which schools their children will attend. As a nation we have adopted a math curriculum that requires students not only to memorize formulas and concepts, but also reach mathematical conclusions through reasoning and investigation. With the introduction of the NCLB Act of 2001, this legislation required grades 3-8 to take state assessments in the area of English Language Arts and Math. The new assessments not only analyze student performance, but also factors in teacher accountability.

Results from the National Assessment of Educational Progress indicated that eighth graders scored higher in 2005, the latest year of data, than ever before; but more than one quarter of students without disabilities (28%) and more than two thirds of students with disabilities (69%) still scored below basic performance. Basic performance means students should complete problems correctly with the help of prompts such as diagrams, charts, and graphs and include the appropriate use of strategies and technological tools to understand algebraic and informal geometric concepts in problem solving (Bottage, Rueda, Serlin, Hung, Ya-Hui, & Kwon, 2007).
anxiety toward math, teachers must present their lessons using a clear and systematic approach. According to Goldman, Pellegrino, Mertz, and Davis (1988) elementary students with learning disabilities are delayed in their ability to learn facts automatically, and suggest that this delay can be addressed through systematic practices” such as scaffolding multi-step concepts (as found in Woodward, 2006).

**Statement of the Problem**

Implementation of math in the classroom setting continues to be problematic. Teachers present materials to their students quickly and rarely scaffold new math concepts so that a student can visualize how a math process takes place. As a result students are not able to fully grasp a concept before a teacher moves on to another concept.

My experience as a sixth grade general education and seventh, eighth and ninth grade special education teacher, has enabled me to frequently observe students who struggle with creating concrete understanding of math processes. I have noticed that students struggle with comprehending the individual steps of a process to find a solution or answer to a problem. Students are not always able to relate previously learned math concepts to real life situations unless the concepts are used in the context of the classroom setting.

I have often asked myself, “How do I present a math concept in a clear concise manner that allows students to focus on the individual steps of a process rather than the process as a whole?” In this action research project, I developed a visually rich math
program that introduced manipulatives and visuals, that were used throughout the 2007-
2008 school year to increase student comprehension and reasoning in math.

Significance of the Problem

Across the United States, students struggle with the comprehension of math. With the introduction of the NCLB Act teachers have been made accountable for their students’ achievement in math. In the four years that I have been a teacher I have taught in both the general education and special education setting. After my first year of teaching mathematics I became frustrated with the fact that my students had little motivation to learn math. As a general education and special education teacher, I was able to speak to many educators about my frustrations. What I realized was that my fellow educators shared in my frustration and struggled with ways to ignite students’ motivation and decrease their anxiety of math. Furner, Yahya, and Duffy (2005) believe math teachers today must work hard to eliminate and prevent any math anxiety their students may develop or carry with them.

Many school districts have begun to take a look at the way math instruction is taught in the classroom. Contrary to the direct teaching method is the method of allowing students to think mathematically and actively participate in the learning process using visuals and manipulatives (Bazeli, 1997). Bazeli (1997) stated, “Engaging students in producing various kinds of visuals provides them with many opportunities to analyze visuals and, even more importantly, to apply problem-solving and critical thinking skills to real situations” (p. 201). The implementation of mathematical concepts can take place at a feverish pace for students. Cornell (1999) thinks back to the frustrations his students felt as they tried to keep up with the presentation of any given math lesson. Students
tried to follow along and understand the mathematical concept taught that day, but more often than not students were not given time to grasp an idea. When asked to demonstrate the mathematical concept taught many students said that three or four concepts one come out at once instead of the one main mathematical concept taught in class that day.

A mathematical approach that allows students to use real life situations and problem solving techniques to verbally explain math processes has been implemented in numerous educational institutions. As a result of this approach a new instructional method called inquiry-based learning has been introduced into the classroom. Inquiry learning is a problem solving activity that allows a student to extend his or her thinking beyond the known facts to gain new insights (Esler & Esler, 2001). This instructional approach allows students to actively participate in the learning process to become active learners. Instead of the teacher passing on mathematics knowledge in small and basically meaningless parts, students have to play an important role in the construction of their knowledge as the teacher helps to create experiences that engage students and encourage them to discover new knowledge, as noted by Kroesbergen and Van Luit (2005). By doing so, students become more interested in the content they are learning.

In order to increase student involvement in the classroom school districts have begun to look into programs that allow students to use different learning tools such as visual aids and manipulatives. Textbook exercises, workbooks, and worksheets rarely interest students and focus on calculations in isolation rather than as a piece to solve a problem. These teacher resources rarely allow a student to create a meaningful connection to math concepts. As a result students express their frustrations by saying “Why do I have to learn this? What is the point of this work?” It has been proven that
hands-on exercises and real-world situations add meaning and relevance to concepts presented in a classroom (Cornell, 1999).

Math instruction has taken the approach of allowing students to investigate concepts on their own as well as having math concepts directly taught. Special education and general education teachers are expected to teach to varying degrees of instructional readiness, given the fact that classrooms are grouped heterogeneously according to their academic ability in order to be most inclusive.

I believed that by implementing a visual instruction plan many different learning needs within the classroom could be addressed. This instructional plan presented strategies that are simple, clear, and to the point of solving math problems. This presentation of a clear and simple process allowed teachers to determine if and where a student does not grasp a defined concept. As a result, a teacher could easily identify the area where a student is struggling and reduce anxieties students may have toward math. When used, this instructional plan reduced a teacher’s interaction time with a student. This limited interaction time allowed a teacher to address other students’ questions or needs within the classroom.

Rationale

Teachers spend considerable time every school year preparing lessons they hope will engage their students in the classroom. Once a student becomes engaged in the classroom setting they become invested in the learning process and their motivation increases. If a student’s motivation to learn increases they are less likely to take part in behaviors that disrupt the class. As a result, a teacher is able to present a lesson in a clear and systematic way without any disruptions.
As an educator with four years experience, I realize that my colleagues share similar frustrations within the classroom. How many educators who provide math instruction become frustrated when students begin to put their heads down, doodle in their notebooks, or slouch down in their chairs as a math concept is being introduced? When teaching math I noticed that many of my students slouch down in their seats and give a big sigh when the math instruction begins. Many mumble, “Why do I have to learn this? I am not good at it” and “I will never have to use math again.” I worked to eliminate these behaviors by implementing an instructional plan that focuses on the strategies used to solve math problems. These strategies allowed students to better comprehend math concepts such as multiplication and division, when presented the strategies used to solve a process using visuals and manipulatives. The National Council of Teachers of Mathematics suggests that the mathematics teacher models, and emphasizes mathematical communication using written, oral, and visual forms (Flevares & Perry, 2001).

The primary purpose of this study was to determine if the understanding of a concept and the motivation of students with special needs would increase with the introduction of a visualized instructional plan as well as manipulatives within the classroom. Schopman and Van Luit (2000) believe that poor math instruction is thought to be one of the main causes of math problems experienced by children with special educational needs.

In the next chapter you will read a review of current literature. The following chapter outlines research related to the difference between two teaching methods referred to as direct instruction and inquiry based learning, instructional methods that provide a
clear and systematic approach, the use of visuals and manipulatives within the classroom, math anxiety, and student motivation.
Definition of Key Terms

Visual Instructional Plan: a string of visual prompts that are simple, clear, and permanent; thinking mentally.

Manipulatives: Any object or material that can be handled in order for a student to find an answer or create a more concrete understanding of a concept.

Visual Aids: A graph, chart, or power point presentation that students can refer to as a visual to assist them in their learning.

Scaffolding: An instructional technique whereby the teacher models the learning strategy or task (use of visuals). This process gradually shifts the responsibility of learning from the teacher to the student.

Direct Instruction: A model for teaching that emphasizes lessons designed around small learning increments and clearly defined and prescribed teaching task. It is based on the theory that clearly defined instruction eliminates misinterpretations. The teacher acts as a facilitator and students take a more passive role.

Inquiry Based Instruction: Instruction that allows students to actively participate in the learning process to become active learners. Instead of the teacher passing on mathematics knowledge in small and basically meaningless parts, students have to play an important role in the construction of their knowledge as the teacher helps to create experiences that engage students and encourage them to discover new knowledge, as noted by Kroesbergen and Van Luit (2005 p. 108).
Chapter II

Literature Review

A. Background of Direct Instruction

The concept of direct instruction can be traced back to behavioral analyses of decoding tasks and process-product analyses of teaching (Ryder, Burton, & Silberg 2006). Direct instruction works well when prerequisites to intellectual skills, such as mathematical procedures, are involved (Burton, Lockee, & Magliaro, 2005). Most recently, direct instruction has included the teaching of complex skills. Direct instruction begins with a target behavior that is broken down into specific tasks. Students are taught each individual component of the task related to the target behavior. The teacher models the target behavior, provides practice and feedback at each step, and assesses whether re-teaching is needed (Ryder et al., 2006).

Direct teaching is used to explain the importance of a given strategy for a math concept and how, when, or where that math concept should be used. As stated in Ryder et al. (2006) direct instruction approaches can be tied to three basic principles: (a) language is broken down into components that are taught in isolation, not in a meaningful context; (b) learning is highly teacher directed; and (c) students have little input into what is to be learned.

Direct instruction can be displayed in different forms. Burton et al. (2005) believe that direct instruction is not using lectures to present content, but is an instructional approach that demands the teacher and student to interact. The key factors of direct instruction include modeling, reinforcement, and feedback. According to Burton et al.
A direct instruction design focuses students learning into goals and tasks, breaking these tasks into specific smaller tasks, designing training activities for mastery, and arranging the learning events into patterns that help to promote transfer and successes of learning that must take place before moving to more advanced learning. Direct instruction is modeling reinforced by guided performance.

A study completed by Maccini, Mulcahy, and Wilson examined the effects of direct instruction approach for teaching fractions and decimal skills to six middle school students classified as learning disabled. The study was implemented over a twenty-week period. During this twenty-week period four of the six students received the direct instruction of fractions and decimals. The direct instruction consisted of teaching prerequisite skills, modeling target skills, guided practice, independent practice, and corrective feedback. Three of the four students exposed to the direct instruction increased their academic performance. The remaining two students, who were not exposed to direct teaching, were presented instruction on decimals and fractions from a traditional textbook. Instruction from a traditional textbook resulted in no change in academic performance.

Another study completed by Kroesbergen and Van Luit examined whether to recommend inquiry based learning (guided instruction) interventions or direct instruction interventions to children classified to have mild mental retardation. Students were exposed to two types of instruction. The two types of instruction implemented in the study were guided instruction also referred to as inquiry based instruction and direct instruction. The study concluded that students who received direct instruction benefited more than students who received guided instruction because the mild mental retardation
(MMR) students need detailed instruction from instructors who put an emphasis on each task needed to complete an entire task. Kroesbergen and Van Luit (2005) present the steps needed for an effective lesson using the direct teaching method. First, a student’s attention is gained by reviewing previous lessons and goals. Secondly, a teacher demonstrates how a particular task can be solved. Lastly, students work on the task until the teacher feels they demonstrate a sufficient understanding of the content presented. It is important for a teacher to provide immediate feedback on the completed task. By providing immediate feedback students are able to better understand why he or she completed the task correctly or incorrectly.

**B. Inquiry Based Learning (Math in Action) based on the Constructivist Approach**

Mathematics instruction in elementary schools has changed over the past twenty-five years. Changes implemented by National Council of Teachers of Mathematics require that students participate in a math lesson by explaining their mathematical reasoning when solving concepts so that they can form their own understanding of math (Kroesbergen, Moss, & Van Luit, 2004).

As mathematics instruction evolves so does a teacher’s teaching practices. The achievement level of a student depends on the effort or willingness a student exhibits in a subject area. Vinson (2001) suggests that negative attitudes towards mathematics can produce negative results in mathematics due to the lack of effort a student is willing to put forth in the classroom. If a student feels inadequate or embarrassed while completing a mathematical task he or she will spend little time solving the problem, could care less if they find a solution to the problem at hand, and will do anything in order to avoid that
task in the future. Vinson (2001) determined effective math instruction is “learning in action”. Math in action can consist of games, problem solving activities, discoveries, and situations that present real-life situations. Teachers reported that the use of manipulatives and real-life mathematical events helped them make math meaningful and reduced the anxiety students felt toward math (Vinson, 2001).

Other authors such as DeGeorge and Santoro (2004) support Venison’s idea of learning in action. DeGeorge and Santoro (2004) found that math in action, an instructional method based on the constructivist approach, was an effective way to learn mathematics. An educator rooted in the constructivist school of thought promotes a type of instruction referred to as inquiry based learning. Inquiry based learning is an instructional method that allows students to actively participate in the learning process to become active learners.

Students who become active participants in instruction learn the concepts more effectively. Kroesbergen and Van Luit (2005) state that math instruction is evolving into a constructivist inquiry based approach. Students must be active participants in the learning process and not only rely on the teacher to pass on mathematic knowledge. Students should discover their own knowledge of math based on experiences provided in the classroom (Kroesbergen and Van Luit, 2005). Students are able to picture different situations that may happen as they work to solve a problem. Vinson (2001) compares this technique to creating a storyboard to improve reading comprehension. Children are expected to create, what many of us would refer to as a cartoon like drawing that allows students to include details on characters, practice sequencing skills, and include different details from scenes in a book.
A teacher must work to discover the different learning needs of his or her students before authentic learning can take place through inquiry-based learning. Generally, most elementary school teachers receive a new class every year. The teacher’s first job is to take the time to become acquainted with his/her new group of students. It is the teacher’s job to assess their students’ different learning styles especially in math, a subject that many students struggle with. DeGeorge and Santoro (2004) state, “Learning becomes interactive and engaging as students become comfortable with their unique learning styles through active learning experiences” (p. 28). As teachers assess students’ learning styles, they should be thinking about an instructional approach that will further develop the students’ learning needs. Moyer states, “Teachers play an important role in creating mathematics environments that provide students with representations that enhance their thinking” (Moyer, 2001, p. 178).

Teachers in their preparation for a lesson must always be thinking about how to meet the students’ individual needs rather than their own need to spend less time planning a lesson. Some teachers focus on the easiest way he/she can present the material to the class rather than the individual needs of the students. Too often teachers teach as they were taught. Morocco (2001) states many teachers grew up on rote learning of facts from textbooks. As a result, they too often engage students in reproducing information rather than in generating solutions from their interactions with ideas, materials, and each other. This instructional method does not engage students, but rather alienates them from the learning process. As a result a real life connection is not made. Students do not see the importance of what they are doing. Students lack motivation because they are told what to do instead of being included in the learning process. Vinson (2001) states feelings of
anxiety from math are often centered on a lack of understanding of how math relates to a students real-life experiences. As a result students are not given the chance to develop a deep understanding of the content presented that day.

If students were included in the learning process they would have a deeper understanding of the material. Morocco (2001) explains deep understanding as the ability to use one’s knowledge beyond the context in which it was acquired. A student’s knowledge can be displayed by exposing him/her to real-life situations that create learning opportunities that put knowledge into action (Morocco, 2001). A deep understanding of a skill allows students to draw from their knowledge and think mathematically in any environment.

The curriculum of math has made a push to create real-life experiences so that students can individually construct his/her knowledge and understanding of a mathematical concept, but does this curriculum meet the needs of both general education and special education students? Kroesbergen, Moss, and Van Luit (2004) completed a study that questioned whether low-achieving mathematics students benefit from instruction that requires them to contribute actively to lessons and construct their own mathematical knowledge under the guidance of a teacher (constructivist instruction) or from instruction that is clearly structured and presented by a teacher (direct instruction).

Thirteen elementary schools of general education and eleven schools that offered special education instruction were used in the study. The schools that offered special education instruction included students with mild mental retardation and students with learning and/or behavior disorders. The topic of multiplication was chosen as the mathematical concept. The concept was taught both by the constructivist inquiry based
approach and direct teaching approach. Students classified as general education learners noticed an increase in their test scores after being exposed to both forms of instruction. After the constructivist approach was implemented general education students showed more motivation to learn the topic. Students classified as special education learners performed lower than the general education group when exposed to the guided practice and constructivist approach of instruction, but scored average to their general education counterparts when exposed to the direct teaching approach (Kroesbergen et al. 2004).

Kroesbergen et al. (2004) state that students classified as special education learners benefit from the direct teaching of a concept because they are exposed to the steps of a process and are not forced to discover the sequence of the steps on their own.

C. Systematic Approach of Instruction

Maccini, Mulcahy, and Wilson, (2007) state that five to eight percent of students experience learning disabilities. Cognitive, emotional, and social factors have been linked to the lack of math achievement by students with learning disabilities (Maccini et al., 2007). Maccini et al. (2007) found that students with learning disabilities in math tend to commit procedural errors, struggle with the organization of information, struggle with basic computation and problem solving activities, and experience both long and short-term learning deficits.

Maccini et al. (2007) also found that students classified as learning disabled experienced more difficulty while solving problems, took more time to complete problems, and struggled to find strategies used to solve a problem than their non-disabled students. An intervention recommended to increase student comprehension of a concept
is for teachers to have a clear and systematic approach when presenting material.

Goldman, Pellegrino, and Mertz (1988) concluded that elementary students with learning disabilities are delayed in their ability to learn facts automatically, and suggest that this delay can be addressed through systematic practices (as found in Woodward, 2006, p.270). Systematic practices are defined as the logical sequence of steps used to find a solution to a concept. A similar study on student’s comprehension of explanations conducted by Flevaras and Perry (2001) concluded that instructors, who simultaneously use verbal and visual instructional methods in a concise and coherent manner, aid in students’ mental representation of the concept being taught.

A systematic approach of instruction requires the use of scaffolding. Scaffolding is solving a problem by breaking it down into smaller steps, simplifying tasks, and focusing attention on each individual step (Gifford, 2004).

Kroesbergen and Van Luit (2005) believe that teaching step-by-step from concrete to abstract, working with materials that help students to visually see the process taking place can help those students to create real life experiences that will allow them to conceptualize the process being learned. As a result, the preparation, understanding, and delivery of instruction by the educator conducting the lesson, affects the conceptualization of a student.

Teachers, in order to create a systematic lesson, have begun to identify learning progressions as a way to plan and monitor their instruction. Popham (2007) states that a learning progression is a carefully sequenced set of building blocks that a student must master in order to have the ability to master further curriculum. Learning progressions are created using a backward analysis. A teacher creating a sequenced lesson must know
the steps used for the backward design approach of planning. First, identify the content as well as the learning standards that will be addressed within the instruction. Secondly, identify a building block that must be taught in order to help students master the content presented. Backward planning can help isolate key tasks students must learn in order to master the content presented (Popham, 2007).

Another name for a systematic process is a graduated instructional process. Leon, Maccini, Mulcah, and Gagnon (2006) suggest that the use of a graduated instructional sequence can help students understand concepts and become active learners in the learning process. A graduated instructional sequence is a systematic approach to teaching concepts and skills to ensure student understanding. The sequence includes three phases: (a) concrete: representing the concepts via objects; (b) semiconcrete: drawing pictures of objects; and (c) abstract: using numerical representation. (Leon et al., 2006).

D. Use of Visual Aids and Manipulatives in Math Instruction

The systematic approach is aided by the use of manipulatives. Trief, Lisi, Cravello, & Yu (2007) state, the use of manipulatives and concrete experiences are especially important for children with multiple disabilities, so that they may be exposed to as many opportunities as possible to acquire knowledge and skills of basic concepts. Educators ponder whether the use of manipulatives is important to math instruction. DeGeorge and Santoro (2004) believe that hands-on learning helps students to more readily understand concepts and boost their self-confidence. The use of manipulatives and hands-on learning help make aspects of what students need to learn more visible than abstract (DeGeorge & Santoro, 2004). Students will be better able to visualize math
concepts and gain a deeper understanding in the necessary fundamentals of different math
concepts with the use of manipulatives such as rods, cubes, and other tools.

Furner, Yahya, and Duffy (2005) suggest different strategies to reach all students' learning needs. One strategy suggested was using manipulatives in order to make problems concrete. Using manipulatives instead of relying on daily worksheets, allow a teacher to be creative when helping students work on math concepts. DeGeorge and Santoro (2004) support hands-on activities and the use of manipulatives because students are better able to visualize math concepts and gain an understanding of the fundamentals of a math concept when they use rods, cubes, and other tools. Effective tools for teaching number facts can be the use of stick bundles, flipbooks, flash cards, and puzzles.

Many mathematical concepts require the ability to complete multiple tasks to find a solution. Students with multiple disabilities struggle to identify the logical sequential steps needed to understand a mathematical concept. When teaching tasks to students with multiple disabilities, a task analysis may be needed to break down specific skills into smaller steps. The breaking down of a multiple step process into clear and sequential segmented tasks has the potential to make such tasks more pleasant and easier to handle for students (Trief, Lisi, Cravello, & Yu 2007). Math instruction should contain a step-by-step process that students can follow. Teachers can use a step-by-step lesson structure to teach many concepts in math. Presenting steps in a sequence helps students with memory or organizational thinking deficits (Hudson & Miller, 2006).

Providing systematic instruction can be enhanced by the use of visual aids. Examples of visual aids are power point presentations, charts, graphs, and written symbols. Flevares and Perry (2001) state, “Nonspoken media including fingers, graphs,
written symbols, and counting blocks, can be essential to give mathematical concepts visible embodiment as referents” (p. 330). Students may refer back to his/her fingers, graphs, and written symbols when solving a mathematical concept. In a study conducted by Woodward (2006), a teacher, instructing his/her class on how to round two and three digit numbers to the nearest tens or hundreds, projected visual representations (number lines) on the overhead. The visual representations were designed to help students with approximation skills. Woodward (2006) concluded that with the use of visual aids students gained a better understanding of the concept of rounding and were able to complete the assigned homework.

Jitendra (2004) believes the graphic representational technique can help all students become effective problem-solvers. This graphic representational technique consists of two phases. The first phase is called identification and representation. This phase uses a schematic diagram that allows students to organize information in the problem to facilitate problem translation and solution. Phase two asks a student to select the appropriate mathematical operation used to solve the problem (Jitendra, 2004).

Another instructional strategy used to create a concrete understanding of mathematical vocabulary in the classroom was to use real objects when teaching the mathematical vocabulary. Good abstract thinking is connected to concrete experiences. When students think abstractly they are forced to conceptualize the sequential steps needed to solve that mathematical process. As a result the lesson becomes math in action.

Manipulatives, such as pattern blocks, shape sets, and unit blocks, as well as real-world objects, such as buttons, help children build representations of mathematical
ideas (Clements, Sarama, & DiBiase, 2004). Teaching and learning that is detached from real-life experiences fail to help students develop a concrete understanding of mathematics. As a result, an emphasis of learning has been placed on the use of a manipulatives, which allows students to copy or mimic real life situations (Vinson, 2001). With the use of manipulatives, students become actively engaged in the learning process (Furner et al., 2005).

The concept of problem solving can be a struggle for many students. Schopman and Van Luit (2000) concluded that the uses of concrete objects are helpful when presenting the mathematical concept of problem solving. Vinson (2001) writes the use of concrete materials in the classroom can decrease that anxiety a student feels toward math. Once students become active participants, their motivation level increases. Moyer (2001) conducted a study that tested whether manipulatives were appropriate for math instruction. She believes lessons that allowed manipulatives to be used, resulted in students who appeared to be interested and wanting to become actively involved. Bazeli (1997) found that by allowing students to produce various kinds of visuals they will have more opportunities to create a deeper understanding by analyzing the visuals as well as applying problem-solving and critical thinking skills to real life situations.

Various studies support the use of visual aids and a systematic approach to teach math instruction. Math and visual aids if used the correct way can help students of all learning abilities comprehend and make math concepts concrete. Pinsky, Joyce, and Wipf (2001) write, “Visual images in combination with verbal instruction have been shown to significantly increase recall and retention” (p. 805). Using a power point presentation as a visual provides teachers with the opportunity to create a dynamic and
innovative presentation that not only commands attention but is also fun to use (Holzl, 1997).

In order for a power point presentation to be seen as fun and interactive by students, teachers must: First, develop a storyboard or a concept map of the content that is presented in class. Both storyboards and concept maps provide a sequence and understanding of the presentation (Klemm, 2007). Secondly, be precise and as straightforward as possible when creating a slide. As a result, a teacher can pause and engage students in discussion and questioning (Klemm, 2007). Both activities help students to interact with one another or the teacher within the classroom. These student to student and teacher to student interactions allow for better understanding of the mathematical content being presented. Lastly, once a sequenced process is developed animations and pictures can easily be inserted into the slide show in order to create a visual that can engage the student by prompting real life experiences of students. As a result, students become more engaged and active in the learning process because the presentation of a step-by-step process helps them to make learning authentic and they are able to apply it to real life situations (Klemm, 2007).

E. Background of Student Motivation

Math is a core subject area that has been observed to cause students to suffer from anxiety. A student’s motivation and enthusiasm toward math is directly related to the way a teacher presents material and how students internalize the material. Emotional states that interfere with motivation include stress, which is caused by anxiety (Lindsay & Phillips, 2006). Students that have had bad experiences in mathematics may feel anxiety
every time they enter a math classroom. Vinson (2001) writes students who feel anxiety in math may display one or all of these actions: an uneasiness when asked to perform mathematically, an avoidance of all math related experiences such as showing up to class at the last possible moment, feelings of physical illness, faintness, panic, and an inability to perform on test. A teacher or parent that has unattainable expectations for the student can cause anxiety and lack of motivation. To be successful in school, students need to feel accepted and valued, and have the skills to be productive (Bowman, 2007).

Once a student is made to feel accepted that student can begin to take ownership in their learning. Gifford (2004) believes “a child’s purpose for learning and ownership of learning goals are important for motivation” (p. 105). Allowing a student to make choices is seen as having a motivating influence in a classroom environment (Lindsay & Phillips, 2006). Related to this is the view that, as much as possible, students in a learning situation should be allowed to explore areas of their own interests (Peters et al., 2000). In doing this students’ motivation increases and they work and develop their learning skills.

Teachers must take many things into consideration when working to support student learning. Gifford (2004) writes that in order to support student-learning teachers must carefully consider:

- Avoiding anxiety and exposure to public failure by encouraging safe risk taking;
- Building mathematical confidence and positive self-image;
- Allowing children ownership of goals and some control in activities;
- Making the purpose of learning explicit;
- Taking children’s interest into account. (p.106)
Student learning can be supported by one of two motivational states—extrinsic or intrinsic. Hart, Mahoney, Stasson, and Story (2007) write extrinsic motivation refers to the desire to work to achieve a goal in order to receive a physical reward, whereas intrinsic motivation refers to the desire that comes from within the person to work to achieve a goal.

Extrinsically motivated students are driven by external factors such as rewards or threats of punishment. Characteristics of extrinsically motivated students are competitiveness and teacher directed learning (Lindsay & Phillips, 2006).

Intrinsically motivated students learn for the sake of learning. A student gains personal gratification and satisfaction through learning. Characteristics of intrinsically motivated students are noncompetitive, independent, and self-directed learning (Lindsay & Phillips, 2006). Students who are driven intrinsically are not afraid to make mistakes or admit when they do not understand something and will ask for help when it is needed. Also intrinsically motivated students create challenging goals that are achievable through risk taking, hard work, and persistence (Lindsay & Phillips, 2006).

Motivation can also be influenced by the placement of a student into a certain program. Placing students according to academic achievement or ability is called tracking. The educational systems of many countries around the world use some form of achievement grouping when placing students in a class. Baumert, Köller, Ludtke, and Marsh (2006) state, students in low-achievement tracks are at a disadvantage to students placed in high-achievement tracks because they may receive lower quality teaching, and develop lower educational aspirations. Furthermore, many educators have argued that being placed in a low-achieving group has negative effects on a student’s motivation.
Another factor that affects a student’s motivation is their home environment. Campbell and Koutsoulis (2001) studied how home environment variables affect students’ motivation such as their attitude toward school and their self-concept toward math and science. A person who studies the circumstances or conditions of one’s surroundings is known as a home environment theorist. Home environment theorists believe that some of the difficulties young people face at school can be due to problems caused by parents. The family provides their child with the main setting for personality growth. Campbell and Koutsoulis (2001) believe that the home environment affects students’ success in school because they may display a negative attitude toward school. At home, children learn the importance of education and school. Parents and teachers are partly responsible for the development of students’ attitudes toward school (both negative and positive).

Student behaviors in math can be linked to different motivational factors. Sideridis (2007), in his article “Why Are Students with LD Depressed? A Goal Orientation Model of Depression Vulnerability” discusses two motivational factors that account for different student behaviors. The two factors are children with learning or mastery orientation (intrinsically motivated) and children with a performance or “helpless” orientation (extrinsically motivated).

An individual who pursues a task for the joy of learning that task not because they will receive an external reward is known to have a learning orientation. That task in itself is the reward. A performance orientation is based on external reinforcement and the recognition that came with the completion of the task. Performance orientation is driven by the desire for people to outperform other people. Performance oriented individuals are
extrinsically motivated individuals who want to always establish their abilities as average or adequate not as incompetent. “As a result, any achievement situation is viewed as a test of their ability and, eventually, as an evaluation of their self-worth” (Sideridis, 2007, p. 2). This test of self-worth leads to anxiety and stress. A mastery-oriented individual views each situation as an opportunity to learn and grow intellectually. A mastery-oriented individual experiences little anxiety or stress because he/she is intrinsically motivated and learns for the sake of learning.

Chapter III

Application and Evaluations

Introduction

The purpose of the study was to determine the effectiveness of using visuals and manipulatives to teach math in an eighth grade self-contained classroom. The main objective of this action research project was to determine whether an emersion of visual prompts and the use of manipulatives increased student achievement as well as student motivation. The implementation of a Visual Instructional Plan that used visual aids and manipulatives within my classroom assisted in the collection of data. This data was gathered to analyze whether there was a relationship between the use of visual aids and manipulatives and student achievement and student motivation.

Participants

The school district in which this study took place is located in western New York State. The members of the target population for this one-month study were eighth grade
special education self-contained students in an urban school district in the city of Rochester. The target group included seven eighth grade students—six boys and one girl—who were diagnosed as being either emotionally disturbed, learning disabled, or autistic. All seven students present in the classroom had individualized education plans (IEP). The student ratio is 7:1:2, meaning seven students, one teacher, and two paraprofessionals.

The districts student population consisted of 34,000 students from pre-K to twelfth grade. The demographics of the district were as follows: 5% African American/Black, 21% Hispanic, 12% White, and 2% Asian/Native American/East Indian/Other. Eighty-eight percent of the students were eligible for free/reduced-price lunch. Seventeen percent of students were classified as having special needs and 8% experienced limited English proficiency. Lastly, fifty percent of the schools were at 90% poverty level or higher.

**Procedures**

Parents/guardians were given a consent form that asked if I could use their child’s comments and performance scores to complete this thesis study (see appendix A). Parents were ensured privacy and safety of their child’s identity because the study never made a reference to students’ names and all the paper work and findings that contained student information of the study was shredded at the completion of the study.

I was given a group of students that lacked the basic fundamentals to solve processes or perform processes such as division and multiplication. As a result, I created a study that utilized visual aids, such as power point presentations, graphic organizers,
and manipulatives, within an eighth grade self-contained classroom (see appendices C, D, I). This type of instruction was new to the student population because, according to paraprofessionals that worked with these students the year before, the students experienced a classroom where the math instruction was dominated by direct instruction that rarely implemented visual aids or strategies used to solve math concepts. The direct instruction approach involved lectures, then busy work to reinforce the lectures.

This study consisted of a direct teaching method that used visuals to explore the concepts of multiplication and division of numbers, focusing on the strategies used to solve each concept. The self-contained class meets five days a week, four days at forty-two minutes and one day at 30 minutes. As both the concepts of division and multiplication were introduced, students were provided with printed power point presentations (visual aids) that contained strategies students could refer to when solving division and multiplication processes. The power point presentations also provided clarification of vocabulary words related to these concepts.

I addressed different strategies used to solve division and multiplication on the board, as the students referred to the printed power point presentations as references. Two weeks were devoted to each concept. Four students were given the use of visuals and manipulatives while learning problem solving skills. Three students were not given the use of visuals and manipulatives while learning problem solving skills. When asked a question for clarification by the teacher all students were required to refer to the power point presentations and attempt to answer the question asked in class. Students were able to use one pass within a forty-minute class period. The pass allowed students to ask a
classmate for help in answering the question provided by the teacher. Both whole group and small group instruction were implemented in the experiment.

Once the lesson was presented and the teacher or paraprofessionals checked for clarification, students were required to do one of two things depending on the day. Students either completed class work or began their homework. As students completed their work they were required to solve each problem writing out the strategy used to solve the problem. Students had the use of cubes, two-sided counters, and visual aids in order to create a concrete visual of their work.

A pre-assessment to each concept was provided at the beginning of both studies to provide a benchmark for the study (see appendices B, H). Test/quiz assessments were also given on the Friday of the first week and the Friday of the third week (see appendices E, J). At the end of both studies a post assessment was given to each student (see appendices F, K).

**Instruments for Study**

The researcher collected data by using test assessments/quizzes, bi-weekly grade reports, progress report, and anecdotal records. Progress reports were completed weekly on each student (see appendix N). Bi-weekly grade reports and performance charts were completed every two weeks in order to ensure that the data collected was current and showed a progression or a lack of progression over time (see appendix G). Bi-weekly grade reports allowed the teacher and paraprofessionals to identify whether students’ achievement had increased, decreased, or remained the same when the instruction
focusing on strategies used to solve multiplication and division concepts were implemented in the classroom.

Anecdotal records on students’ behavior and participation were kept daily by both the researcher and the paraprofessionals present in the classroom. Anecdotal records were kept to identify whether students became less disruptive and more focused within the classroom or more disruptive and less focused within the classroom.

The progress report was administered using a quantitative design. Progress reports were used to assess the general attitude that students had toward levels of motivation, understanding of math concepts, and anxiety levels. This data allowed the researcher to identify whether the implementation of the strategy based instruction resulted in either a greater level of understanding and achievement or a lesser level of understanding and achievement over time using a Likert scale. Each category on the progress report involved a 1-3 Likert scale, yielding a maximum score of 9. Throughout the study student charts were compared to the charts of the previous weeks in order to monitor student achievement over time.

The Likert rating was based on a number scale from one to three. The number scale was as follows:

1: No change in student motivation, understanding of math concepts, and anxiety level.

2: Minimal change in student motivation, understanding of math concepts, and anxiety level.

3: Consistent change in student motivation, understanding of math concepts, and anxiety level.
A bi-weekly report was administered every two weeks to students. This report assessed how a student believed their level of motivation; understanding of math concepts, and anxiety level had changed since the strategy-based instruction had been implemented in the classroom. The data assisted the teacher in identifying whether the implementation of the strategy based instruction resulted in a greater level of understanding and achievement, a lesser level of understanding and achievement, or remained the same over time.

The information collected from the bi-weekly and progress reports were gathered using the quantitative design. The data was evaluated numerically. All data collected from the progress report and bi-weekly grade reports were charted on the student achievement progression form (see appendix L) and the student motivation progression form (see appendix M). Once the data was charted I looked to see if the data showed a positive or negative relationship between academic achievement and student motivation.

Chapter IV

Results

During the first two weeks of the study, seven students were presented the concept of multiplication. Four of the seven students were exposed to the use of cubes, two-sided counters, and visual aids in order to help the students further develop and gain a more concrete understanding of the math concepts of multiplication. The last two weeks of the study, students were presented the concept of division. The same four students were given the use of cubes, two-sided counters and visual aids such as power point presentations to help scaffold the steps of division.
Of the four students only one regularly complained about the instructional plan implemented and felt that the instructional plan was tedious and did little for his or her conceptualization of the mathematical concept. The three remaining students exposed to the instructional plan used visuals in order to conceptualize the mathematical concepts of division and multiplication. These students regularly asked questions referring to the process and the researcher would say, “Refer back to the visual handed out in the beginning of class that broke down the mathematical concepts into a systematic process.” Once these students referred back to the visual they were given in the beginning of class they were able to figure out their answers on their own with little assistance from the researcher. The researcher and paraprofessionals were present in the room to act as facilitators of the information and to remind the students that the visuals presented in the beginning of class had the multiplication/division process broken down for them.

The researcher measured the progress of each student by giving students a quiz or test every Friday. Students worked throughout the weeks to create a concrete understanding of the concepts of division and multiplication by referring to their visuals and using the manipulatives provided in class.

Prior to teaching the mathematical concepts of multiplication, students were given a pretest to assess their level of understanding of the concept of multiplication. At the end of the presentation of multiplication, students were given a post-test. Both the pre-test and post-test were based on a one hundred point grading scale. Students 1 through 4, who experienced the implementation of the visual instructional plan and the use of manipulatives, are referred to as experimental group A. Students 5 through 7, who had no exposure to the use of manipulatives, are referred to as control group B. The
individual results of each student's multiplication pre-test and post-test are reported in Table 1 found below.

<table>
<thead>
<tr>
<th>Student</th>
<th>Scores on Pre-Test</th>
<th>Scores on Post-Test</th>
<th>Difference in scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>68%</td>
<td>88%</td>
<td>+ 20%</td>
</tr>
<tr>
<td>2*</td>
<td>45%</td>
<td>65%</td>
<td>20%</td>
</tr>
<tr>
<td>3*</td>
<td>38%</td>
<td>68%</td>
<td>+ 30%</td>
</tr>
<tr>
<td>4*</td>
<td>53%</td>
<td>75%</td>
<td>+ 22%</td>
</tr>
<tr>
<td>5</td>
<td>80%</td>
<td>85%</td>
<td>+ 5%</td>
</tr>
<tr>
<td>6</td>
<td>63%</td>
<td>68%</td>
<td>+ 5%</td>
</tr>
<tr>
<td>7</td>
<td>60%</td>
<td>60%</td>
<td>+ 0%</td>
</tr>
</tbody>
</table>

* Experimental Group A: Students Exposed to the use of visuals and manipulatives

Table 1 shows that once students were exposed to the implementation of the visual instructional plan and the use of manipulatives eighty six percent of student scores increased. Not one students’ score decreased. One hundred percent of experimental group A, students who experienced the implementation of the visual instructional plan and the use of manipulatives, experienced a significant increase in their knowledge of the multiplication concept. Sixty- seven percent of control group B, students who were not exposed to the use of manipulatives, experienced an increase in their understanding of multiplication skills. Thirty three percent of control group B experienced no change in knowledge of the mathematical concept of multiplication.
Table two, found below, displays the mean scores of the pre-test and post-test of the mathematical concept of multiplication presented to both experimental group A and control group B.

Table 2  
**Mean Scores of Multiplication Pre-Test and Post- Test**

<table>
<thead>
<tr>
<th>Student</th>
<th>Pre-Mean Scores</th>
<th>Post-Mean Scores</th>
<th>Difference in Scores</th>
<th>Failing Scores as per District Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group A</td>
<td>51%</td>
<td>74%</td>
<td>+23%</td>
<td>71%</td>
</tr>
<tr>
<td>Control Group B</td>
<td>68%</td>
<td>71%</td>
<td>+3%</td>
<td>14%</td>
</tr>
</tbody>
</table>

* Students who did not receive the use of manipulatives.

The overall mean score of both experimental group A and experimental group B of the multiplication pre-test was 60%. The pre-test mean score of experimental group A, students who experienced the implementation of the visual instructional plan and the use of manipulatives was 51%. The pre-test mean score of control group B, students who did not experience the implementation of the use of manipulatives, was sixty-eight percent. Seventy-one percent of the students did not meet the district’s requirement of a passing score of 65%.

The overall mean score of both experimental group A and experimental group B of the multiplication post-test was 73%. The post-test mean score of experimental group A was 74%. One hundred percent of experimental group A met what the district considers a passing score. Experimental group A increased their mean score 23% from the pre-test to the post-test. The post-test mean score of control group B was 71%. Sixty-seven percent of control group B met what the district considers a passing score. Control group B increased their mean score 3% from the pre-test to the post-test.
Prior to teaching the mathematical-concepts of division students were given a pretest. At the end of the teaching of the mathematical concept students were given a post-test. Both the pre-test and post-test were based on a one hundred point grading scale. The individual results of each student’s division pre-test and post-test are reported in Table 3, found below.

Table 3  Division Pre-Test and Post- Test Scores

<table>
<thead>
<tr>
<th>Student</th>
<th>Scores on Pre-Test</th>
<th>Scores on Post-Test</th>
<th>Difference in scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>30%</td>
<td>70%</td>
<td>+ 40%</td>
</tr>
<tr>
<td>2*</td>
<td>40%</td>
<td>70%</td>
<td>+ 30%</td>
</tr>
<tr>
<td>3*</td>
<td>70%</td>
<td>90%</td>
<td>+ 20%</td>
</tr>
<tr>
<td>4*</td>
<td>20%</td>
<td>50%</td>
<td>+ 30%</td>
</tr>
<tr>
<td>5</td>
<td>40%</td>
<td>30%</td>
<td>- 10%</td>
</tr>
<tr>
<td>6</td>
<td>80%</td>
<td>90%</td>
<td>+ 10%</td>
</tr>
<tr>
<td>7</td>
<td>60%</td>
<td>60%</td>
<td>0%</td>
</tr>
</tbody>
</table>

* Experimental Group A: Students Exposed to the use of visuals and manipulatives

Table 3 shows that once students of experimental group A were exposed to the implementation of the visual instructional plan and the use of manipulatives, one hundred percent of students of experimental group A scores increased. Thirty-three percent of control group B, students who were not exposed to the use of manipulatives, experienced an increase in their understanding of division skills. Thirty three percent of control group B experienced no change in knowledge of the mathematical concept of division. Thirty-three percent of control group B decreased.
Table four found on this page, displays the mean scores of the pre-test and post-test of the mathematical concept of division presented to both experimental group A and control group B.

Table 4  
Mean Scores of Division Pre-Test and Post-Test

<table>
<thead>
<tr>
<th>Student</th>
<th>Pre-Mean Scores</th>
<th>Post-Mean Scores</th>
<th>Difference in Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group A</td>
<td>40 %</td>
<td>70 %</td>
<td>+ 30%</td>
</tr>
<tr>
<td>Control Group B</td>
<td>60 %</td>
<td>60 %</td>
<td>0 %</td>
</tr>
</tbody>
</table>

The overall mean score of both experimental group A and experimental group B of the division pre-test was 50%. The pre-test mean score of experimental group A, students who experienced the implementation of the visual instructional plan and the use of manipulatives was 40%. The pre-test mean score of control group B, students who did not experience the use of manipulatives, was 60%. Seventy-one percent of the students in control group A and control group B did not meet the district's requirement of a passing score of 65%. The overall mean score of both experimental group A and experimental group B of the division post-test was 66%. A score that does meet the district's requirement of passing score of 65%. The post-test mean score of experimental group A was 70%. One hundred percent of experimental group A met what the district considers a passing score. Experimental group A increased their mean score 30% from the pre-test to the post-test. Thirty-three percent of control group B met what the district considers a passing score.

The student achievement progression form is data collected from the bi-weekly grade report and student progress reports. The bi-weekly grade reports were completed every
two weeks and the student progress reports were completed weekly in order to ensure that the data collected was current and showed a progression or a lack of progression over time. Bi-weekly reports focused on the students’ averages having to do with class work, homework, and tests/quizzes. The bi-weekly grade reports also allowed the teacher and paraprofessionals to identify whether students’ achievement had increased, decreased, or remained the same when the instruction focusing on strategies used to solve multiplication and division concepts were implemented in the classroom. The results of the bi-weekly grade reports and student progress reports are reported in the student achievement progression form Table 5, found on the next page.
Table 5 allowed the teacher and paraprofessionals to identify whether students’ achievement had increased, decreased, or remained the same throughout the month long study. Forty-three percent of students’ grade point average increased during the study. Twenty-nine percent of students’ grade point average remained the same. Fourteen percent of students’ grade point average decreased during the month long study. Fifty percent of students from experimental group A displayed an increase in grade point average during the study. Twenty-five percent of students from experimental group A displayed no change in grade point average during the study. Thirty-three percent of students from control group B displayed an increase in grade point average during the study. Thirty-three percent of students from control group B displayed a decrease in grade point average during the month long study. While thirty-three percent of students from control group B displayed no change in grade point average during the month long study.

Progress reports, completed weekly, were used to assess the general attitude that students had toward levels of motivation, understanding of math concepts, anxiety levels, and the students average for the week. Each category on the progress report involved a
1-3 Likert scale, yielding a maximum score of 9. A score of 3 shows little if any change in a student’s attitude toward levels of motivation, understanding of math concepts, anxiety levels, and the students average for the week. A score of 6 shows minimal change in a student’s attitude toward levels of motivation, understanding of math concepts, anxiety levels, and the students’ average for the week. A score of 9 shows an extreme change a student’s attitude toward levels of motivation, understanding of math concepts, anxiety levels, and the students’ average for the week.

The results of the progress reports are reported in Table 6, titled the student motivation progression form, found on the next page.
Table 6, charted whether student motivation based on three categories, understanding of mathematical concepts, level of motivation, and class average per week, increased by the end of the study. Seventy-one percent of student’s motivation from experimental group A and control group B increased gradually throughout the study. Thirty percent of student motivation from experimental group A and control group B remained the same throughout the study. Fifty-seven percent of students’ were able to achieve a Likert scale score of eight. A score of eight shows that a student has experienced an extreme change in his/hers attitude pertaining to levels of motivation, understanding of math concepts, anxiety levels, and the students’ average for the week.

The motivation of seventy-five percent of students from experimental group A increased throughout the study. The motivation of twenty-five percent of students from experimental group A remained the same. The motivation of sixty-six percent of students from control group B increased through the length of the study. The motivation of thirty-three percent students of control group B remained the same.

The students of experimental group A, according to their comments made on their progress reports, displayed a concrete understanding of the mathematical concepts as well
as an increased interest to learn math. As a result, they felt more motivated to learn and complete their work. Seventy-five percent of the students from experimental group A, who experienced the implementation of the visual instructional plan and the use of manipulatives, displayed an increase in both student motivation and grade point average.

The students of control group B, according to their comments made on their progress reports displayed an average understanding of the mathematical concepts as well as no increase in his/hers interest to learn math. Thirty-three percent of students from control group B, individuals who had no exposure to the implementation of the visual instructional plan and the use of manipulatives displayed an increase in both student motivation and grade point average.

Chapter V

Conclusions and Recommendations

The purpose of this thesis was to determine if the understanding of a concept and the motivation of students with special needs would increase with the introduction of a visualized instructional plan as well as manipulatives within the classroom. By analyzing the results of bi-weekly grade reports, progress reports, anecdotal records, and test and assessments I have drawn some conclusions about the effectiveness of using manipulatives and a visualized instructional plan within a classroom to affect student grade point average and motivation.

Based on the data collected, it is clear that students were able to make more of a concrete understanding of the mathematical concepts of multiplication and division. Students once exposed to the manipulatives and a visual instructional plan showed an
increase in grade point average. Students were able to sit down and think mathematically by breaking the task into smaller pieces in order to achieve success.

Based on the researcher's observation students were engaged and less confrontational or agitated during math instruction. Students were able to make a concrete understanding of mathematical concepts by the use of manipulatives and a visualized instructional plan that systematically breaks apart the concept.

According to the data collected, students felt less anxious and expressed a motivation to learn rather than to avoid learning. This behavior supports the current research findings that when students become active participants their motivational level increases and they begin to take a vested interest in their learning. Students become more confident and as a result become more enthusiastic in their ability to learn. Learning is not seen as a chore, but as a way for students to become more active in gaining knowledge and becoming active participants in the learning process.

After analyzing the pre and post-test of the mathematical concepts of multiplication and division one main conclusion can be made. Students, once presented a systematic approach to a concept rather than the concept as a whole process, can identify and correct careless mistakes that they may have previously made. Students internalized the process and as a result gained a better understanding of each component of the process.

While reporting the data found in Table 6, the student motivation progression form, the researcher would like to present factors that may have influenced student motivation during the study. One student during the implementation of the use of manipulatives and a visual instructional plan was suspended for five days for behaviors displayed outside
Another student received two five-day suspensions during the study. These absences could result in discrepancies between student motivations.

The researcher has been teaching math for five years to students at the fifth, sixth, seventh and eighth grade levels. I often wondered how I could help students to better understand math and not always display feelings of disgust or anxiety toward math. I thought back to what I would have liked to see when I was learning math as a student. After careful thought I realized I was never able to find the importance of math. I was never made to internalize math by developing a real life connection to math. Never was I given the chance to use manipulatives. I was taught mathematical concepts as a whole process rather than a systematic approach that broke mathematical concepts into small steps.

I believe that more research needs to be done on the negative feelings many students both general education and special education have toward math. Although many studies have been completed on this topic, I feel that the student population is forever changing. I would like to see a longitudinal study completed comparing the negative/positive feelings of a student population that experiences hardships of poverty (shelter, food, materials, clothing, etc.) and a student population that does not have to worry about the hardships of poverty.

Also, I would suggest further research that addresses the best instructional practices that promote the use of manipulatives within a classroom. Is direct instruction required to teach students how to use of manipulatives within the classroom? When students become confident with the manipulatives should they be allowed to practice inquiry based learning, which focuses on student participation by allowing them to go out and
explore concepts on their own? Or is it better to isolate these instructional practices from one another?

In the future, I would like research to be conducted on how student motivation is affected by the relationships students have with teachers and paraprofessionals found in a classroom. I believe that many special education students in an 8-1-2 setting struggle with creating social relationships with classmates and faculty members. If students could develop a friendly, open, and risk free working environment with their teacher and paraprofessional would these relationships motivate a student to learn a specific concept though issues exist outside the school environment?

I learned that when students are exposed to mathematical concepts in a systematic process rather than a process as a whole they become active members in the learning process. I also observed that by providing students' manipulatives in order to better conceptualize a concept, students become active learners. Students as active learners become more attached to the learning process and there are less feelings of negativity toward math. As a result students become more motivated to learn and less worried about making a mistake or feeling anxious that they can not complete the work given to them in class.

In conclusion, students of experimental group A, students who experienced the implementation of the visual instructional plan and the use of manipulatives consistently made improvements in student motivation, grade point average, and mean test scores of the mathematical concepts of multiplication and division compared to students of control group B, students who did not experience the use of manipulatives. Students of control
group B showed minor if any improvements in student motivation, grade point average, and mean test scores of the mathematical concepts of multiplication and division.
References


Appendix A: Parent Letter
December 3, 2007

Dear Families,

This form describes a research study being conducted with students about their understanding of and attitudes about improving problem solving skills in math and the use of visuals and manipulatives to develop the techniques needed to improve problem solving in math. The purpose of this research is to understand the effects of using visuals and manipulatives to develop the techniques needed to improve problem solving in math. My overarching goal is to assess the impact of using visuals and manipulatives to develop the techniques needed to improve problem solving in math and student motivation.

The person conducting the research is Mr. Todd Fleming, a student at SUNY College at Brockport. If you agree to have your child participate in this study, she/he will be asked to complete student quizzes every Friday. Students will also receive a bi-weekly progress and grade report that will address their level of motivation, understanding of mathematical concepts, and level of anxiety toward math.

The possible benefit from being in this study could be that information will be learned that would allow teachers to better prepare young people to become problem solvers and better comprehend math. Your child’s participation in this study is completely voluntary. Being in it or refusing to be in it, will not affect your child’s grades or class standing. S/he is free to change her/his mind or stop being in the study at any time.

I understand that:

1. My child’s participation is voluntary and s/he has the right to refuse to answer any questions. S/he will have a chance to discuss any questions s/he has about the study with the researcher after the introduction of the study to students.

2. My child’s confidentiality is guaranteed. Her/his name will not be written on the survey. There will be no way to connect my child to the written survey. If any publication results from this research, s/he would not be identified by name. Results will be given anonymously and in group form only, so that neither the participants nor their schools can be identified.

3. There will be no anticipated personal risks or benefits because of participation in this project.

4. My child’s participation involves completing four daily Friday quiz assessment over the period of a month. It is estimated that it will take forty minutes to complete each assessment.

5. Approximately eight people will take part in this study. The results will be used for the completion of a research project by the primary researcher.
6. Data and consent forms will be kept separately in a locked filing cabinet by the investigator and will be destroyed by shredding when the research has been completed.

You are being asked whether or not you will permit your child to participate in this study. If you wish to give permission to participate, and you agree with the statement below, please sign in the space provided. Remember, you may change your mind at any point and withdraw from the study. Your child can refuse to participate even if you have given permission for her/him to participate.

I understand the information provided in this form and agree to allow my child to participate as a participant in this project. I am 18 years of age or older. I have read and understand the above statements. All my questions about my child's participation in this study have been answered to my satisfaction.

If you have any questions you may contact:

Primary researcher  
Todd Fleming

Faculty Advisor  
Tom Allen

Education and Human Development  585-395-2205

______________________________  __________________________
Signature of Parent  Date

Child's name __________________________
Appendix B: Division Pre-Test
Division Pre-Test

Directions: Divide. Remember to include remainders if needed.

(1) \(567 \div 7 = \) ________________

(2) \(756 \div 4 = \) ________________

(3) \(345 \div 9 = \) ________________

(4) \(1,000 \div 10 = \) ________________

(5) \(770 \div 77 = \) ________________
(6)  $156 \div 26 = \phantom{0000}$

(7)  $371 \div 53 = \phantom{0000}$

(8)  $9,927 \div 41 = \phantom{0000}$

(9)  $8,728 \div 11 = \phantom{0000}$

(10)  $5,628 \div 84 = \phantom{0000}$
Appendix C: Power Point Visual of How to set up a Division Problem
Divisor / Dividend = Quotient

DIVISION PROBLEM
Appendix D: Power Point Visual of Division of Whole Numbers
Divide Whole Numbers

How do we set up a division problem?

Example: 756 divided by 12

\[
12 \left[ \begin{array}{c} 756 \\ \hline 63 \end{array} \right. \quad \text{Quotient}
\]

12 \( ) \) 756

Or \( 756 \div 12 \)

- **Divisor**: Number by which another number is divided.
- **Dividend**: The number being divided by another number.
- **Quotient**: The answer to a division problem.
(1) Think in what Place Value will the first digit be.

12 ) 756  

How many times does 12 go into 756?

Tens Place

(2) Decide which number will be the first digit.

(3) Continue dividing until you can’t subtract anymore or there is a remainder.

(4) Check: Quotient times divisor. 63  

\[ \frac{x12}{756} \]

*Add remainder if needed.
Appendix E: Division Friday Quiz
Daily Quiz

Directions: Use the words in the word bank to label the parts of a division problem.

<table>
<thead>
<tr>
<th>Divisor</th>
<th>Dividend</th>
<th>Quotient</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

6 $\overline{18}$
Directions: Solve the problem. Show all work.

<table>
<thead>
<tr>
<th>(4)</th>
<th>(3)</th>
<th>(2)</th>
<th>(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>892</td>
<td>104</td>
<td>366</td>
<td>248</td>
</tr>
<tr>
<td>÷ 4</td>
<td>÷ 2</td>
<td>÷ 6</td>
<td>÷ 4</td>
</tr>
<tr>
<td>223</td>
<td>52</td>
<td>61</td>
<td>62</td>
</tr>
</tbody>
</table>
Appendix F: Division Post-Test
Division Post-Test

Directions: Divide. Remember to include remainders if needed.

(1)  $756 \div 4 = \underline{\hspace{2cm}}$

(2)  $567 \div 7 = \underline{\hspace{2cm}}$

(3)  $345 \div 9 = \underline{\hspace{2cm}}$

(4)  $371 \div 53 = \underline{\hspace{2cm}}$

(5)  $156 \div 26 = \underline{\hspace{2cm}}$
(6) \[ 8,728 \div 11 = \text{___________} \]

(7) \[ 9,927 \div 41 = \text{___________} \]

(8) \[ 770 \div 77 = \text{___________} \]

(9) \[ 4,240 \div 32 = \text{___________} \]

(10) \[ 5,628 \div 84 = \text{___________} \]
Appendix G: Bi-Weekly Grade Report
<table>
<thead>
<tr>
<th>Category</th>
<th>Class work</th>
<th>Homework</th>
<th>Tests/Quizzes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bi-Weekly Grade Report</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weeks 1-2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Teacher Comments**
Appendix H: Multiplication Pre-Test
Name: _______________________________ Date: ____________________

Multiplication Pre-Test

1. $2 \times 3 = \underline{\hspace{1.5cm}}$
2. $2 \times 4 = \underline{\hspace{1.5cm}}$
3. $2 \times 5 = \underline{\hspace{1.5cm}}$
4. $2 \times 6 = \underline{\hspace{1.5cm}}$
5. $2 \times 7 = \underline{\hspace{1.5cm}}$
6. $2 \times 8 = \underline{\hspace{1.5cm}}$
7. $2 \times 9 = \underline{\hspace{1.5cm}}$
8. $3 \times 3 = \underline{\hspace{1.5cm}}$
9. $3 \times 4 = \underline{\hspace{1.5cm}}$
10. $3 \times 5 = \underline{\hspace{1.5cm}}$
11. $3 \times 6 = \underline{\hspace{1.5cm}}$
12. $3 \times 7 = \underline{\hspace{1.5cm}}$
13. $3 \times 8 = \underline{\hspace{1.5cm}}$
14. $3 \times 9 = \underline{\hspace{1.5cm}}$
15. $4 \times 4 = \underline{\hspace{1.5cm}}$
16. $4 \times 5 = \underline{\hspace{1.5cm}}$
17. $4 \times 6 = \underline{\hspace{1.5cm}}$
18. $4 \times 7 = \underline{\hspace{1.5cm}}$
19. $4 \times 8 = \underline{\hspace{1.5cm}}$
20. $4 \times 9 = \underline{\hspace{1.5cm}}$
21. $5 \times 5 = \underline{\hspace{1.5cm}}$
22. $5 \times 6 = \underline{\hspace{1.5cm}}$
23. $5 \times 7 = \underline{\hspace{1.5cm}}$
24. $5 \times 8 = \underline{\hspace{1.5cm}}$
25. $5 \times 9 = \underline{\hspace{1.5cm}}$
26. $6 \times 6 = \underline{\hspace{1.5cm}}$
27. $6 \times 7 = \underline{\hspace{1.5cm}}$
28. $6 \times 8 = \underline{\hspace{1.5cm}}$
29. $6 \times 9 = \underline{\hspace{1.5cm}}$
30. $7 \times 7 = \underline{\hspace{1.5cm}}$
31. $7 \times 8 = \underline{\hspace{1.5cm}}$
32. $7 \times 9 = \underline{\hspace{1.5cm}}$
33. $8 \times 8 = \underline{\hspace{1.5cm}}$
34. $8 \times 9 = \underline{\hspace{1.5cm}}$
35. $9 \times 9 = \underline{\hspace{1.5cm}}$
36. $12 \times 10 = \underline{\hspace{1.5cm}}$
37. $13 \times 6 = \underline{\hspace{1.5cm}}$
38. $123 \times 4 = \underline{\hspace{1.5cm}}$
39. $15 \times 9 = \underline{\hspace{1.5cm}}$
40. $17 \times 4 = \underline{\hspace{1.5cm}}$
Appendix I: Power Point Visual of Multiplication
**Multiplication Patterns**

**Factor** - A number multiplied to give a product.

Ex: \(4 \times 5 = 20\)

- factors

**Product** - The answer to a multiplication problem.

Ex: \(4 \times 5 = 20\)

- product

**Multiple** - The product of any two whole numbers.

Ex: \(4 \times 7 = 28\) - Becomes multiple of 7 or 4
1. Multiply the first numbers (digits).

Ex: $60 \times 30 = \underline{60} \times \underline{30} = \underline{18}$

2. Count the number of zeros in each factor (number).

Ex: $30 \times \underline{60} = 2$ zeros
Write that many zeros to the right of the product found in Step 1.

Ex: \[
\begin{array}{c}
60 \\
x 30 \\
\hline
1,800 \\
\end{array}
\]

\[
\begin{array}{c}
60 \\
x 30 \\
\hline
00 \\
\end{array}
\]

\[
\begin{array}{c}
+1800 \\
\hline
1,800 \\
\end{array}
\]
Appendix J: Multiplication Friday Quiz
<p>| | | | | | |</p>
<table>
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<th></th>
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<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>1.</td>
<td>741</td>
<td>x 21</td>
<td></td>
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</tr>
<tr>
<td>2.</td>
<td>23</td>
<td>x 57</td>
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<tr>
<td>3.</td>
<td>521</td>
<td>x 53</td>
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<tr>
<td>4.</td>
<td>214</td>
<td>x 11</td>
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<td></td>
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<tr>
<td>5.</td>
<td>77</td>
<td>x 50</td>
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<td>6.</td>
<td>944</td>
<td>x 25</td>
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<td>7.</td>
<td>15</td>
<td>x 16</td>
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<td>74</td>
<td>x 28</td>
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<td>9.</td>
<td>521</td>
<td>x 43</td>
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<td>10.</td>
<td>42</td>
<td>x 70</td>
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<tr>
<td>11.</td>
<td>25</td>
<td>x 46</td>
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<tr>
<td>12.</td>
<td>969</td>
<td>x 49</td>
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<tr>
<td>13.</td>
<td>76</td>
<td>x 33</td>
<td></td>
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<tr>
<td>14.</td>
<td>198</td>
<td>x 60</td>
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<tr>
<td>15.</td>
<td>93</td>
<td>x 33</td>
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<td>16.</td>
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<td>x 51</td>
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<td>17.</td>
<td>84</td>
<td>x 91</td>
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<tr>
<td>18.</td>
<td>52</td>
<td>x 98</td>
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<td>19.</td>
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<td>x 65</td>
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<tr>
<td>20.</td>
<td>938</td>
<td>x 63</td>
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</table>
Appendix K: Multiplication Post-Test
Name: ____________________________ Date: ________________

**Multiplication Post-Test**

1. 2 x 3 = ________________
2. 2 x 5 = ________________
3. 2 x 4 = ________________
4. 2 x 6 = ________________
5. 2 x 7 = ________________
6. 2 x 9 = ________________
7. 5 x 7 = ________________
8. 2 x 8 = ________________
9. 3 x 4 = ________________
10. 3 x 5 = ________________
11. 3 x 6 = ________________
12. 3 x 7 = ________________
13. 3 x 8 = ________________
14. 9 x 9 = ________________
15. 4 x 4 = ________________
16. 4 x 5 = ________________
17. 4 x 6 = ________________
18. 4 x 7 = ________________
19. 15 x 9 = ________________
20. 4 x 9 = ________________
21. 5 x 5 = ________________
22. 5 x 100 = ________________
23. 3 x 3 = ________________
24. 5 x 8 = ________________
25. 5 x 9 = ________________
26. 6 x 6 = ________________
27. 6 x 7 = ________________
28. 123 x 4 = ________________
29. 6 x 9 = ________________
30. 7 x 7 = ________________
31. 7 x 8 = ________________
32. 7 x 9 = ________________
33. 8 x 8 = ________________
34. 8 x 9 = ________________
35. 3 x 9 = ________________
36. 12 x 10 = ________________
37. 13 x 6 = ________________
38. 6 x 8 = ________________
39. 4 x 8 = ________________
40. 17 x 4 = ________________
Appendix L: Student Achievement Progression Form
Student Achievement Progression Form

<table>
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<tr>
<td>90</td>
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<td>85</td>
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<td>75</td>
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<td>70</td>
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<td>60</td>
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Student Number: ___________
Appendix M: Student Motivation Progression Form
### Student Motivation Progression Form

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<tr>
<td>7</td>
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<tr>
<td>6</td>
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<tr>
<td>5</td>
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<td>3</td>
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Student Number: __________________
Appendix N: Student Progress Report
<table>
<thead>
<tr>
<th>Student Progress Report</th>
<th>Likert Score</th>
<th>Student Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Comments</td>
<td></td>
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</table>

- Categories of Improvement
- Understanding of mathematical Concepts
- Level of Motivation
- Class Average for the Week