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A comparison of traditional instruction and standards-based instruction on seventh-grade mathematics achievement

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A COMPARISON OF TRADITIONAL INSTRUCTION AND STANDARDS-BASED INSTRUCTION ON SEVENTH-GRADE MATHEMATICS ACHIEVEMENT

By

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INSTRUCTION ON SEVENTH-GRADE

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The purpose of this study was to determine if method of instruction, standards-based or traditional, had an impact on student mathematics achievement. More specifically, this study sought to determine if students taught using the *JBHM Achievement Connections*® standards-based method of instruction would show higher academic gain than students taught using a traditional method of instruction through the use of *Mathematics: Applications and Connections, Course 2*® in seventh-grade. The research design was a quasi-experimental design, with 65 students participating. Group A received a traditional method of instruction through the use of *Mathematics: Applications and Connections, Course 2* and Group B received a standards-based method of instruction through the use of *JBHM Achievement Connections*. The test instrument administered for the pretest and posttest was the *PLATO eduTest*®. An analysis of the pretest and posttest scores was conducted. T-tests were run to examine the differences between pretest and posttest scores and gender, based on the method of instruction.

Analysis of variance (ANOVA) was computed to examine differences in performance based on class period representation. A paired t-test was computed to examine differences between the pretest and posttest scores after students were exposed to a method of instruction.

After the data was collected and analyzed, the findings showed that there were no statistical differences in student achievement between students taught using *JBHM Achievement Connections* standards-based method of instruction (Group A) and those students taught using *Mathematics: Applications and Connections, Course 2* traditional method of instruction (Group B) as measured by the *PLATO eduTest* scores. Students taught using the *JBHM Achievement Connections* standards-based method of instruction and the *Mathematics: Applications and Connections, Course 2* traditional method of instruction both showed increased mathematics outcomes. However, the students taught using *JBHM Achievement Connections* standards-based method of instruction had a higher mean score and a greater degree of gain between pretest and posttest scores than the students taught using the *Mathematics: Applications and Connections, Course 2* traditional method of instruction.

DEDICATION

I would like to dedicate this research to the honor and glory of God and to my parents, Patricia and Curtis Kemp, my daughter, Camry O'Shae' Buckhalter, and my siblings, Kalilah and Curtis. In addition, I would like to dedicate this research to a special friend, James Tompkins, Jr. Your words of encouragement, support and wisdom have inspired me to accomplish this goal.

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INTRODUCTION

A great deal of debate exists concerning improving academic outcomes for all students using scientifically proven methods of instruction. American mathematics education came under great scrutiny in the late 1980's. Popular press, educational publications, journal articles, major conference presentations, and the United States Department of Education voiced concerns about the mathematics achievement of United States students (Ysseldyke, Spicuzza, Kosciolek, & Boys, 2003).

> The results of the Third International Mathematics and Science Study indicated that eighth grade students in the United States scored below the international average in mathematics, and eighth graders in 20 other countries scored statistically significantly higher in mathematics than United States eighth graders (Yesseldyke, Spicuzza, et al., 2003).

Educators attempted to respond to these findings by increasing student mathematics achievement by identifying and implementing effective instructional techniques (Ysseldyke et al., 2003).

Educational reform is a process to improve our school system. In order to enhance student mathematics achievement and to address the educational needs of students, educators must adhere to mathematics standards. The National Council of Teachers of Mathematics (NCTM, 1989) developed standards and goals for mathematics education. The Council's core goal is the development of students who are mathematically literate or who have mathematical power (Reed, 2004). Reed (2004) indicated that k-12 students must learn to value mathematics, become confident in their ability to do mathematics, become mathematical problem solvers, and learn to communicate and reason mathematically. Recommendations of mathematics standards published by The NCTM (1989) promote engaging students in discourse investigations, involving students in discourse about mathematical ideas, and solving real-world problems. The standards are meant to serve as a vision of how mathematics should be taught in schools. Proper implementation of the standards in schools will affect the mathematics achievement of students.

The needs of some students cannot be met within the general mathematics curriculum (Berry, 2005). Students need flexible learning materials in order to provide equity in mathematics education. Therefore, educators must reevaluate the current mathematics curriculum. The NCTM (2000) addressed the subject of equity (McKenna, Hollingsworth, & Barnes, 2005). To further support equity in mathematics education, The NCTM standards have been revised to focus on a new consensus about effective mathematics instruction. According to the NCTM, school districts throughout the country will have to reevaluate the content of mathematical programs they implemented over the past 10 years (Evers & Milgram, 2000).

Educational curricula and teaching methods are changing. Changes in these two educational components have resulted in a shift in focus of current pedagogical practices. Instead of using traditional models, teachers have begun to use a transactional curriculum. The transactional curriculum requires students to be actively engaged in learning, whereas in the traditional model the teacher acts as the sole facilitator of knowledge while the students intake facts (Gray, n.d).

As the nation began to focus closely on ways to improve student achievement in schools, President Bush signed into law the *No Child Left Behind Act (NCLB), 2002* (Flynn, Lawrenz, & Schultz, 2005). A key principle of NCLB is educational accountability. Educational accountability requires districts that accept Title I funds to adopt higher standards in reading, language arts, and mathematics. Another principle was the development and implementation of evaluation tools to measure academic progress in core subject areas. The requirement for states to adopt higher standards is an administrative solution for ensuring schools use scientifically based methods. The standards must entail the development of higher-order thinking and problem solving skills in all students. Content and instructional practices in mathematics should be aligned with national standards (Flynn, Lawrenz, & Schultz, 2005).

States began to reevaluate the instructional practices and curricula and ponder on ways to close the achievement gap. States had to make sure that all students achieve proficiency, are given more flexibility, and are taught based on what works. States adopted higher standards to address the achievement gap, required that instruction be provided by highly qualified teachers, and mandated that steady assessments and progress be shown.

Local school districts adopted their state's plan of reevaluating the instructional practices and curricula by placing emphasis on holding students, teachers, administrators, and school districts accountable for the academic achievement of all students. For that reason, new forms of curriculum materials were adopted, and states mandated that assessments become aligned with national standards by introducing the concept of standards-based curricula and standards-based instruction.

Curricula that are linked to the standards and supported by the National Science Foundation are referred to as standards-based curricula (Trafton, Reys, & Wasman, 2001). Teaching and learning mathematics that can be used in the daily lives of students are emphasized by the new curricula concept of standards-based curricula (Montague, Warger, & Morgan, 2000). The NCTM relevancy to real-world mathematics experiences uses problem solving as its centerpiece for mathematics instruction. There is a link between mathematics content and mathematical processes in standards-based curricula. The belief is that problem solving, reasoning, communication, and representation should be learned and used by all students (Trafton, Reys, & Wasman, 2001).

Standards-based instruction presents a view of mathematics learning, teaching, and assessment that shifts the focus of curriculum and instruction from traditional mathematics that consists of memorization, rote learning and application of facts and procedures to conceptual understanding and reasoning (Goldsmith & Mark, 1999). Standards-based instruction emphasizes the development of conceptual understanding and reasoning. Standards-based instruction moves toward more active student engagement with mathematical ideas through collaborative investigations, hands-on explorations, the use of multiple representation and discussions and writing (Goldsmith & Mark, 1999). Students being actively involved and building their own understanding is based on the educational perspective called constructivism.

Statement of the Problem

The platform for the NCTM (1989) was "mathematical literacy and power for all students." Documents published by the NCTM revealed its vision of mathematics by promoting problem solving, student reasoning, and classroom discussion. Testing and curricula recommendations had shifted toward the standards in more than half of the 50 states by 1993.

Standards-based instruction's benefits have been debated in various educational communities. The fact that scores on the mathematics section of the National Assessment of Educational Progress rose substantially between 1990 and 2000 is stressed by many proponents of the standards (Lubienski, 2004). The substantial rise in mathematics scores on national assessments could prompt states to reevaluate the methods of instruction to determine what method of instruction works best at the state level.

The NCTM vision of mathematics teaching has prompted educational communities to reevaluate instruction. Standards-based instruction is one method that has placed emphasis on mathematical literacy and problem solving in order to improve student achievement. States have begun to implement this method of instruction as a way to improve student achievement.

The problem of the study was to determine if a standards-based method of instruction through the use of *JBHM Achievement Connections®* or a traditional method of instruction through the use of *Mathematics: Applications and Connections, Course 2®* had an impact on student mathematics achievement at the middle school level. More specifically, this study was to determine if students taught using *JBHM Achievement*

Connections standards-based program made higher academic gain than students taught using *Mathematics: Applications and Connections, Course 2* traditional program as measured by *PLATO*, *eduTest*.

JBHM Achievement Connections is a standards-based mathematics program whose curriculum is aligned with the state-adopted standards curriculum. Research based *JBHM Achievement Connections* is a result driven program that tightly aligns assessments, instruction, and curriculum together to increase student achievement (www.jbhm-edgroup.com).

Mathematics: Applications and Connections Course 2 textbook is a three-text middle school series intended to bridge the gap from elementary mathematics to middle school mathematics (Collins, Dritsas, Frey, Harris, Ott, Pelfrey, et al., 2001).

As stated in the PLATO online brochure:

> *PLATO eduTest* is an online assessment system as well as a pencil paper assessment. Over 12 million tests have been scored since 1966. *PLATO eduTest* assessment uses a variety of benchmark tests formulated on state and national standards. This assessment tool has a test bank of over 180,000 items in math, reading, language arts, science, and social studies as well as reporting options for formative assessments for districts, schools, and teachers. *PLATO eduTest* assessments offer flexible test administration options and comprehensive detailed reports for answers chosen. It allows districts and schools to test and re-test to evaluate how students are doing in comparison with the state standard curriculum, standards, and/or instructional frameworks (www.plato.com).

Purpose of the Study

For the past two years, more than 50% of the seventh-grade students at a middle school in the Mississippi Delta region have performed in the minimal and basic categories on the mathematics sub-test of the *Mississippi Curriculum Test (MCT)*. A sub-test is one of a battery of related test (www.wordreference.com). The *Mississippi*

Curriculum Test is a criterion-referenced test based on the state's curriculum and is administered to students in grades 2-8 (www.mde.k12.ms.us). The Mississippi Curriculum Test assesses students in the areas of language, reading, and mathematics. The Mississippi Curriculum mathematics sub-test is utilized as the district's standardized test. As a result, a middle school in the Mississippi Delta region district decided to adopt a standards-based mathematics program for all seventh-grade students. *JBHM Achievement Connections* is a standards-based mathematics program whose curriculum is aligned with the state-adopted standards curriculum. The purpose of this study was to examine the impact of *JBHM Achievement Connections* seventh-grade mathematics program, a standards-based program, and a traditional program have on student mathematics achievement. Educators today are faced with enormous challenges to simultaneously reach large numbers of students, as educational systems feel the pressure to improve the academic performance of their students.

Research Questions

In order to address the problem of this study, the researcher developed ten research questions designed to assess the impact of the two teaching strategies on the student academic performance. The research questions were:

1. What was the academic performance, as measured by pretest/posttest scores, when seventh-grade students were taught using the *JBHM Achievement Connections*, a standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?

2. What was the academic growth of students within the seventh-grade mathematics sections, as measured by the pretest/posttest scores, when taught using the *JBHM Achievement Connections,* a standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
3. What was the academic growth between the seventh-grade students taught using the *JBHM Achievement Connections*, standards-based method of instruction in comparison to the seventh-grade students who were taught using *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
4. What was the academic achievement of the seventh-grade males and females taught using the *JBHM Achievement Connections*, standards-based method of instruction, as measured by the *PLATO eduTest*?
5. What was the academic achievement of the seventh-grade males and females taught using *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
6. Was there a significant difference in academic performance as measured by pretest/posttest scores when seventh-grade students are taught using the *JBHM Achievement Connections*, a standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
7. How do students within the seventh-grade mathematics sections differ in academic growth in their pretest/posttest scores when taught using the *JBHM*

Achievement Connections, a standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?

8. Was there a significant difference in academic growth between the seventh-grade sections taught using the *JBHM Achievement Connections*, standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
9. Was there a significant difference in academic achievement between the seventh-grade males and females taught using the *JBHM Achievement Connections*, standards-based method of instruction, as measured by the *PLATO eduTest*?
10. Was there a difference in academic achievement between the seventh-grade males and females taught using *Mathematics: Applications and Connections, Course 2* a traditional method of instruction, as measured by the *PLATO eduTest*?

Theoretical Framework

The movement to reform mathematics education began in the mid 1980's in response to the documented failure of traditional methods of teaching mathematics, to the curriculum changes necessitated by the widespread availability of computing devices, and to a major paradigm shift in scientific study of mathematics learning (Battista, 1999). Mathematics reform recommendations have been made in the Curriculum and Evaluation Standards for School Mathematics published by the NCTM in 1989. Reform recommendations dealt with how mathematics is taught, which mathematics are taught, and at a more fundamental level, the very nature of school mathematics (Battista, 1999).

With the newest wave of reform, some mathematical programs have called for teachers to move away from teaching by telling and move toward a constructivist teaching paradigm (Draper, 2002). Constructivism is the philosophy or belief that learners create their own knowledge based on interactions with their environment including their interactions with other people. Gray (n.d.) defines constructivism by reference to four principles: (a) learning depends on what we already know; (b) new ideas occur as we adapt and change our old ideas; (c) learning involves inventing ideas rather than mechanically accumulating facts, and (d) meaningful learning occurs through rethinking old ideas and coming to new conclusions about new ideas. Constructivism draws on the developmental work of Piaget and Kelly (Gray, n.d.). Constructivists recognize that experience and environment play a large role in how well the learner learns. Constructivists also believe that language plays a key role in the acquisition of knowledge (Draper, 2002).

Constructivism represents a learning theory and perspective that has been central to the research reported in mathematics education journals in recent years (Draper, 2002). Constructivism, as a theory of learning, can provide the framework needed to help mathematics teachers move from a transmission model to one in which the learner and the teacher work together to solve problems, engage in inquiry, and construct knowledge (Draper, 2002). In addition, constructivists provide the structure and support necessary to move students from the inability to perform a particular task, to the ability to perform it and with repeated exposure, to the ability to perform it unassisted. As a result, mathematics reformers hope to challenge the beliefs and routines of school mathematics tradition in order to help students gain meaningful, lasting and useful mathematical knowledge.

Assumptions

The following assumptions were made regarding the present study:

1. It is assumed that all students received the same amount of instructional time.
2. It is assumed that all students were taught mathematics objectives from the *Mississippi Mathematics Framework.*
3. The *PLATO eduTest* provided a valid and reliable pretest/posttest measure of mathematics achievement.
4. Student participation in the standards-based method of instruction and the traditional method of instruction during the nine-week time frame was sufficient to affect student performance outcomes.

Limitations

The following limitations were made regarding this study:

1. The study consisted of four intact seventh-grade classes.
2. The study consisted of students of low socio-economic statuses.
3. The study was in a rural area in the Mississippi Delta.
4. One teacher taught all four sections of the mathematics classes.
5. The study was conducted for a nine-week period.
6. The study cannot be generalized to any other middle school.

Delimitations

The following delimitations were made regarding this study:

1. The study was conducted in four self-contained classes that were previously randomly assigned by a computer program at the beginning of the school year. This computer program was used by the targeted school to automatically schedule students in classes, track attendance and discipline, and to post student grades.
2. There was no attempt to distribute students equally according to gender in the classrooms.
3. The study was conducted in one school.
4. The study was conducted during the Fall semester, 2006.
5. Teacher characteristics, such as attitude, could pose a threat to the internal validity.

Definition of Terms

To ensure clarity and to facilitate understanding of this study, the researcher has defined the following terms:

Academic Achievement represents the students' scale scores on the mathematics test that was administered. Scale scores are numeric scores ranging from 0-100 assigned to students based on their performance.

Academic Growth refers to the improvement of test scores between the pretest and posttest.

Academic Performance refers to students' level of performance on the mathematics test for this study. Performance levels are referenced as Advanced (100%-86%), Proficient (85%-76%), Basic (75%-66%), and Minimal (65%-0%). These performance levels are also called categories.

Constructiveness is knowledge constructed by learners through an active mental process of development; learners are the builders and creators of meaning and knowledge (Gray, n.d.).

JBHM Achievement Connections® refers to a scripted standard-based instructional program that consists of pretests and posttests, guided and independent practice materials, and lesson plans. This is an out-of-the-box guide to providing mathematics instruction (wwwjbhm-edgroup.com).

Mathematics: Applications and Connection Course 2® textbook is a three-text middle school series intended to bridge the gap from elementary mathematics to middle school mathematics (Collins, W., et al., 2001).

Mississippi Curriculum Test (MCT) is a criterion-referenced test based on the state's curriculum and is administered to students in grades 2-8. Grades 3 and 7 are benchmark grades, meaning a student who does not meet the benchmark must receive remediation the following school year and retake the test in January. Student performance on the grade 3 and 7 benchmarks is used along with other data to determine whether the student should be promoted to the next grade (www.mde.k12.ms.us).

PLATO eduTest is an online assessment system as well as a pencil paper assessment. Over 12 million tests have been scored since 1966. *PLATO eduTest* assessment uses a variety of benchmark tests formulated on state and national standards (www.plato.com).

Standards-Based Instruction emphasizes the development of conceptual understanding and reasoning. Students are more actively engaged with mathematical ideas through collaborative investigations, hands-on explorations, multiple representations, and discussion (Goldsmith & Mark, 1999).

Standardized Test is the measurement of the structure of knowledge a pupil has developed in some particular defined area of learning (Cable, 2000). These tests measure how students compare with each other (norm-referenced) or how much of a particular curriculum they have learned (criterion-referenced) (www.FairTest.org).

Student Achievement is the primary, but not only, measure of success when evaluating the effectiveness of the system's performance (www.assumption.k12.la.us)

Traditional Instruction is a teacher-centered, hierarchically organized and individually assessed method of instruction (Herrington, Oliver, Herrington & Sparrow, 2000).

Traditional Mathematics is the term used for the style of mathematics instruction used for a period in the 20th century before the appearance of reform mathematics based on NCTM standards, so it is best defined by contrast with alternatives (www.wikipedia.org).

Rationale for the Study

Across the country, educators are revising the instructional strategies, the grouping practices, and the curriculum in mathematics education (Reed, 2004). Providing a curriculum that is designed to enhance mathematical learning and grouping students heterogeneously is a major thrust of the reform movement in mathematics education (Reed, 2004). The *Principals and Standards for School*

Mathematics Video (NCTM, 2000) revealed that United States students deserve and need the best mathematical education possible.

In a middle school in the Mississippi Delta region, school board members, the superintendent, building level administrators, and teachers have expressed eminent concern for the high percentage of seventh-grade students performing at the basic and minimal categorical levels on the *Mississippi Curriculum Test*. Table 1 shows the percentage of seventh-grade students at a middle school in the Mississippi Delta Region who scored at the basic and minimal category on the *Mississippi Curriculum Test* during the 2003/04 through 2004/05 school years. During the 2003/04 school term, of the 81 students enrolled in seventh-grade mathematics, 67% scored below proficient on the mathematics subtest of the *Mississippi Curriculum Test*. Furthermore, during the 2004/05 school term, of the 96 students enrolled in seventh-grade mathematics, 84% scored below proficient on the mathematics subtest of the *Mississippi Curriculum Test*. Because of the growing concern for improving student academic performance and making students more competitive in the academic arena, this research may assist the school district and educational administrators in assessing the current academic agenda and reevaluating the curriculum taught to seventh-grade students. As Table I shows, the majority of students have not been performing at the basic level in mathematics on the *Mississippi Curriculum Test*.

Results of this research study could be a key component in the decision-making process of the school district, as it could help to determine student needs, guide the instructional decisions of the school district, and establish the best course of action for academic improvement. The *PLATO eduTest* quickly identifies strengths and needs for students, classrooms, schools, or the entire district. The data gathered could be used to improve instruction, as well as student performance, since it is believed that positive student achievement is associated with the systematic use of data-driven decision-making.

Table 1 Percentages of Seventh-Grade Students' MCT Scores

School Year	Enrollment	Basic Category	Minimal Category	Total
2002-03	101	17%	33%	50%
2003-04	81	19%	48%	67%
2004-05	96	38%	46%	84%

Source: Mississippi Department of Education, Office of Research and Statistics (2005).

Summary

Educators are continually trying to teach students in a more efficient and effective manner. Debates exist concerning ways to improve academic outcomes for all students using scientifically proven methods of instructions. This study attempts to explore two methods of instruction, traditional instruction through the use of *Mathematics: Applications and Connections, Course 2* and standards-based instruction through the use of *JBHM Achievement Connections*. This chapter presented the need to examine the performance of seventh-grade students based on their exposure to *JBHM Achievement Connections* standards-based method of instruction and the *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction.

This middle school in the Mississippi Delta region has been experiencing high percentages of seventh-grade students scoring in the minimal and basic categories on the mathematics subtest of the *MCT*. The targeted school's administration expressed concerns about the high percentages, and the researcher decided to investigate the method of instruction. Chapter II presents a review of the literature pertinent to the study.

CHAPTER II

LITERATURE REVIEW

One of the United States greatest accomplishments is public education. Our public schools offer a toll free road to success, prosperity, and happiness. Even though the United States education system has been recognized for its achievements, it also has received a widespread amount of criticism (Broland & Michael, 1984). In recent years, public attention has focused on the general failure of the American education system to prepare students adequately for careers that require advanced mathematics and science skills (Reed, 2004). Furthermore, *TIMSS* (National Center for Education Statistics, 1999) reported that overhauling America's educational system is vital if United States middle and high school students are ever to achieve the levels of math proficiency demonstrated by their international peers (Reed, 2004). Numerous mandates have been issued by legislators toward improving the quality of public education.

How to properly repair the educational system remains unclear (Aaron, 1996). Manzo (1997) added that many problems in mathematics could be attributed to inconsistencies in expectations, curriculums, and low academic standards. As a result, many children are failing to excel in mathematics. Students in the United States are attributing their lack of achievement to a mathematics curriculum that introduces a large number of topics that are not being taught for mastery (Checkley, 1997). The current mathematics curriculum introduces topics that are not taught in depth. However, mathematic topics are taught to students in other countries until mastery is achieved. After mastery is reached, the topics are discontinued (Reed, 2004).

A national agenda set forth by the United States government placed emphasis on mathematics achievement through its national education goals, *Goals 2000* (United States Department of Education, 1994). This legislation was, perhaps, the most prominent and most country-wide adopted national education initiative ever developed by the Bush Administration (Lawton, 1998). Goal five of *Goals 2000* stressed that by the year 2000, students in the United States would be first in the fields of mathematics and science (United States Department of Education, 1994). Nonetheless, United States eighth-grade students are still far from reaching the national goal of being first in the world of mathematics and science achievement because they rank below the international average in mathematics and science (Checkley, 1997). The National Center for Education Statistics (1995) reported:

> Proficiency in mathematics is an important outcome of education. In an increasing technological world, the mathematics skills of the nation's workers are a crucial component of economic competitiveness. In addition, knowledge of mathematics is critical for success in science, computers, and a number of other selected fields of study. (p.58)

Proficiency in the language of mathematics is becoming an increasingly vital skill for all individuals in today's society. More than 10 years ago, the United States Department of Labor (1991) recognized the growing emphasis placed on technology in the workplace. During a testimony before the United States Congressional House Committee on Education and the Workforce, Ehlers (1999) revealed that because of the extreme need for an overhaul of the education system, his challenge as an educator was to improve math and science education in the United States. However, recent national studies indicate that at the current level of performance, United States students will not have the necessary skills to meet the changing demands of the United States workplace. According to Ysseldyke, Betts, Thill, & Hanning, (2004) the 1996 National Assessment of Educational Performance results revealed that only 21% of fourth-grade students are performing at or above proficiency in mathematics. Many educators are debating the best ways to increase math achievement levels of United States middle and high school students given the pressing need for mathematics proficiency.

What is Mathematics?

According to Lewis (n.d.) mathematics is not about answers, it is about processes. Mathematics is an instructional area in which the opportunity to learn has a direct effect on achievement. The development of students with mathematical skills is a primary goal of instruction in schools. Mathematics is defined as a language that is used to express relations between and among objects, events, and times (Clarke & Shinn, 2004). Mathematics skills are developed through undertaking challenging problems and comprehending complex ideas (Yesseldyke, Betts, Thill, & Hannigan, 2004). It must be used as a direct function of teaching.

Mathematics is defined by students as how they do math; however, if the mathematical focus were understanding concepts and making them meaningful, students would have a different definition (Burns, 2004). Acquiring the ability to apply skills to new real-life situations can be learned by all students. In order to obtain that ability, the philosophy of teaching and learning mathematics must change. Students must be actively involved in creating their own knowledge, instead of memorizing steps. Mathematics can be learned as an application of skills.

Mathematics is sometimes viewed as a foreign language that students must practice using (Burns, 2004). Mathematics has been an integral part of the human search for understanding for thousands of years. Many discoveries in mathematics have evolved through everyday occurrences. Some discoveries were made as an attempt to describe the world, while others were derived in an attempt to form inevitable truth about logic (Lewis, n.d.). Today, mathematics is more about expression and understanding. As a result, mathematics is more important than ever before. In order to become proficient, and embrace the importance of mathematics, students must have the ability to hear, write, and speak mathematics (Higgins, 1997).

Discovery and problem solving have been mathematical teaching methods used by mathematics educators. Problem solving exists as a relationship between the learner and a task. According to Higgins (1997), problem solving can be an observation for one person, a puzzle for another, and a condition in which he is acquainted. There are several mathematical works that lead to successful problem solving. These mathematical work include: (a) grasping the problem to determine what is clear and what is to be learned, (b) planning the work to determine how to gather the information needed, (c) execution of the plan to actually work the task to see if the plan will work or will not work, and (d) testing the results (Higgins, 1997).

Today, mathematics is used not only in classrooms but also outside the classroom. Students must understand why and how to perform a certain operation and be able to explain the results. Furthermore, the ability to reason, explain and communicate mathematics is a need of all students. The way in which mathematics is taught contributes to students being able to just do mathematics or understand mathematics.

A change has been called for mathematics instruction by the NCTM and the National Research Council (NRC; Higgins, 1997). The change evolved from the view that there is an overemphasis of computational arithmetic skill and less understanding and problem solving. Traditionally, mathematics curricula and instruction had revolved around a set of memorized computational skills and had been taught following scripted schedules. These schedules gave the projected progression through the acquisition and proficiency of the skills to be taught (Battista, 1999).   While computational proficiency is agreed upon by researchers and mathematics educators, they feel that there is much more to mathematics. The quest now is to determine what it means to know, understand, and learn mathematics (Higgins, 1997).

Curriculum Reform

Improving academic outcomes for all students using scientifically proven methods of instruction and intervention is a constant of many research and policy efforts (Niebling, 2005). An increased focus on accountability has been manifested in requirements that educators monitor students' progress toward meeting goals and objectives was noted in the Individuals with Disabilities Education Act (Hosp & Hosp, 2003). Identifying appropriate ways for teachers to assess students' skills has resulted in the development of curriculum reform.

One factor educators addressed to increase mathematics achievement levels was curriculum reform. While the academic curricula changes to meet the needs of a changing society, instruction must also. According to Miller, Butler, and Lee (1998) the traditional model, in which the teacher demonstrates the procedures needed to solve a problem and then provides time for drill and practice, does not meet the educational needs of all learners. In addition, solving mathematical problems requires more reasoning and communication skills that are usually not emphasized using the typical textbook approach.

Curriculum reform in mathematics is based on the principle that mathematics is a way of thinking that relies on the ability to understand, and represent problem situations. Additionally, curriculum reform in mathematics organizes and classifies relevant information. Furthermore, curriculum reform draws on appropriate mathematical knowledge and know where, when, how, and why to apply that knowledge. Curriculum reform explains the concepts underlying problem, solutions, and why creating procedures are used (NCTM, 1995). The traditional and conventional mathematics curriculum is based on declarative and procedural knowledge with little regard for developing conceptual and strategic knowledge in students (Montague, Warger, & Morgan, 2000). The NCTM Standards promote using problem solving as the centerpiece for mathematics instruction. Mathematics, as outlined by the new curricula concepts, emphasizes teaching students to use mathematics by implementing it in their daily lives (Montague, Warger, & Morgan, 2000).

Classroom instruction shifts in order to adhere to a curricular reform (Jacobs, 2006). There are five major shifts that occur: (a) classrooms are no longer viewed as a group of individuals but as learning communities; (b) results are verified by mathematical evidence, not solely on the teacher; (c) mathematical reasoning is encouraged instead of memorization; (d) more problem solving and reasoning is required instead of automatic answer finding; and (e) make connections through the use of prior knowledge (McCaffrey, et al., 2001). These instructional changes should be noted in the classrooms by the tasks chosen by the teacher, the teacher-student interaction, the classroom environment and the assessments of the teaching and learning process (McCaffery et al., 2001).

Performing procedures was how mathematics was taught in early years (Burns, 2004). Memorizing definitions, rules, and formulas were the major requirements for students. Success in mathematics rested on if students could do mathematics quickly and without much thought (Burns, 2004). Today, it is apparent that in order for mathematics skills used in the classroom to be implemented outside of the classroom, students must have a full understanding of the processes that are taking place. Understanding the processes means that students can not only perform the operation, but also comprehend why the process is successful and have the ability to fully understand the results. As students acquire the ability to comprehend all aspects of a process, they are more likely to know when it is appropriate to implement what they have (Burns, 2004).

It is quite challenging to implement the components of effective instruction and to manage mathematics learning experiences (Yesseldyke, Betts, et al., 2004). The needs of most students cannot be met within the limits of the general mathematics curriculum. McKenna, Hollingsworth and Burns (2005) wrote that mathematics builds upon itself. It is exceedingly difficult to enrich a student without actually accelerating his or her study of mathematics. Teachers struggle with the realization that their classrooms contain students with a wide range of skills. Teachers are constantly searching for ways to effectively teach the entire range of student skills. Integrating effective instruction to meet the needs of all students is overwhelming. Teachers would benefit more from a systematic way to manage the needs of the students. The idea is to study the structural and sequential quality of instruction as it is delivered and its effects on students' academic responses (Ysseldyke, Spicuzza, et al, 2003).

Today, teachers face the challenge of managing a vast number of instructional and non-instructional responsibilities (Hosp & Hosp, 2003). Teachers must balance their time and schedule between collecting data on students and providing meaningful instruction on academics. It is essential that educators design instruction that accelerates rates of academic behaviors and increases times in which teachers use specific, effective instructional arrangements and formats (Ysseldyke, Spicuzza, et al., 2003).

According to Hoff (2002) a panel of eight educators and mathematicians are starting to review whether federally financed curricula, based on voluntary national mathematics standards, help raise student achievement. The panel is reviewing studies evaluating the new curricula to decide whether the studies are rigorous enough to draw definitive conclusions about the effectiveness of the programs (Hoff, 2002). The federally funded programs curriculum is aligned with the 1989 standards published by the NCTM. The curricula introduced topics not previously covered in certain grades-such as statistics in the elementary years and de-emphasized some of the skills commonly taught by repetition and memorization, such as multiplication tables. The current standards movement rests on the assertion that virtually all students can reach high levels of achievement if they receive high-quality curriculum and instruction (Hoff, 2002).

Ysseldyke, Betts, et al. (2004) provided examples of programs that have been actively trying to implement and manage a successful reform of mathematics learning. They indicated that the most effective math programs involve challenging curriculum and instructional materials, intensive and ongoing professional development, time for planning and collaboration, and the use of mathematics specialists and master teachers. Yesseldyke and Christensen (1987) identified some instructional features broadly grouped as planning, managing, delivering and evaluation that are related to improved student achievement.

The goal of educators is to provide the best education for all students. However, the instructional methods seem to not reach all students (Morrell, Flick, & Wainwright, 2004). Traditional instructional is the method of instruction known to all students. A review of traditional education will provide a closer look into its operations.

Traditional Instruction

Traditional instruction is a pedagogical approach held in contempt by many in the educational community. For most of the 20th century, traditional instruction has been the dominant method of instruction in classrooms. When defined, traditional instruction is a teacher-centered, hierarchically organized and individually assessed method of instruction (Herrington, Oliver, Herrington, & Sparrow, 2000). According to Herrington, et. al. (2000) many studies assume the reader knows what is meant by the term traditional instruction, whereas, many research studies do not define it at all. As a result, some authors define it by means of the characteristics of traditional instruction.

Characteristics of Traditional Instruction

A major characteristic of traditional instruction places emphasis on content and skills. Traditional instruction promotes generalized theoretical principles and skills rather than the situation-specific captivities (Higgins, 1997). It is disembedded from ordinary experience (Herrington, et al., 2000). It largely promotes individual endeavor and cognition (Higgins, 1997). Herrington, et al., 2000 found that traditional instruction involves competitive relations and individual assessments. The mathematical framework is referred to as a comprehensive set of skills that require no modifications and or easily retained by students following instruction (Romberg & Carpenter, 1986).

Implementing traditional practices involves several key components. According to Feldman (2002) the instructor must choose the topic from the curriculum and develop instructional strategies and activities. In addition, selection of the proper assessment and/or test is vital. The final grade or feedback is used to show mastery of the content as well as to identify any misconceptions. Instead of re-teaching any misconceptions, traditional practices move to the next lesson (Feldman, 2002).

Traditional Classrooms

Herrington, et al. (2000) referred to the traditional classroom as "traditional bricks and mortar classrooms". Classroom furniture consists of desk arranged in rows facing a chalkboard (Scott, 2005). Instruction occurs frequently with the whole class. Traditional classrooms reveal a strict adherence to fixed curriculum that is highly valued. Mastery of content and skill is imperative. Textbooks guide curriculum and context (Scott, 2005). Curricula begin with the parts of the whole and emphasize basic skills. Learning is based on repetition.

Instructor's Role

In traditional instruction, the teachers' role is to teach, create, and ensure content that is logical and understandable. Teachers' roles are directive and rooted in authority (Choi, 2000). Built on competition, traditional instruction has been teacher-centered and passive for learners. Teacher talk exceeds student talk (Scott, 2005). Dialogue is controlled by the teacher (Scott, 2005). According to Choi (2000) traditional teacher-centered instruction is very common and usually occurs in whole group or direct lecture. This teaching strategy relies on teacher talk, rote memorization of facts, and passive learning. Choi (2000) suggests that many teachers express a very narrow conception about the frameworks of mathematics and the way they were taught (Choi, 2000). In addition, Choi referred to this narrow concept as a cut and dry way to facilitate dialogue. Traditional instructors are known as experts pouring knowledge into students (Scott, 2005). Furthermore, teachers disseminate information to students causing students to be recipients of knowledge. The teacher, who controls the learning environment, ensures that students are on the right track by correcting any misconceptions or wrong answers (Herrington, et al., 2000).

Student's Role

In the traditional classroom, students are expected to be passive learners and consumers of information (Scott, 2005). They are held responsible for learning the content and skills taught. Students are to work primarily alone. Student mastery of rules and procedures are the main goals of traditional instruction (Wilson & Lloyd, n.d).

Delivery Method

Lecture is the delivery method for traditional instruction. Lecture is a passive approach to learning and largely out of the control of the student (Turnwald, Bull & Seeler, 1993). Students absorb information that is considered important. Lectures can convey large amounts of material to many listeners at the same time (Turnwald et al., 1993). In addition, lectures can describe subject matter that is otherwise unavailable such as original research or unpublished current developments. Furthermore, lecture can organize material in ways to meet the needs of a given audience. According to Scott (2005) when the goal of instruction is to provide a summary of materials to the learner, lecture and discussion is effective.

Testing

Pencil and paper tests are identified as an indicator of traditional education. These tests are used to determine mastery of content and skill. In addition, traditional testing identifies student progress. There are two forms of testing, informal and formal testing. Informal testing consists of both oral and written assessments. Teachers can create their own assessments or use pre-printed assessments that usually accompany the textbook. Standardized test are the formal test administered to identify student progress (Chall, 2000). Numerical grades are assigned to address success or failure of content.

Challenges of Traditional Instruction

Scott (2005) reported that traditional instruction has not always reached students or met their needs. Passive learning styles may not be beneficial to all students. As a result, educators are challenged to provide more active learning opportunities for students. Scott (2005) suggests that traditional instruction fails to allow students to maximize their skills and abilities. The idea of one style of teaching meeting the needs of a diverse and growing student population does not seem practical (Brown, 2003).

Traditional Mathematics Instruction

Mathematics curricula have been modified to present problem solving without thinking, to problems that can be solved by applying the procedure previously studied. Traditional mathematics involves students memorizing and performing specific processes in order for problem solving to occur. These fixed views encourage memorization and execution of isolated skills and factors. Students being taught by traditional mathematics will acquire knowledge that is discrete, hierarchical, sequential, and fixed (Draper, 2002). Mastery of algorithmic procedures as isolated skills is the key of traditional mathematics (Schoenfeld, 1988).

Traditional mathematics instruction consists of three elements. The first element requires the instructor to give a lecture to establish the mathematical concepts that will be learned by the students. The next element requires the instructor to provide exercises and activities that allow the students to repeat the rules of the concept that they are learning several times. The final element requires the instructor to select the most efficient form of assessment that will show that the material has been learned by the students

(Schoenfeld, 1988). This is done by administering examinations, quizzes, and homework. This teach-test strategy does have a tendency to produce very good test scores, because the students are simply reproducing rehearsed math skills (Schoenfeld, 1988). The trouble with the traditional methods is it encourages the development of lower-order mathematical thinking (Schoenfeld, 1988). This method does not promote higher-order mathematical reasoning. This presents a problem when the students have to solve unfamiliar mathematical problems that require abstract thought and creative thinking. In recent years, there has been a significant increase in the amount of research that has been done regarding teaching and learning mathematics (Berry & Nyman, 2002). These studies have shown that students' prior perceptions of good learning and prior understanding of mathematical subject matter can affect their ideas about teaching, learning, and assessment. Berry and Nyman (2002) conducted a study that revealed that adult learners fall into one of two categories. Members of the first group have experienced mathematical instruction in which learning is initiated and controlled by an external agent like the instructor. Information is given from the teacher to the student and the information is recalled when it is needed to answer a question. Learning is seen as simply storing and retrieving information. The second group of learners experienced a student-centered classroom with many activities that were designed to change the learner. The learning process is an active process, which helps the students interpret information and understand how it fits into their own reality. To this group, learning is a more active, rather than passive, process of obtaining knowledge. The ways that students perceive mathematics often dictates their approach to learning mathematics. According to Schoenfeld (1988) many people feel that mathematics is one definite concrete body of knowledge that can be known for certain. Berry and Nyman (2002) stated that traditional teaching strategies focus strictly on the final product or the answer rather than the process of arriving at the answer. The traditional methods are more conducive of the lecture style of presentation in which the teacher is the authority figure with the right answer. The students are expected to learn and then mimic the concepts taught by the teacher. This strategy allows the teacher to ask questions, but it does not actively encourage student questions. The teacher knows the correct answer so the students do not want to question his authority by asking questions. This limits the use of student questioning and imaginative reasoning to solve problems. In addition, Berry and Nyman (2002) asserted that mathematics, mathematical thinking, and the significance of mathematics are unimportant to middle school pupils between the ages of 13-14 years.

Standards-based Education

A new trend in America is standards-based education (AFT, 2003). Standards-based education applies to setting the academic content standards by incorporating prior knowledge and skills, assessing student progress, and allowing schools to be held accountable for results. Four components of standards-based education include (a) clear academic content strands, (b) teacher support, (c) effective assessments and (d) accountability (AFT, 2003). The expectations of students should be stated clearly. All teachers should be equipped with training and instructional material. Students must be assessed regularly to record progress. Everyone is held accountable for the results produced.

National concerns grew as a result of American students' inabilities to compete in the global economy as well as the large gap in achievement. As a result, more rigorous educational standards and methods for assessing student achievement were adopted and implemented by many school districts. The new practice became known as standards-based learning (AFT, 2003). The 1994 legislation mandated that students who received Title I funding be allowed the same educational expectations of non recipients through the Elementary and Secondary Education Act (ESEA). Students are no longer being taught to memorize. Students are now being asked to apply what they know or have learned.

In theory, standards-based education enables greater flexibility at the district level in terms of curriculum changes and organization. Assessing students' abilities and comprehension of standards, however, can be an enormous task due to the diverse needs and abilities of students. In response to theses challenges, educators developed concepts of authentic learning and of the assessing of students' abilities to apply their acquired knowledge. In other words, student assessment is not based on memorization; instead, students are required to actually apply the knowledge and skills that they acquired to various situations and concepts (http://webhost.bridgew.edu).

The standards based education movement evolved from the idea that specific learning goals are essential in the pursuit of high quality education for all students (Marzano, Pickering, & McTighe, 1993). Schools must work collaboratively in their efforts to use standards-based materials and assessments in order to make academic progress a reality. According to the National Institute of Student Achievement, Curriculum and Assessments improving student achievement in the core content areas requires a coordinated and comprehensive approach. The main components of that approach include setting higher expectations, articulating clear academic content standards, measuring student performance in valid and reliable ways and ensuring that teachers have the knowledge and skills to assist students in meeting these expectations (Marzano, et al., 1993).

In addition, the students must have an understanding of the standards and an ability to translate them in terms that they can understand and actually use. Goals for student work become more specific, understandable, and challenging when students are encouraged to express standards in their own words (Rolheiser & Ross, 2000). Another way to make the standards more meaningful to both students and teachers is to encourage students to assess their own work. Student self-assessment (SSA) refers to training students to evaluate their own work for the purpose of improving it (Bruce, 2001). In order for these student evaluations to be effective, students must have a clear understanding of what is expected, an opportunity to provide input, receive feedback and the opportunity to correct and revise work before submission.

Standards-based Instruction

Standards-based instructional strategies are established using standards of learning determined by the state. The first step of implementing a standards-based instructional system is to consider the appropriate standards and the most efficient means of assessing those standards. Standards-based instruction places an emphasis on the understanding of the concepts being taught in addition to developing reasoning skills. A key element that embodies this method of instruction is the engagement of the learner with the theories and concepts that they are taught. This is accomplished through various routines such as collaborative investigations, hands-on explorations, the use of multiple representations of the material, and discussion and writing assignments related to the materials (Goldsmith & Mark, 1999). The focus of a standards-based curriculum is centered on the larger theories and concepts that formulate the basis of the structure and function of mathematics (Goldsmith & Mark, 1999). According to Castillo, DeSart, and Magdaleno (n.d.), in order to maximize learning opportunities for all students, teachers must implement standards-based instruction. To obtain this goal, time and thoughtful reflection by the teacher is needed to facilitate learning and help students learn.

Influence of Standards in Classrooms

There is a debate on how mathematics should be taught in the classrooms (Jacobs, et al., 2006). Educators are arguing for more students' involvement and problem solving and less computational skills. Mathematical goals for students and teachers designed by the NCTM are the center of the debate. Jacobs et al. (2006) found that students taught using standards-based mathematics or taught using an aligned standards-based curriculum learn more than students who are not taught using these methods.

According to Jacobs et al. (2006) practices consistent with curriculum standards are supported by the National Research Council, the American Association of Advancement of Science, and the NCTM. Providing instruction that engages participants in the learning process is supported by these organizations. The NCTM has a vision of mathematics that is included at every grade level to stress problem solving, reasoning, mathematical connections and communication.

Classroom practices that demonstrated the vision include problem-based activities, peer groups, the use of manipulatives and open ended assessments that allow students to create their own answers rather than pick one from a multiple choice assessment. Support of these practices is limited. However, Ginsburg-Bleck and Fantuzzo conducted a study using elementary students and found that the use of the standards practices resulted in higher scores on mathematics assessments (McCaffrey, et al., 2001). McCaffrey et al. (2001) concluded that collaborations, problem solving, and mathematical connections to the real world have been attributed to mathematical success. In addition, McCaffrey et al. (2001) conducted a study of reported use of curricula reformed standards practices by teachers and found that school-based scores increased. On standardized multiple-choice tests, Mayer (1998) found a relationship between curricular reform practices and high test scores. Curricula that include problem solving and conceptual understanding have delivered positive results. McCaffrey et al. (2001) found that students who were instructed to use problem solving and reasoning skills, performed better than students whose instruction included memorization of steps or procedures. Student gains were associated with the use of curricula reformed instruction.

Characteristics of Standards-based Instruction

Standards-based instruction shifts away from the teachers as sole authority for right answers toward logic and mathematical evidence as verification. It also shifts from mechanistic answer-finding toward problem solving (Bay, Reys, & Reys, 1999). When constituting competency in a field, one must recognize that including knowledge, understanding processes and skills are of great concern. Understanding and skills are recognized not only as a primary concern, but also for their importance and interconnectedness. Knowledge and skills as a balanced approach allow for students to acquire problem solving skills needed in mathematics. These acquired skills create a foundation for continued and in-depth study in the area of mathematics (Trafton, Reys, & Wasman, 2001).

There are four primary components that are common to standards-based instructional strategies. The first component requires the instructor to select the standards that will best accommodate the needs of the students. Different standards may be needed for various groups of learners. The second component involves designing assessment techniques that enable the learners to demonstrate their mastery of the skills and concepts in a way that makes it evident that the standard has been met. The third and fourth components are interwoven and are both vital. The third component requires the instructor to identify the learning opportunities necessary to help students attain the knowledge and skills. The final component involves organizing instructional time to allow every learner an adequate opportunity to learn (Feldman, 2002). In order to transform these elements into an efficient standards-based system of instruction, the instructor must know how to assign new roles for the students. Students must fulfill their individual roles and the instructor must observe how they assume their roles. Very little research has been done to explain how student's perceptions of these roles affect the learning process. In spite of the lack of research, this method can only be successful if the instructor observes each students' interpretations of and reactions to their roles (Lubienski, 2004).

Standards-based Classrooms

Standards-based classrooms do require students to memorize important content information, but they establish a connection of that material with the real world. If students cannot remember a portion of the content, they are encouraged to use critical thinking to find the answer (Feldman, 2002). A standards-based classroom uses the connection to promote two very essential types of cognitive development within the students. The connection between subject matter and the real world encourages the students to construct knowledge in a meaningful way, while simultaneously showing the interdependence between various standards for different subjects. It reveals that the various standards for different subjects are connected. The curriculum for standards-based classrooms organizes the subject content information in several specific ways. The material is organized using the big concepts to define the structure and function of the subject overall. The individual part of each big concept is then further expanded to reveal the concepts in a more complete manner. In addition to these schemes of organization, the curriculum also entails other structural elements, such as materials, that include primary materials and manipulative materials and learning is interactive building on what the students already knows (www.thirteen/ed.online).

Student's Role

The students use a variety of ways to present the materials that they have learned. These include demonstrations, drawings, and formal mathematical and logical arguments to convince themselves and their peers of the validity of their answers. The goal of standards-based instruction is to create an engaging cooperative environment that encourages the growth of relationships between the students, their peers, and the instructor. For this reason, most assignments are completed in groups (Field, 1993). Standards-based instruction is student-centered and this allows the students to take control of the learning process through decision-making (www.thirteen/ed.online). Gray (n.d) asserts that when the students are allowed to be active participants in the learning process, it is mutually beneficial to both the students and the teacher. Another aspect of this experience is the students are required to reflect on what they have learned. This helps them improve their ability to take in new information (www.thirteen/ed.online).

Anderson (1996) states that students must be active builders of their own knowledge. Students address content by communication with other students, negotiating meanings and modifying concepts. In addition, students are required to reconceptualize teaching and construct an understanding of the concepts. Furthermore, students need to create knowledge by integrating information and problem solving instead of memorizing materials and filling in blanks on worksheets.

Instructor's Role

The role of an instructor in a standard-based environment starts with deciding what standards to select and then deciding how to guide students as they attempt to reach these standards. One way that this is accomplished is by the instructor modeling real life data analysis to teach conceptual based mathematics. The students are expected to write logical arguments and conclusions and this will help them become active participants in the learning process. To motivate the learners the teacher must facilitate enthusiasm for the material by providing a stimulating environment and access to an assortment of resources (Field, 1993). The instructor must take the backseat and allow the students to assume the leadership roles necessary to carry out the assignments. The instructor actively engages the students by requesting theorization of important mathematical situations and concepts. This is done through group discussion and debate about different mathematical solutions, and ideas. In addition to this, the students learn to make sense of the material by connecting it to real life situations (Wilson & Lloyd, n.d.). The primary role of the teacher is to encourage the students to gain new knowledge through their own evaluations and self-reflection. This promotes critical thinking and teaches learners to construct knowledge. To successfully accomplish this, the instructor has to teach the learner various skills such as problem solving, inquiry-based learning activities, drawing conclusions, and collaborative learning. The teacher must develop an understanding of the students' preexisting perceptions, and then teach them how to address these perceptions so that they can build on what they already know (www.thirteen/ed.online). According to Gray (n.d.) the main responsibility of a standards-based instructor is to create an environment founded on communication and flexibility. This will allow the needs of all students to be met. The name of this style of teaching is standards-based teaching. It is based on the principle that learning is promoted by actively engaging the learner and challenging them to construct the meaning of the knowledge as it relates to them. This opposes learning that passively transmits information from teacher to student. The goal of standards-based teaching is to produce motivated independent learners.

Testing

Standards-based instructional assessments include student works, observations, and tests. The assessments provide complex and interesting problems that allow the learner to demonstrate creative thinking, reasoning, and the ability to draw conclusions (Jacobs et al. 2006). The central focus of the standard-based instructional assessment is the process that helps the learner arrive at the answer, not just the final product. Mastery of content can be assessed by means other than pencil and paper grading. Assessment tools proven to be useful are learning logs, response logs, portfolios and peer tutoring (http://webhost.bridgew.edu).

Standards-based Mathematics

Current calls to redefine mathematics education have caused significant curricular changes (Bay, Reys & Reys, 1999). This effort to redefine or reform mathematics is referred to as standards-based mathematics. Standards-based mathematics is formed on the NCTM core belief that mathematical literacy is essential if students are to become informed, well-rounded, competent citizens. Regardless of the student's ability, they deserve to be mathematically literate and receive an adequate mathematical education. Mathematical literacy encompasses knowing mathematical principles, developing mathematical ways of thinking, acquiring fluency with numbers, and manipulating mathematical data. This end can only be achieved by teaching learners to actively participate in mathematical activities that require them to use these skills and knowledge to solve and investigate mathematical ideas. As students learn mathematics, they should become confident in their own ability to solve complex problems and correct any errors; thereby becoming confident in their ability to solve problems (Bay, Reys, & Reys, 1999).

Challenges to Standards-based Instruction

The greatest challenge is implementing a new system of instruction while operating within a system that is a product of the old system (Anderson, 1996). The vision of the NCTM standards is inconsistent with the old teaching style of mathematics. The ideology that many instructors subscribe to is challenged tremendously because standard-based instruction is a fairly new concept. Most teachers are accustomed to the didactic method of instruction, because they themselves were educated using that method of instruction. Another problem in implementing the standard-based instruction is most teachers do not know how to provide it. Teaching as telling, receiving, learning and practicing is inconsistent with the NCTM standards (Mark, 2002). A TIMSS report revealed that 95% of U. S. teachers reported familiarity with the NCTM standards. However, videos of their teaching revealed they relied on misinterpretations of the changes. As a result, mathematics supervisors are challenged with moving teachers away from mathematics as they experienced it as students and guiding them toward a view of mathematics consistent with the standards (Mark, 2002).

Another problem is the attitude of students. Students must also change their way of thinking. Expectations of students under this new system present a huge challenge. Students who were successful under the old system resist change. Under the old system, students could predict the process in which they knew they would succeed. The new system fosters a process of intellectual development that is unfamiliar. Students encounter problems of multiple solutions as well as vague directions. They need to learn to build on prior knowledge instead of memorization. Problem solving, reasoning, making connections and communication should be emphasized when learning mathematics (Mark, 2002).

Parents may resist the new system because of the confusion of higher expectations and demanding work. Obtaining a consensus between the public and the school is a challenge as well. The public's resistance to change may evolve as a result of the challenge to the operational and cultural beliefs and value systems and priorities of all stakeholders. An adequate consensus vision should be consistent with the desires of everyone involved.

There is a need for an educational reform. This would involve restructuring instructional curriculum standards and assessment tools that support higher-order learning outcomes. The difficulty of reforming the existing traditional methods of instruction lies within the preexisting perceptions and expectations that have become institutionalized throughout the educational system.

Summary

Students in the United States have lower scores than students from other nations on international tests of mathematics and science (National Center for Education Statistics, 1999). Extreme effort has been made to improve the nation's public K-12 education system. School districts throughout the United States have incorporated immense curricula initiatives to produce high achieving students in math and science.

This allows the United States to remain economically competitive in the global technological era (O'Conner & Miranda, 2002).

Today, standards and testing are the primary approaches being taken to improve public education in America, as well as establishing expected statewide educational outcomes for all students, testing every student by subject and grade level, and holding the children and schools accountable for the results.

Mathematics is a critical subject area for students during the middle school years. Middle school is the time in which students' critical thinking skills and reasoning skills emerge; therefore, public schools must provide impartial learning opportunities. Students must be educated and challenged to rise to their maximum potential in order for the United States to be competitive in today's society (Reed, 2004).

CHAPTER III

METHODOLOGY

The purpose of the study was to determine if *JBHM Achievement Connections*, a standards-based method of instruction, or *Mathematics: Application and Connections, Course 2*, a traditional method of instruction had an impact on seventh-grade mathematics achievement. This chapter presents information on the participants, instructor, instruments, research design, reliability and validity, procedures, data analysis, and data collection for this study.

Participants

The participants for this research study consisted of four intact seventh-grade mathematics classes totaling 65 students and one teacher in the Delta region of Mississippi. The participants were 65 students enrolled in four mathematics classes taught by one teacher for the study. Students were randomly assigned to classes at the beginning of the school year through a computer program. Two classes totaling 35 students were assigned to Group A and two classes totaling 30 students were assigned to Group B. The classes were randomly assigned an instructional method through a drawing by the teacher. There were four slips of paper, two labeled as traditional instruction and two labeled standards-based instruction, in a hat. The researcher called out a class period and the teacher pulled an instructional method out of a hat for that class period. Four class periods were called and the teacher pulled an instructional method for each.

Description of Instructor

The instructor in all four seventh-grade mathematics sections was a veteran teacher with six years of experience teaching mathematics in public schools. She has a B.S. Degree in Mathematics and Science. She is certified in both mathematics and science. Her teaching experience encompasses high school and middle school. Prior to this study, she had taught one year using a standards-based method of instruction. In addition, she completed Institutional Review Board training as well as *JBHM Achievement Connections* seventh-grade mathematics training.

Instruments

The materials for the mathematics study were drawn from the *Mississippi Mathematics Frameworks*. The traditional instructional tool was the *Mathematics: Applications and Connections, Course 2*. The standards-based instructional tool was the *JBHM Achievement Connections* seventh-grade mathematics. The test instrument used in the study for the pretest/posttest was the *PLATO eduTest*. The targeted school had previously used this test for mathematics for two years to measure content learning gain. The test consisted of multiple-choice questions.

JBHM Achievement Connections

JBHM Achievement Connections is a researched-based, result-driven program that tightly aligns assessments, instruction, and curriculum together to increase student achievement. *JBHM Achievement Connections* is an educational service provided through the JBHM Educational Group, LLC.

JBHM Education Group, LLC is an educational management service company with a mission of assisting school communities in the effort to better organize themselves and give families the support needed to ensure success of their children.

According to a 2000 press release, JBHM Education Group stated that as a result of poorly-aligned local curricula and nationally published textbooks, it had developed a customized curriculum to support school improvement efforts, titled the *JBHM Achievement Connections* (www.jbhm-edgroup.com). The *JBHM Achievement Connections* offers curriculum in the areas of English I/II, Pre-Algebra/Algebra I, fifth-eighth-grade Mathematics, Geometry, U.S. History, Biology and third-eight-grade Science. The *JBHM Achievement Connections* is custom-tuned to state benchmarks and includes professional development for teachers. It includes pretest and posttest using state assessments formats.

The *JBHM Achievement Connections* seventh-grade mathematics curriculum is centered on the 1989 NCTM curriculum and evaluation standards. It focuses on hands-on classroom activities that are aligned with the competencies and objectives in the *Mississippi Mathematics Frameworks* and the benchmarks of the *Mississippi Curriculum Test (MCT)* in mathematics. This structured program includes practice problems in the *MCT* format, complete lesson plans, lesson planning guides such as guided practices/strategies, independent practices, re-teaching, enrichment, assessments, integration ideas, and handouts. It also includes cooperative/collaboration learning activities, language and writing connections, grading period pacing guide, embedded professional development, and a comprehensive unit test in the *MCT* format.

JBHM Education Group, LLC provides services to over 90 schools in over 50 school districts in Mississippi, Louisiana, and Alabama (www.jbhm-edugroup.com).

Mathematics: Applications and Connections, Course 2

Mathematics: Application and Connection, Course 2 is a three-text Middle School series intended to bridge the gap from Elementary Mathematics and Middle School Mathematics. This textbook is used on the seventh-grade level by the target school in mathematics.

Mathematics: Applications and Connections, Course 2 is designed to motivate middle school students, enable them to see the usefulness of mathematics, and enhance the language of mathematics. This textbook has easy-to-follow lesson formats, chapter projects and test practices.

PLATO eduTest

As stated in PLATO online brochure:

> *PLATO eduTest* is an online assessment system as well as a pencil paper assessment that has scored over 12 million tests since 1966. *PLATO eduTest* assessment uses a variety of benchmark tests formulated on state and national standards. This assessment tool has a test bank of over 180,000 items in math, reading, language arts, science and social studies as well as reporting options for formative assessments for districts, schools and teachers. *PLATO eduTest* assessments offer flexible test administration options and comprehensive detailed reports for answers chosen. It allows districts and schools to test and re-test to evaluate how students are doing in comparison with the state standard curriculum, standards and/or instructional frameworks (www.plato.com).

PLATO eduTest assessments have accessible test based on 20 state standards. These tests are geared to the Stanford 9, ITBS and Terra Nova (www.plato.com).

Reliability and validity have been studied in three states. Moderate to high correlations of 0.50 to 0.83 were found between fixed tests at three grade levels on the eduTest assessment item banks and the state tests. Cronbach's Alpha reliability found a high internal consistency of 0.67 to 0.92 in these studies (www.plato.com).

Tests are designed using *PLATO eduTest* by teachers, school level administrators and district level administration. These individuals select the benchmarks that are to be assessed and the number of questions for the test. *PLATO eduTest* automatically selects problems related to the benchmarks identified and creates the test. For this research study, the researcher used *PLATO eduTest* to create the test.

Research Design

The research design for this study was quasi-experimental. Creswell 2003, states that a quasi-experimental design is utilized when the control group and experimental group participants are not randomly assigned (see Figure #1 below). Intact classes were randomly assigned a particular method of instruction as opposed to individuals. A nonequivalent control group design was the quasi-experimental research used (Creswell, 2003). Students were randomly assigned to classes at the beginning of the school year through a computer-generated program, and the study used the intact grouping of students for Group A and Group B based on these prior school placements.

O	X1	O
Pretest	Treatment: Group A Traditional Instruction	Posttest

O	X2	O
Pretest	Treatment: Group B Standards-based Instruction	Posttest

Figure 1: Quasi-Experimental Nonequivalent Control Group Design

Note: From *Research Design: Qualitative, Quantitative, and Mixed Methods Approach, 2nd ed.* by John W. Creswell, 2003, p.169.

Reliability and Validity

Even though standards and accountability requirements place great emphasis on assessments, there are other issues that are important with the *PLATO eduTest*, such as the alignment of the test and school standards, the integration of the tests with the curriculum and instruction, and the quality of the tests, including validity and reliability issues. Test quality is expressed in terms of validity and reliability. It was important to ensure that these tests came without bias to certain genders, ethnicities, economic groups, and student populations, so that all test takers who have the knowledge would perform the same way on the test. Precautions had to be taken to ensure that the test monitors minimized any source of validity issues. Validity of this norm-referenced test was established by first giving the test to different groups of students, and then examining to see if the test results matched the ability of students as measured by other means. All items were peer reviewed for clarity, content accuracy, and instructional design.

Additional design guidelines and development practices were used to help to assure reliability. Some of these procedures included time-on-task analysis, technical review and testing. An in dept check was given to each question, including evaluation of formatting and appearance (Plato Learning Inc., 2000).

Procedures

Students were in intact classes throughout the study. A computer-generated program was used to schedule and randomly assign students to each group at the beginning of the semester. There were no attempts by the researcher to divide the classes for gender balance, academic achievement, and equal number of students per class. Some classes may have one or two more or less students as well as students one or two years older than the norm. Students and parents received letters of consent and assent prior to the commencement of the study. Only those students granted permission to participate served as participants in the study. All 65 of the students enrolled agreed to participate in the study and were administered the pretest; however, 62 students were administered the posttest because three students transferred from the school (Appendix C).

The mathematics study consisted of four intact classes of 65 students. The teacher used the *Mississippi Mathematics Frameworks* for the objectives taught to assess achievement. All classes received a written pretest and posttest developed using *PLATO eduTest*. The pretest and posttest consisted of multiple-choice questions. Group A received instruction using *Mathematics: Applications and Connections, Course 2*, traditional method of instruction. Group B received instruction using *JBHM Achievement*

Connections standards-based method of instruction. The classes were randomly assigned an instructional method through a drawing by the teacher. There were four slips of paper, two labeled as traditional instruction and two labeled standards-based instruction, in a hat. The researcher called out a class period and the teacher pulled an instructional method out of a hat for that class period. Four class periods were called and the teacher pulled an instructional method for each.

Group A (Traditional Instruction)

The instructor taught using the traditional method of instruction. The instructor took a teacher-centered approach and controlled the learning environment. Lecture was the main delivery of instruction. The students had limited group work. Homework was checked for accuracy by the instructor. The instructor used her own method of solving problems and did not explore the validity of students own solutions. After the homework check, the instructor lectured on the new content and assigned homework for the next class period.

The instructor's role was to ensure algorithmic proficiency. The areas taught were the *Mississippi Mathematics Frameworks*' 2nd nine week objectives of Number Sense that included ratios, fractions, percentages, decimals, proportions, equations, and integers (Appendix E). Manipulatives were available; however, the instructor prescribed exactly how the manipulatives were used. The focus was on discussion, drill, and practice. The goal was procedural competency and memorization of the steps of a teacher-centered algorithm.

Group B (Standards-based Instruction)

The instructor began class with a short review of four to five problems posted on the white-board. As students entered the room, they were responsible for working those problems and communicating the problem solving method and solution with a group of three students whom they were previously assigned. This assignment took approximately 5-10 minutes. An introduction of the key concepts of that day's content followed. Notes were printed and given to students during the introduction. Students were arranged in groups to solve open-ended problems assigned for homework or created in a previous class period. Then a solution was discussed within the group and presented to the entire class for discussion. A solution was more than just the answer. A solution consisted of an explanation and justification of the mathematical process used. If groups or individuals disagreed, they challenged the given solution and provided another solution.

The instructor served as a facilitator or coach to the entire class during discussion time. She clarified points, suggested ideas for thought, focused the discussion and summarized the key concepts. The areas taught were the *Mississippi Mathematics Frameworks'* 2nd nine week objectives of Number Sense that included ratios, fractions, percentages, decimals, proportions, equations, and integers (Appendix E). Manipulatives, hands-on activities, and/or games were used to visualize the concepts.

The focus of standards-based instruction was on hands-on exploration, the use of multiple representation, discussions, and problem solving, writing, and collaborative investigations. Students were asked to write short essays regarding their solution to solve problems as a means of checking mathematical literacy. The goal was to create a student-centered learning environment as well as emphasize active learning, communication, reasoning, and problem solving.

Summary of Procedures

Group A and Group B were similar in the objectives taught and the amount of time allowed for each class. The difference was the method of instruction. Group A was taught using *JBHM Achievement Connections*, standards-based method of instruction and Group B was taught using *Mathematics: Applications and Connections, Course 2 Textbook*, traditional method of instruction.

All students were given the chance to participate. It was explained that only those students who had a signed parental consent form and a signed student assent form could participate. It was also explained that students who refused to participate would not be penalized. On the first day of the study, students were administered the *PLATO eduTest* pretest. On the last day of the study, students were administered the same form of *PLATO eduTest* as a posttest. The pretest and posttest were compared to determine which method of instruction had an impact on student mathematics achievement. Only those students completing both tests were included in the study. Three students who transferred from the school after completing the pretest were eliminated from the study.

Data Analysis

Once the data was collected, a statistical analysis was done to compare the means of the pretest and posttest for Group A and Group B using an independent t-test. When the evaluation of the mean difference involves two treatment conditions, independent measures are used (Gravetter &Wallnau, 1999; Scott, 2005). Alpha level was set at .05 level of significance for conducting the analyses in this study.

The independent variable was the method of instruction. The dependent variable was the posttest scores. The paired t-test was used to examine for differences between the students' overall scores on the pretest and their scores on the posttest. The independent t-test was used to examine differences between Group A and Group B test scores, and the analysis of variance (ANOVA) was conducted to examine differences in student performances based on class period representation.

Prior to using the ANOVA, the researcher made several assumptions about the data that were anticipated. The ANOVA procedure expects the assumptions of random sampling and independence of sample, normality and homogeneity of within group variances. Prescreening was conducted for missing data and outliers prior to computation of the data. No data transformation was needed.

The ANOVA is robust to violations of the normality assumptions, and violations of normality should not be a cause for substantial concern (Gravetta & Wallnau, 1999). Slight deviations from normality are tolerated, but even larger deviations are not expected to have great impact on the interpretation of the results (Kennedy & Bush, 1985). The testing of these assumptions was done through an examination of histograms and boxplots of the data to determine the degree of skewness and kurtosis. This examination did not reveal a violation of the assumption of normality. Violation of the assumption of homogeneity was examined through the Levene test of homogeneity of variances.

Data Collection

Approval was received from the Institutional Review Board prior to the collection of data (Appendix A). Written permission was obtained from the Superintendent, the school principal, and the seventh-grade teacher (Appendix B). Parental consent and student assent forms were obtained prior to the data collection (Appendix C). All of the 65 students who were enrolled in the selected classes completed the consent forms and were granted permission to participate in the study. In addition, written permission was obtained by JBHM, Education Group to utilize the *JBHM Achievement Connections* prior to the study (Appendix D).

A pretest was administered to Group A and Group B prior to the study on the first day of school. Group A received nine weeks of traditional instruction through the use of *Mathematics: Applications and Connections, Course 2*. Group B received nine weeks of standards-based instruction through the use of *JBHM Achievement Connections*. A posttest was administered to Group A and Group B at the completion of the study. The pretest and posttest scores were compared to determine whether the *JBHM Achievement Connections*, standards-based instruction or the *Mathematics: Applications and Connections, Course 2*, traditional instruction had an impact on seventh-grade students' mathematics achievement.

Summary

This section described the study's methodology. The instruments used were the standards-based instructional tool, *JBHM Achievement Connections* and the traditional instructional tool, *Mathematics: Applications and Connections, Course 2*. The test instrument used for the pretest and posttest was the *PLATO, eduTest*. The test instrument was administered to 65 students at the beginning and 62 students at the end of the study. The pretest was given at the beginning of the semester. This was followed by nine weeks of instruction, after which the posttest was administered. The data collection was conducted during the second 9-week term of the school year. Permission to conduct the study from the Institutional Review Board and informed consent and student assent were obtained. In addition, permission from the targeted schools' superintendent, school principal, teacher, and JBHM Education Group were obtained. A quasi-experimental design was the research design. A paired t-test and the independent t-test were the statistical analysis conducted to compare the means of the pretest and posttest. An analysis of variance (ANOVA) was conducted to examine differences in student performances based on class periods. Chapter IV presents the results of the study.

CHAPTER IV

RESULTS

Chapter IV is a presentation of the analysis of data describing seventh-grade mathematics students' performance on a test using *PLATO eduTest*, while being taught using a standard-based method of instruction and traditional method of instruction. This study sought to determine if students taught using the *JBHM Achievement Connections*, a standards-based method of instruction would make higher academic gain than students taught using the *Mathematics: Applications and Connection, Course 2,* a traditional method of instruction, as measured by *PLATO eduTest.* An analysis of a pretest and posttest was used to determine if there was an impact on student mathematics achievement when taught using either one of the two instructional methods.

In order to address the problem of this study, the researcher developed ten research questions. The research questions were the following:

Research Questions

1. What was the academic performance, as measured by pretest/posttest scores, when seventh-grade students were taught using the *JBHM Achievement Connections*, a standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?

2. What was the academic growth of students within the seventh-grade mathematics sections, as measured by the pretest/posttest scores, when taught using the *JBHM Achievement Connections,* a standards-based method of instruction, and *Mathematics: Applications and Connections, Course2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
3. What was the academic growth between the seventh-grade students taught using the *JBHM Achievement Connections*, standards-based method of instruction in comparison to the seventh-grade students who were taught using *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
4. What was the academic achievement of the seventh-grade males and females taught using the *JBHM Achievement Connections*, standards-based method of instruction, as measured by the *PLATO eduTest*?
5. What was the academic achievement of the seventh-grade males and females taught using *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
6. Was there a significant difference in academic performance as measured by pretest/posttest scores when seventh-grade students are taught using the *JBHM Achievement Connections*, a standards-based method of instruction, and *Mathematics: Applications and Connections, Course,* a traditional method of instruction, as measured by the *PLATO eduTest*?
7. How do students within the seventh-grade mathematics sections differ in academic growth in their pretest/posttest scores when taught using the *JBHM*

Achievement Connections, a standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?

8. Was there a significant difference in academic growth between the seventh-grade sections taught using the *JBHM Achievement Connections*, standards-based method of instruction and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?
9. Was there a significant difference in academic achievement between the seventh-grade males and females taught using the *JBHM Achievement Connections*, standards-based method of instruction, as measured by the *PLATO eduTest*?
10. Was there a difference in academic achievement between the seventh-grade males and females taught using *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction, as measured by the *PLATO eduTest*?

This quasi-experimental research project used a pretest-posttest research design. Data was` collected from 65 students for this research project. Students were randomly assigned to classes at the beginning of the school year through a computer generated program. Two classes totaling 35 students were assigned to Group A (traditional method) and two classes totaling 30 students were assigned to Group B (standards-based method). The classes were randomly assigned an instructional method through a drawing by the teacher. Students were administered a pretest prior to the beginning of their instruction utilizing either one of the two teaching strategies the *JBHM Achievement Connections* program, a standards-based method or the *Mathematics: Applications and Connections, Course 2*, a traditional method to determine which group of students would make higher academic gains. The research study was conducted over a nine-week period. At the end of the study, a posttest was administered to 62 participants because three students transferred from the school. Data was analyzed using SPSS 14.0 (Norusis, 2004).

This chapter includes a section on the descriptive data, test score analyses, and a summary.

Descriptive Data

Data were collected on 65 students in four intact seventh-grade mathematics classes in a middle school in the Mississippi Delta region. Table 2 reports a summary of the percentage of students participating in the study by gender, method of instruction and class periods. The study was conducted in four self-contained classes that were previously randomly assigned by a computer program at the beginning of the school year. The four self-contained classes are referenced by Period 1, Period 2, Period 3, and Period 4. The classes were randomly assigned an instructional method through a drawing by the teacher. There were four slips of paper, two labeled as traditional instruction and two labeled standards-based instruction, in a hat. The researcher called out a class period and the teacher pulled an instructional method out of a hat for that class period. Four class periods were called and the teacher pulled an instructional method for each. Class Period 1 and Period 2 were assigned the standards-based method of instruction through the use of *JBHM Achievement Connections*. Class Period 3 and Period 4 were assigned the traditional method of instructional through the use of *Mathematics: Applications and Connections, Course 2*, *JBHM Achievement Connections*, standards-based method of instruction is referenced as JBHM Connections in the tables. *Mathematics: Applications and Connections, Course 2*, traditional method of instruction is referenced as *Mathematics Connections* in the tables.

Table 2 presents a summary of the characteristics of students participating in the study based on gender, method of instruction and class periods. More males participated in the study and more students were taught using *Mathematics Connections* traditional method of instruction. A few more students were enrolled in Class Periods 2 and 3 than Class Periods 1 and 4.

Table 2. Characteristics of Students

Variable	Number	Percentage
Gender		
Male	38	59
Female	27	41
Method of Instruction		
JBHM Connections	30	46
Mathematics Connections	35	54
Class Period		
Period 1	13	20
Period 2	17	26
Period 3	20	31
Period 4	15	23

Table 3 indicates the differences in overall mathematics achievement of all students as well as differences in the mathematics performances of students who took the *PLATO eduTest* pretest and posttest by class periods. The mean scores (average scores) increased by 25 points from the pretest to the posttest. The range of scores increased by 39 points. The maximum scores increased by 35 points. The data in Table 3 show that student achievement increased between the pretest and posttest in all categories and for all class periods.

Table 3. Mathematics Achievement based on the Pretest and Posttest Data

	Pretest All	Posttest All	Pretest Period 1	Posttest Period 1	Pretest Period 2	Posttest Period 2	Pretest Period 3	Posttest Period 3	Pretest Period 4	Posttest Period 4
N	65	62	13	12	17	17	20	20	15	13
Mean	32	57	32	63	33	57	29	50	33	61
Range	45	84	19	61	38	77	39	81	26	74
Min.	10	6	23	42	10	32	16	6	19	16
Max.	55	90	42	84	48	87	55	87	45	90

Table 4 shows the academic performance levels of all students who took the pretest and posttest by class periods. The percentage of students scoring in the minimal category on the pretest was extremely high; however, the percentage of students scoring in the minimal category was reduced on the posttest between 25% and 50%, with Period 1 displaying the greatest degree of improvement in this regard. Of the total number of students who took the posttest, 37% scored Basic, Proficient, or Advanced. Table 4 also reveals that all students participating in this study were performing at the minimal level prior to their exposure to the teaching strategies. Improvements in student performances were noted for all class periods with as much as 23% of the students from Period 4 categorized as performing at an advanced level.

Table 4. Academic Performance Levels based on Pretest and Posttest Mathematics Scores of the Seventh-Grade Students by Class Periods

	Pretest Period1	Posttest Period1	Pretest Period2	Posttest Period2	Pretest Period3	Posttest Period3	Pretest Period4	Posttest Period4
N	13	12	17	17	20	20	15	13
Advanced (86%-100%)	0%	0%	0%	12%	0%	5%	0%	23%
Proficient (76%-85%)	0%	42%	0%	12%	0%	15%	0%	15%
Basic (66%-7%)	0%	8%	0%	12%	0%	5%	0%	0%
Minimal (0%-65%)	100%	50%	100%	64%	100%	75%	100%	62%

Table 5 reports the students' classification according to the method of instruction. The number of students decreased between the pretest and posttest. Three students transferred before the posttest was administered. The group taught using the *Mathematics*

Connections traditional method lost two students, while the group using the *JBHM Achievement Connections* standards-based method lost only one student.

Table 5: Numbers of Students that took the Pretest and Posttest based on the Instructional Methods

	JBHM Achievement Connections (Standards-Based Instruction)	Mathematics Connections (Traditional Instruction)	Total
Pretest	30	35	65
Posttest	29	33	62

Table 6 reports the gender of students who took the pretest and posttest under the two different methods of instruction. More male students took the pretest and posttest. For the pretest and posttest, more students were in the group using the *Mathematics Connections*, the traditional method of instruction.

Table 6. Gender by Instructional Method (Pretest and Posttest)

	JBHM Achievement Connections		Mathematics Connections	
	Pretest	Posttest	Pretest	Posttest
Males	20	20	18	17
Females	10	9	17	16
Total	30	29	35	33

Test Score Analyses

Research Question One

Research question one asked: What was the academic performance, as measured by pretest/posttest scores when seventh-grade students were taught using the *JBHM Achievement Connections*, a standards-based method of instruction and *Mathematics: Applications and Connections, Course 2* traditional method of instruction as measured by the *PLATO eduTest?* The data in Table 7 compares the academic performance of the students based on the instructional method applied. All students performed approximately the same as seen by the pretest scores. There were differences in academic performance of the students based on the posttest scores. The posttest scores revealed that the students taught using the *JBHM Achievement Connections* standards-based method of instruction scored five points higher than the students taught using the *Mathematics: Applications and Connections, Course 2* traditional method of instruction. However, all students improved between the pretest and posttest. The mean difference between the overall pretest and posttest scores was 25.26 points with the posttest score being higher than the pretest score. For students who were taught using the standards-based *JBHM Achievement Connections* standards-based method, the mean posttest score was 26.75 points higher than the mean pretest score and students who were taught using the traditional *Mathematics: Applications and Connections, Course 2* traditional method, the mean posttest score was 23.93 points higher than the mean pretest score. Students who were exposed to the two methods of instruction showed improvement in their test scores between the pretest and the posttest. Students who were taught using the *JBHM*

Achievement Connections, standards-based method scored higher than the students who were taught using the *Mathematics Connections* traditional method.

Table 7: Instructional Methods and Mathematics Achievement Mean Scores

	N	Pretest Mean	Std	N	Posttest Mean	Std	Increase in Performance
All Students	65	31.55	8.82	62	56.81	21.88	25.26
Students taught using the JBHM Achievement Connections	30	32.53	9.28	29	59.28	18.42	26.75
Students taught using the traditional Mathematics Connections	35	30.71	8.44	33	54.64	24.59	23.93

Research Question Two

Research question two asked: What was the academic growth of students within the seventh-grade mathematics sections, as measured by the pretest/posttest scores when taught using the *JBHM Achievement Connections,* a standards-based method of instruction, and *Mathematics: Applications and Connections, Course 2* a traditional method of instruction, as measured by the *PLATO eduTest*? To address this question the researcher analyzed students' pretest and posttest based on class periods to determine where differences occurred. As shown in Table 8, the mean scores for students in all four class periods improved from the pretest to the posttest. The students in Period 1 and Period 2 who were taught using the *JBHM Achievement Connections* standards-based method of instruction had greater of gains within their class sections with a mean difference of 55 points between the pretest and posttest. The students in periods three and four who were taught using *Mathematics: Applications and Connections, Course 2* had a mean difference of 49 points between the pretest and posttest.

Table 8. Mathematics Pretest and Posttest Mean Scores by Class Periods

	N	Pretest Mean	Std	N	Posttest Mean	Std	Increase in Performance
Students Taught During Period 1	13	32	9.28	12	63	17.51	31
Students Taught During Period 2	17	33	8.44	17	57	19.19	24
Students Taught During Period 3	20	29	9.28	20	50	25.43	21
Students Taught During Period 4	15	33	8.44	13	61	22.59	28

Research Question Three

Research question three asked: What was the academic growth between the seventh-grade students taught using the *JBHM Achievement Connections*, standards-based method of instruction in comparison to the seventh-grade students who were taught through *Mathematics: Applications and Connections, Course 2* textbook a traditional method of instruction as measured by the *PLATO eduTest*? The students taught using the *JBHM Achievement Connections* standards-based method of instruction displayed an academic gain that was six points higher than those taught using *Mathematics: Applications and Connections, Course 2* traditional method of instruction as shown in Table 7.

Research Question Four

Research question four asked: What is the academic achievement of the seventh-grade males and females taught using the *JBHM Achievement Connections*, standards-based method of instruction as measured by the *PLATO eduTest*? As seen in Table 9, the female students who were taught using the *JBHM Achievement Connections* standards-based method of instruction scored six points higher than the male students on the posttest. There were fewer females taught using the *JBHM Achievement Connections* standards-based method of instruction; therefore revealing that more female students test scores were in the performance level range of Basic, Proficient, or Advanced resulting in a higher mean score.

Table 9. Mathematics Achievement by Gender of Students taught using *JBHM Achievement Connections*

	N	Posttest Mean	Std
Male	20	57	17.38
Female	9	63	20.92

Research Question Five

Research question five asked: What was the academic achievement of the seventh-grade males and females taught using the *Mathematics: Applications and Connections, Course 2,* traditional method of instruction as measured by the *PLATO eduTest*? As seen in Table 10, the female students who were taught using the *Mathematics: Applications and Connection, Course 2,* traditional method of instruction had mean scores that were two points higher than the male students on the posttest. There was one less female taught using the *Mathematics: Applications and Connections, Course 2,* traditional method of instruction; therefore revealing that more female students test scores were in the performance level range of Basic, Proficient, or Advanced resulting in a higher mean score.

Table 10. Mathematics Achievement by Gender of Students taught using *Mathematics: Connections*

	N	Posttest Mean	Std
Male	17	54	23.55
Female	16	56	25.37

Research Question Six

Research question six asked: Was there a significant difference in academic performance as measured by pretest/posttest score when seventh-grade students are taught using the *JBHM Achievement Connections*, a standards-based method of instruction and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction as measured by the *PLATO eduTest?* Table 11, shows the independent t-test results that was computed to examine the differences in academic achievement by students who were taught using the *JBHM Achievement Connections* traditional method and students who were taught using the *Mathematics Connections* traditional method. Differences in the pretest scores and the posttest scores of the students were examined based on their method of instruction. No significant difference was found in the mean scores of the students on the pretest ($p > .05$) In addition, no significant difference was found in the posttest scores of the students ($p >.05$).

Table 11. Independent T-Test Results of the Mathematics Achievement of Students using both Instructional Methods

	N	Mean	Std. Deviation	t	df	Sig
Pretest Scores						
JBHM Achievement Connections (Standards-based Instruction)	30	33	9.28	.827	63	.411
Mathematics Connections (Traditional Instruction)	35	31	8.44			
Posttest Scores						
JBHM Achievement Connections (Standards-based Instruction)	29	59	18.42	.831	60	.409
Mathematics Connections (Traditional Instruction)	33	55	24.59			

Research Question Seven

Research question seven asked: How students within the seventh-grade mathematics sections differed in academic growth in their pretest/posttest scores when taught using the *JBHM Achievement Connections,* a standards-based method of instruction and *Mathematics: Applications and Connections, Course 2* a traditional method of instruction, as measured by the *PLATO eduTest?* Table 12 is a presentation of an Analysis of Variance (ANOVA) that was computed to examine differences in performance of the students based on their representation in each of the four class periods. The ANOVA for the students' performance on the pretest and posttest revealed no significant differences based on their assignment to the four class periods (p > .05).

Table 12: Analysis of Variance of Student Performances when taught using both Instructional Methods

	Sum of Squares	df	Mean Square	F	Sig.
Pretest Score	178.48	3	59.49	.757	.523
Between Groups	4795.58	61	78.62		
Within Groups	4974.06	64			
Total					
Posttest Score					
Between Groups	1500.39	3	500.13	1.058	.378
Within Groups	27683.29	58	477.30		
Total	29183.68	61			

Research Question Eight

Research question eight asked: Was there a significant difference in academic growth between the seventh-grade sections taught using the *JBHM Achievement Connections*, standards-based method of instruction and *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction as measured by the *PLATO eduTest?* Table 13 shows the results of a paired t-test that was computed to examine differences between the pretest and posttest scores of the students based on the method of instruction to which they were exposed. An examination of the students' performances on the pretest and the posttest revealed that there was a significant difference between the pretest scores and the posttest scores ($p < .05$) of students who were taught using the *JBHM Achievement Connections* standards-based method. An examination of the students' performances on the pretest and the posttest revealed that there was a significant difference between the pretest scores and the posttest scores ($p < .05$) of students who were taught using the *Mathematics Connections* traditional method. Both teaching methods had an impact on student performance.

Table 13. Paired T-Test- Mathematics Pretest and Posttest Scores of Students by Instructional Method

	N	Mean	Std. Deviation	t	df	Sig.
JBHM Connections						
Pretest	30	32.53	9.27	-6.586	28	.000*
Posttest	29	59.28	18.42			
Mathematics Connections						
Pretest	35	30.71	8.45	-6.579	32	.000*
Posttest	33	54.64	24.59			

* Difference is significant

Research Question Nine

Research question nine asked: Was there a significant difference in academic achievement between the seventh-grade males and females taught using the *JBHM*

Achievement Connections, standards-based method of instruction as measured by the *PLATO eduTest?* An independent t-test that was administered to examine differences between the pretest and posttest scores of the male and female students who were taught using the *JBHM Achievement Connections* standards-based method of instruction. As seen in Table 14, no significant difference was found between the males and females in their performances on the pretest and the posttest. On the pretest, the mean score of the males and females were very similar. On the posttest, the females outscored the males by six points.

Table 14. Independent T-Test Results of Mathematics Achievement by Gender of Students taught using *JBHM Achievement Connections*

	N	Mean	Std. Deviation	t	df	Sig.
Pretest Score						
Male	20	32.70	8.76	.137	28	.892
Female	10	32.20	10.74			
Posttest Score						
Male	20	57.25	17.38	-.879	27	.387
Female	9	63.78	20.92			

Research Question Ten

Research question ten asked: Was there a difference in academic achievement between the seventh-grade males and females taught using *Mathematics: Applications and Connections, Course 2,* a traditional method of instruction as measured by the *PLATO eduTest?* An independent t-test was administered to examine differences between the pretest and posttest scores of the male and female students who were taught using the *Mathematics: Applications and Connections, Course 2* traditional method of instruction. As seen in Table 15, no significant difference was found between the males and females in their performances on the pretest and the posttest. On the pretest, the mean score of the males was a little higher than the females. On the posttest, the females outscored the males by only two points.

Table 15. Independent T-Test Results of Mathematics Achievement by Gender of Students taught using *Mathematics: Connections*

	N	Mean	Std. Deviation	t	df	Sig.
Pretest Score						
Male	18	31.50	9.17	.561	33	.579
Female	17	29.38	7.80			
Posttest Score						
Male	17	53.47	23.55	-.277	31	.784
Female	16	55.87	25.37			

Summary

Chapter IV provided the results of the study. The data analysis indicated that there was not a significant difference in mathematics achievement of the students taught using both instructional methods. All students showed improvement between the pretest and posttest, but the students taught using *JBHM Achievement Connections* showed a higher degree of growth between the pretest and posttest. The results revealed that there was a significant difference found in the pretest and posttest scores of the students based on the method of instruction to which they were exposed. The students taught using *JBHM Achievement Connections* showed a significant difference between the pretest and posttest. The students taught using *Mathematics: Applications and Connections, Course 2* also showed a significant difference between the pretest and posttest. The class periods taught using *JBHM Achievement Connections* showed a greater gain within their sections than those taught using *Mathematics: Applications and Connections, Course 2.*

The female students taught using both instructional methods achieved higher mathematics scores on posttest than the male students. However, the mean scores from the posttest revealed that there was not a significant difference found between the genders.

Chapter V presents a summary of the study, conclusion, and recommendations for future practices and research.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Chapter V is a presentation of summary, conclusions and recommendations of the study conducted to evaluate the impact of two instructional methods on seventh-grade student mathematics performance. The problem of the study was to determine if a standards-based method of instruction or a traditional method of instruction had an impact on student mathematics achievement at the middle school level. More specifically this study sought to determine if students taught using the standards-based *JBHM Achievement Connections* program would make higher academic gain than students taught using *Mathematics: Applications and Connections, Course 2* traditional method of instruction as measured by *PLATO, eduTest*. The researcher sought to determine if the students who were taught using the standards-based method of instruction had higher scores on the seventh-grade mathematics achievement test than the students who were taught using the traditional method of instruction.

The participants for this research study consisted of four intact seventh-grade mathematics classes from a middle school in the Mississippi Delta region comprised of 65 students and one teacher. Students were randomly assigned to classes at the beginning of the school year through a computer-generated program. Two classes composed of 35 students were assigned to Group A and two classes composed of 30 students were assigned to Group B. The classes were randomly assigned an instructional method through a drawing by the teacher.

The materials for the mathematics study included the *Mississippi Mathematics Frameworks.* The traditional instructional tool was the *Mathematics: Applications and Connections, Course 2.* The standards-based instructional tool was the *JBHM Achievement Connections*. The test instrument used in the study for the pretest/posttest was the *PLATO eduTest*, which measured the students' academic performance in mathematics. The school had used this test for mathematics for two years prior to this study to measure content learning gain. The test consisted of multiple-choice items.

Conclusion

Based on the findings of the study, there was not a significant difference between the two methods of instruction. All of the students' scores on the pretest revealed that they were performing at no higher than the minimal level, revealing that students scale scores were between 0-65. Student performances varied on the posttest; 37% of all the students who took the posttest scored at the Advanced, Proficient, or Basic level.

Students taught using the *JBHM Achievement Connections* scored higher on the posttest than those students taught using *Mathematics: Applications and Connections, Course 2*. Students taught using *JBHM Achievement Connections* achieved higher mathematics scores on the posttest because a larger number of these students had performance levels that were Advanced, Proficient, or Basic. Students performing in the Advanced, Proficient, or Basic categories exhibit high test scores.

The differences found in the scores of students who were taught using *JBHM Achievement Connections* could be attributed to the percentage of students performing in the Advanced, Proficient or Basic categories on the posttests**.** Of students taught using *JBHM Achievement Connections,* 43% attained a scale score above 65 on the posttest; whereas only 31% of students taught using *Mathematics: Applications and Connections, Course 2* attained a scale scored above 65 on the posttest.

Possible explanation for these findings could be that 7% of the students participating in the study were Special Education Students. Special Education students are those who are unable to function on grade level due to academic, physical, or behavioral disabilities. These students are included in the regular education classes but are taught on instructional level required for the regular grade level. Instructional level refers to the type of instruction deemed appropriate for the functional capacity of students of the particular grade level. This was done to uphold the requirement that these students be tested on grade level.

The fact that there were fewer females who participated in the study could have resulted in the data showing that there was not a significant difference in student achievement. This could potentially be a reason since the study revealed that the female students out-scored the male students on the posttest. This group of students who promoted to the seventh grade during the 2006-2007 school year comprises of more female than male students. Based on the previous year's standardized test scores of the females, most of the females were scheduled in a higher mathematics course prior to 2006 school term, thereby limiting the number of females available to be scheduled in the seventh-grade General Mathematics course.

A possible explanation for the lack of a significant difference between the two methods of instruction could have been the time frame within which the posttest was administered. The posttest was administered on the last day of school before the Christmas holiday. Students are given a two-week break from school during the Christmas holiday. It could be assumed that they were more focused on the Christmas holiday than on the posttest.

Another explanation for the finding of no significant difference between the two methods of instruction could have been the level of difficulty and number of benchmark items tested during the study. The second 9-week scope and sequence from the *Mississippi Mathematical Framework* outlined 14 benchmark items to be taught. For the benefit of the study, the teacher might have given students less time to master each benchmark resulting in low performance on the posttest.

Mathematics Applications and Connections, Course 2 traditional method of instruction had been taught to all seventh-grade students for the past 3 years. A summary of the past 3 year mathematics performance shows an average of 25% of students scoring in the Basic category and an average of 42% of students scoring in Minimal categories on mathematics subtest of the *Mississippi Curriculum Test (MCT).* Those percentages revealed that an average of 67% of students did perform well on the mathematics subtest of *Mississippi Curriculum Test (MCT).* Miller et al. (1998) found that the traditional model, in which the teacher demonstrates the procedures needed to solve a problem and then provides time for drill and practice, may not meet the educational needs of all learners.

The data in this study showed that there was a significant difference between the pretest and the posttest of both teaching methods. Students who were exposed to both teaching methods demonstrated gains in their posttest scores. However, the mean posttest tests scores of students taught using the standards-based *JBHM Achievement Connections* were higher than those students who were taught using *Mathematics: Applications and Connections, Course 2* traditional method of instruction. Miller et al. (1998) findings support the instructional findings of this study that the students taught using *JBHM Achievement Connections*, standards-based method of instruction scored higher than those students taught using *Mathematics: Applications and Connections, Course 2*. Although there was not a significant difference between the two methods of instruction, the mean posttest scores for those students taught using *JBHM Achievement Connections* were higher. The flexibility of the curriculum and the requirement to construct the meaning behind the numbers through a standards-based method of instruction appears to impact students' abilities to acquire mathematical knowledge.

McCaffrey et al. (2001) found that the use of standards-based practices resulted in higher scores on mathematics assessments on elementary students. Furthermore, school based scores increased as a result of the curricula reform standards practices. Student gains were associated with the use of curricula reformed instruction. McCaffrey et al. (2001) found that students who were instructed to use problem solving and reasoning skills performed better than students whose instruction included memorization of steps or procedures. The mean scores on the posttest of the students taught using *JBHM Achievement Connections* standards-based method of instruction were higher than those students who were taught using *Mathematics: Applications and Connections, Course 2* traditional method of instruction. Jacobs et al. (2006) found that students taught using standards-based mathematics learn more than students who are not taught using that method.

Berry and Nyman (2002) asserted that mathematics, mathematical thinking, and the significance of mathematics are unimportant to middle school pupils between the ages of 13-14. This information gathered from this study does not support Berry and Nyman's view. The students taught using *JBHM Achievement Connections* standards-based method of instruction were middle school students ages 12-15. This study adds to the literature that standards-based instruction is important to middle school students.

Mathematical thinking and the significance of mathematics is the core of standards-based instruction. Those students taught using *JBHM Achievement Connections* standards-based method of instruction not only scored higher on the posttest but also had a greater degree of gain between the pretest and posttest. The findings of the study did not show a statistical difference between the methods of instruction however, students' scores increased between the pretest and posttest for both methods of instruction.

Summary of Conclusion

The study revealed that *JBHM Achievement Connections*, standards-based method of instruction impacts student achievement. *JBHM Achievement Connections*, standards-based method of instruction encouraged students to connect mathematical learning to real life situations. *JBHM Achievement Connections*, standards-based method of instruction allowed students to be actively engaged in the teaching and learning process thereby motivating them to perform. Standards-based instruction emphasizes problem solving, reasoning skills and communication. In order to continue developing successful students, the instructor must create a sense of responsibility in the students by actively engaging them and allowing them to assume the leadership roles necessary to carry out the assignments. To motivate the learners, the teacher must facilitate enthusiasm for the material by providing a stimulating environment and access to an assortment of resources (Field, 1993).

The goal of the study was to determine if a standards-based method of instruction or a traditional method of instruction had an impact on student mathematics achievement at the middle school level. The study was successful in showing that the standards-based method of instruction had a positive impact on student achievement. Furthermore, the study sought to determine if the students taught using the *JBHM Achievement Connections* made a higher gain than students taught using *Mathematics: Applications and Connections, Course 2* traditional method of instruction. The findings support that students taught using *JBHM Achievement Connections* standards-based method of instruction showed a greater degree of gain between the pretest and posttest. The results of this study showed that no significant difference was found between the posttest scores of the students who were taught using the *JBHM Achievement Connections* standards-based methods and the students who were taught using the *Mathematics: Applications and Connections, Course 2* traditional method of instruction. Nonetheless, the study did show improvement in students' achievement and performance levels for all groups.

The study provides the targeted school with data that *JBHM Achievement Connections* standards-based method of instruction has an impact on students' achievement. The mandates found in the *NCLB Act* (2002) call for school districts to develop and implement evaluation tools to measure academic progress in core subjects. Higher standards are being adopted in the areas of reading, language and mathematics. Those higher standards must come with higher-order thinking skills and problem solving skills. Standards-based instruction moves toward more active students' engagement with mathematical ideas through collaborative investigations, hands on explanations, the use of multiple representation and discussion and writing (Goldsmith & Mark, 1999).

Recommendations for Future Practices

The researcher has made the following recommendations based on the findings of this study:

1. It is recommended that *JBHM Achievement Connections* standards-based method of instruction be incorporated in the mathematics courses. Mathematics is an area that students appear to experience difficulties. Standards-based instruction instructs students to become more active learners, problem solvers, and stresses reasoning skills. Understanding the meaning of numbers provides a pathway for earning proficiency in the area of mathematics.
2. It is recommended that a standards-based method of instruction be utilized at every grade level. Standards-based instruction places emphasis on understanding concepts not rote memorization. This allows students to acquire and apply knowledge not memorize steps.

Recommendations for Future Research

The researcher believes that this study adds to the literature in the area of standards-based instruction and traditional instruction. Based on the findings of this study, the researcher believes that further studies could be conducted to examine the following:

1. Further study could be conducted to determine differences in student performances based on the standards-based method of instruction and the traditional method of instruction using different grade levels and in different geographical locations.
2. A qualitative study could be conducted to examine school administrators', teachers', and students' attitudes about standards-based instruction and traditional instruction.
3. A longitudinal study could be conducted to explore the long-term effects of standards-based method of instruction.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD

APPROVAL LETTER

Mississippi State UNIVERSITY

October 6, 2006

Manika Kemp
426 Coahoma St.
Clarksdale, MS 38614

RE: IRB Study #06-217: A Comparison of Traditional Instruction and Standards-based Instruction on 7th Grade Mathematics Achievement

Dear Ms. Kemp:

The above referenced project was reviewed and approved via expedited review for a period of 10/5/2006 through 9/15/2007 in accordance with 45 CFR 46.110 #7. Please note the expiration date for approval of this project is 9/15/2007. If additional time is needed to complete the project, you will need to submit a Continuing Review Request form 30 days prior to the date of expiration. Any modifications made to this project must be submitted for approval prior to implementation. Forms for both Continuing Review and Modifications are located on our website at http://www.msstate.edu/dept/compliance.

Any failure to adhere to the approved protocol could result in suspension or termination of your project. Please note that the IRB reserves the right, at anytime, to observe you and any associated researchers as they conduct the project and audit research records associated with this project.

Please refer to your docket number (#06-217) when contacting our office regarding this project.

We wish you the very best of luck in your research and look forward to working with you again. If you have questions or concerns, please contact Christine Williams at cwilliams@research.msstate.edu or by phone at 662-325-5220.

Sincerely,

R. Dwight Hare
Chairman

cc: Anthony Olinzock

Office of Regulatory Compliance
P. O. Box 6223 • 8A Morgan Street • Mailstop 9563 • Mississippi State, MS 39762 • (662) 325-3294 • FAX (662) 325-8776

APPENDIX B

PERMISSION LETTERS

Henry Phillips, Superintendent
West Bolivar School District
P.O. Box 159
Rosedale, MS 38769

Dear Mr. Phillips:

I am a doctoral student in Elementary, Middle, and Secondary Education Administration at Mississippi State University. I am in the dissertation phase of the process, and am writing to seek you assistance in completing this segment of my program of study. Dr. Anthony A. Olinzock is my major professor and dissertation director.

The title of my research is "A Comparison of Traditional Instruction and Standards-Based Instruction on seventh-grade Mathematics". This study will determine which method of instruction increases mathematics achievement. The sample will be approximately eighty-four seventh-grade mathematics students in the West Bolivar School District. The study will be conducted for one nine-week grading period.

To confirm our conversation granting me permission to conduct this study in your district, a letter should be written on your school letterhead with your signature and date. All requirements of the Institutional Review Board for the Protection of Human Subjects in Research (IRB) at Mississippi State University have been satisfied to conduct this study. Per our conversation, I will share a summary of the results with you upon completion of the study.

If you should have any questions about this research project, please feel free to contact me. For additional information involving human protection in research, please contact the MSU Regulatory Compliance Office at (662) 325-0994.

Your cooperation and assistance regarding this matter would be greatly appreciated.

Sincerely,

Manika Kemp, Ed.S

Larry Johnson, Principal
West Bolivar Middle School
P.O. Box 189
Rosedale, MS 38769

Dear Mr. Johnson:

I am a doctoral student in Elementary, Middle, and Secondary Education Administration at Mississippi State University. I am in the dissertation phase of the process, and am writing to seek you assistance in completing this segment of my program of study. Dr. Anthony A. Olinzock is my major professor and dissertation director.

The title of my research is "A Comparison of Traditional Instruction and Standards-Based Instruction on seventh-grade Mathematics". This study will determine which method of instruction increases mathematics achievement. The sample will be approximately eighty-four seventh-grade mathematics students in the West Bolivar School District. The study will be conducted for one nine- week grading period.

To confirm our conversation granting me permission to conduct this study in your school, a letter should be written on your school letterhead with your signature and date. All requirements of the Institutional Review Board for the Protection of Human Subjects in Research (IRB) at Mississippi State University have been satisfied to conduct this study. Per our conversation, I will share a summary of the results with you upon completion of the study.

If you should have any questions about this research project, please feel free to contact me. For additional information involving human protection in research, please contact the MSU Regulatory Compliance Office at (662) 325-0994.

Your cooperation and assistance regarding this matter would be greatly appreciated.

Sincerely,

Manika Kemp, Ed.S

Keyia Brown, Teacher
West Bolivar Middle School
P.O. Box 189
Rosedale, MS 38769

Dear Ms. Brown:

I am a doctoral student in Elementary, Middle, and Secondary Education Administration at Mississippi State University. I am in the dissertation phase of the process, and am writing to seek you assistance in completing this segment of my program of study. Dr. Anthony A. Olinzock is my major professor and dissertation director.

The title of my research is "A Comparison of Traditional Instruction and Standards-Based Instruction on seventh-grade Mathematics". This study will determine which method of instruction increases mathematics achievement. The sample will be approximately eighty-four seventh-grade mathematics students in the West Bolivar School District. The study will be conducted for one nine- week grading period. I am requesting cooperation by allowing the study to be conducted using your seventh-grade mathematics classes.

To confirm our conversation granting me permission to conduct this study, a letter should be written on your school letterhead with your signature and date. All requirements of the Institutional Review Board for the Protection of Human Subjects in Research (IRB) at Mississippi State University have been satisfied to conduct this study. Per our conversation, I will share a summary of the results with you upon completion of the study.

If you should have any questions about this research project, please feel free to contact me. For additional information involving human protection in research, please contact the MSU Regulatory Compliance Office at (662) 325-0994.

Your cooperation and assistance regarding this matter would be greatly appreciated.

Sincerely,

Manika Kemp, Ed.S

APPENDIX C

LETTERS OF CONSENT AND ASSENT

LETTER OF INFORMED CONSENT

Dear Parents,

I am a doctoral student at Mississippi State University and in the dissertation phase of my program and required to conduct a research study. I am writing to request your permission to allow your child to be a participant in my study.

The purpose of this study is to research whether teaching methods affect student achievement in mathematics. The study will compare the results of standards-based method of instruction and traditional method of instructions on seventh-grade mathematics.

The study will be conducted over a nine week time period. Students will participate in the study during their regularly scheduled class periods of 50 minutes a day for 5 days a week. In addition, homework assignments will be given occasionally. The study will consist of two groups. One group will use the traditional method of instruction, where textbooks and workbooks will be the materials used for instruction. The other group will use the standards-based method of instruction, where the JBHM Achievement Connections materials will be used such as workbooks, manipulative, etc. Students will work in groups, problem solve, communicate mathematical literacy skills.

I will be administering a pretest and posttest on the 2^{nd} nine week scope and sequence of the Mississippi Frameworks. The pretest will determine their prior knowledge of the topics and will be given on the first day of school before we begin the study. The posttest will be given at the completion of the study. Intact classes will be randomly assigned to a traditional method of instruction group and a standards-based instruction group. Participation in this study will make students become active learners, make mathematics meaningful and assist school in improving mathematics achievement.

There are no risks or discomforts associated with this study. All personal information will be kept confidential; however, the result of the study will be shared with district personnel.

If you should have any questions concerning this research project, please feel free to contact Manika Kemp at (662) 759-0004. For additional information regarding human participation in research, contact the Mississippi State University Regulatory Compliance Office at (662) 325-0994.

Please understand that your child's **participation is voluntary**, your **refusal to participate will involve no penalty or loss** of benefits to which you are otherwise entitled, and you **may discontinue your child's participation** at any time without penalty or loss of benefits. Your child will continue to be a part of the teaching experience, but I will not include any data from your child.

A copy of this form will be given to you for your records.

_________________________________ __________________

Participant Signature Date

_________________________________ __________________

Investigator Signature Date

Letter of Assent

I, ______________________ a seventh-grade mathematics student, agree to participate
Print name

in a research study conducted by Ms. Manika Kemp as part of earning a doctorate degree from Mississippi State University. I am assured that my participation is voluntary, and I may withdraw from the study at any time. My name will not be used any where in the study. Overall results will be shared with the West Bolivar School District.

____
Student's Signature

APPENDIX D

JBHM PERMISSION LETTER

Mike Walters, President
JBHM Education Group, LLC
2525 Lakeward Dr., Ste 200
Jackson, MS 39216

Dear Dr. Walters:

I am a doctoral student in Elementary, Middle and Secondary Education Administration at Mississippi State University. I am in the dissertation phase of the process, and I am seeking your assistance in completing this segment of my program of study. Dr. Anthony A. Olinzock is my major professor and dissertation director.

My research will examine the factors that will assist schools in their effort to comply with the education reform, specifically the mathematics reform. Mathematics reformers have indicated that mathematics instruction should be student-centered and transferable to everyday situation. In order to make math meaningful, mathematics instruction has to change. Instruction should move from a traditional approach to a transactional approach. It should be more hands-on and less drill and practice. The Achievement Connection, seventh-grade Math addresses the concerns of the mathematics reformers. This program has a student-centered approach to learning which produces meaningful learning, and a variety of manipulatives to reach all types of learners. In fact, I am presently working at West Bolivar Middle School in Rosedale, MS and have personally seen the dramatic change in student learning as a result of The Achievement Connection.

I am requesting permission to utilize The Achievement Connection, seventh-grade Math program in my study. This study will compare the Achievement Connection seventh-grade math program as the standards- based method of instruction and the traditional method of instruction. This study will determine which method of instruction produces better performance on standardized test. In addition, I am requesting all background information, case studies, pilot studies, and theoretical framework that helped to create the program for the completion of this study.

If permission is granted, please respond in writing on your company's letterhead. I will share a summary of the results with you upon completion of this study. If you should have any questions, please feel free to contact me at 662-402-1030 or 662-759-3743.

Your cooperation and assistance regarding this matter will be greatly appreciated.

Sincerely,

Manika Kemp, Ed.S

APPENDIX E

SECOND NINE-WEEKS SCOPE AND SEQUENCE

FROM THE MISSISSIPPI MATHEMATICS

FRAMEWORKS

Seventh-Grade MATH
2ND GRADING PERIOD

Unit 2-Number Sense

Benchmark Items:

44: Expresses ratios as fractions
47: Explores equivalent ratios and expresses them in simplest form
48: Solves problems involving proportions
49: Determines unit rates
50: Uses models to illustrate the meaning of percent
51: Converts among decimals, fractions, mixed numbers, and percents
52: Determines the percent of a number
53: Estimates decimals, fractions, and percents
54: Uses proportions and equations to solve problems with rate, base, and part with and without calculators
55: Finds the percent of increase and decrease
56: Solves problems involving sales tax, discount, and simple interest with and without calculators
37: Recognizes and writes integers including opposites and absolute value
38: Compares and orders integers
39: Adds, subtracts, multiplies, and divides integers with and without calculators