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Teachers' Self-Efficacy in Mathematics and Teaching Mathematics, Instructional Practices, and the Mississippi Curriculum Test, Second Edition for Mathematics in Grades 3-5

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by

Tracy Hardwell Yates

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
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ABSTRACT

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The purpose of this correlational study was to examine the relationship among the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers. This study was also designed to determine how these variables influence an individual teacher's QDI in relation to MCT2 math scores in grades 3-5. The study included 117 third, fourth, and fifth grade elementary teachers who taught mathematics during the 2012-2013 school year. These teachers completed the Mathematics Teaching and Mathematics Self-Efficacy (MTMSE) survey and the Patterns of Adaptive Learning Scales (PALS) survey. A descriptive analysis was conducted on the data collected. The results of the study indicated that teachers are most confident teaching the numbers and operations strand of the NCTM 2000 standards for mathematical content. However, teachers indicated an overall confidence in their ability to teach all mathematical topics related to the NCTM 2000 standards. Teachers agreed that they should incorporate instructional practices that stress the importance of students working hard and that strategies should be fun and keep students from being bored in the classroom. Teachers also agreed that students should be recognized for individual progress and that instruction should be differentiated based on students' needs. A multiple regression was also used to analyze the data. The results of the statistical analysis indicated that there is no statistically significant relationship between MCT2 math QDI and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy. The results also indicated that there is no statistically significant relationship between MCT2 math QDI and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction. The research indicated that self-efficacy and instructional practices may not be good predictors of an individual teacher's QDI. Therefore, self-efficacy may not correspond to a teacher's actual ability. Teachers may think that they are better or worse teachers than they actually are, and this factor could affect QDI. When analyzing a teacher's QDI, practitioners should take into consideration other factors such as class size, student ability, and student attendance.

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DEDICATION

I dedicate this dissertation to my husband, Craig, my daughter, Shelby, and my parents, Johnny and Lillian. Without their support, none of this would have been possible.

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Writing this dissertation has been one of the most significant challenges I have ever faced. I would have never been able to finish without the guidance of my committee members and unconditional help, support, and encouragement from my professors, colleagues, friends, and family throughout this entire process.

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TABLE OF CONTENTS

LIST OF TABLES

Table

CHAPTER I

INTRODUCTION

The growing influence of mathematics can be seen in all aspects of society, from routine tasks to the workforce, where its role is often imperative (Stevens, Olivarez, Lan, & Tallent-Runnels, 2004). “In the current high-stakes testing environment, any attribute of a student that positively influences achievement is of interest” (Fast et al., 2010, p. 729); therefore, current and future students will need better and more training in mathematics to be successful (Marshall, 2003).

In 1995, the National Center for Education Statistics (NCES) conducted the Third International Mathematics and Science Study (TIMSS) (U.S. Department of Education, 1996). The TIMSS study was used to evaluate mathematics and science education (U.S. Department of Education, 1996). As a result of this study, it became clear how math and science education differs in the United States compared to other countries (U.S. Department of Education, 1996). According to the TIMSS study, eighth graders from the United States scored below the international average in mathematics, and twelfth graders in the United States scored below the international average on the general knowledge math test (U.S. Department of Education, 1998). As a result of the TIMSS study, the United States began to question whether the expectations for students were high enough, whether the educational system was good enough, and whether the standards and curriculum were in line with the goal of being ranked number one internationally by the year 2000 (U.S. Department of Education, 1996).

Mathematics reform is necessary in order to change how students feel about mathematics and about their abilities (Marshall, 2003). The purpose of mathematics reform is to teach for comprehension (Greenes, 2009). Therefore, teachers are vital in order to transform mathematics education in the U.S. (Battista, 1994). According to Cornell (1999), math teachers must ensure that students understand the mathematical vocabulary associated with their lessons before they explain how these terms interact together; otherwise, many students will not be prepared holistic understanding and comprehension. One way to teach for comprehension and understanding is by using big ideas and relating them to other concepts (Greenes, 2009). For example, it would be difficult for a student to understand long division if he or she does not first understand the difference between a divisor and a quotient (Cornell, 1999).

According to Fennell (2007), mathematics is a subject that is important for everyone, not just the most intelligent students. According to Marshall (2003), schools often use remediation to help students; however, Marshall also noted that if students are taught correctly the first time, remediation might not be necessary. Teachers need to make math more enjoyable for students to encourage persistence in problem solving (Fennell, 2007). Teachers must begin teaching mathematics in a manner that enables students to understand mathematical concepts in ways that can be applied to future problems (Marshall, 2003). Marshall (2003) warned that this may be difficult for teachers who may not have been taught in this manner. In order to do this, teachers must have the mathematical knowledge that will allow them to recognize problem-solving strategies that are not effective, as well as the ability to explain to students a better way to work the problem without deterring students' future efforts (Cornell, 1999).

Cornell (1999) compared learning mathematics to a foot race—when students fall behind in mathematics it is often very difficult for them to catch up with their peers. Therefore, it is important for teachers to be able to identify when students do not understand the material in order to make immediate, necessary accommodations (Cornell, 1999). Currently, students are learning math through rote learning rather than gaining a true understanding of the material (Greenes, 2009). Students often use memorization when they do not fully understand the concepts (Cornell, 1999). Although memorization may help students achieve more success on the test, it does not provide a firm foundation required for success in future mathematics (Cornell, 1999). In order to be successful in mathematics, teaching for memorization must be replaced with teaching for understanding (Cornell, 1999; Marshall, 2003).

According to Fennell (2007), two challenges affect how students perceive mathematics and their mathematical abilities, and teachers must be prepared for these challenges when they encounter them. The first challenge occurs when parents make excuses for their children when they struggle in math because they were not good at math either (Fennell, 2007). At parent-teacher conferences, the researcher often hears parents say, “I was never good at math either” or “I understand because math was my worst subject too.” If the children are present when these comments are made, they may determine that it is acceptable to view math as unimportant, and these viewpoints may be passed on from one generation to the next (Fennell, 2007).

The second challenge occurs in the classroom. Teachers often work hard presenting the lesson, and students want to know when they will use this in life (Fennell, 2007). These questions are common, and as a math teacher, the researcher often hears students say, “Oh well, I can’t do math anyway,” “I’m not good at math anyway,” or “Math just isn’t my subject.” Teachers must be prepared so that they will be confident in their abilities, inspire and motivate students, and help create a better, deeper understanding of mathematics that students can build upon as they progress through life (Marshall, 2003). Although this could be frustrating for teachers, they must be prepared to answer these questions, and this can be accomplished by incorporating relevant, real-life activities into classroom instruction (Fennell, 2007). Marshall (2003) suggested that increased student understanding can be accomplished through detailed illustrations and real-world examples.

Statement of the Problem

“Self-efficacy is a context-specific assessment of competence to perform a specific task, a judgment of one’s capabilities to execute specific behaviors in specific situations” (Pajares & Miller, 1994, p. 194). A person’s level of self-confidence determines how the individual will handle situations (Bandura, 1977, 1983; Zimmerman, 2000). These self-efficacy beliefs play a role in the goals individuals set for themselves, the amount of effort they use to accomplish these goals, how long they are willing to work to be successful, and how they respond to failure (Bandura, 1977, 1993; Pajares & Miller, 1994). The researcher has seen evidence of teachers covering only what they feel comfortable teaching.

Justification

Smith (2010) conducted a study in Mississippi involving mathematics anxiety, mathematical self-efficacy, mathematical teaching self-efficacy, and the instructional practices of elementary school teachers in grades K-6. Although research has been done involving mathematical self-efficacy, mathematical teaching self-efficacy, and the instructional practices of elementary school teachers (Kahle, 2008; Smith, 2010), this research has not been tied to how they influence Mississippi Curriculum Test, Second Edition (MCT2) math scores in grades 3-5. The researcher investigated the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers and their influences on MCT2 math scores in grades 3-5.

Purpose of the Study

The purpose of this study was to determine mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers and their influences on an individual teacher's QDI in relation to MCT2 math scores in grades 3-5. The independent variables in this study included mathematical teaching self-efficacy, personal mathematical teaching self-efficacy, and instructional practices. The independent variables were measured using Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000) and the Mathematics Teaching and Mathematics Self-Efficacy Scale (MTMSE) (Kahle, 2008). The dependent variable in this study was the Mississippi Curriculum Test, Second Edition (MCT2) Math grades 3-5. The dependent variable was measured using teachers' Quality Distribution Index (QDI). Using established cut scores, each student was labeled as Basic, Proficient, or Advanced based on performance (Mississippi Department of Education, 2012b). The distribution of the students among these three performance levels determines a teacher's QDI (MDE, 2012b).

Theoretical Framework

The theoretical framework for this research study was based on the theories of self-efficacy and constructivism.

Self-Efficacy

The efficacy beliefs held by students and teachers impact academic performance (Bandura, 1993). According to Bandura (1993), "efficacy beliefs influence how people feel, think, motivate themselves, and behave" (p. 118). A person's efficacy beliefs not only affect how he or she thinks; these beliefs also affect emotional reactions to situations (Pajares, 1996). People with a high sense of efficacy have visions of success and focus on how to make it happen, whereas people with a low sense of efficacy visualize failure and everything that might go wrong (Bandura, 1993).

Bandura (1977, 1982) discussed four sources that affect self-efficacy: (a) performance accomplishments (1977), performance attainments (1982), or enactive experiences (Zimmerman, 2000); (b) vicarious experiences; (c) verbal or social persuasion; and (d) physiological states. According to Pajares and Miller (1994), an individual's self-assessment of his or her competence to perform a specific task is that person's self-efficacy. A person's self-confidence determines how that individual will handle situations (Bandura, 1977, 1983; Zimmerman, 2000). People usually embrace activities and situations that they feel capable of handling with confidence and avoid activities where they feel threatened (Bandura, 1977, 1983).

Self-efficacy helps individuals form an opinion about future performance expectations, and individuals use these judgments before attempting tasks (Zimmerman, 2000). Although efficacy expectations play a role in the activities in which people choose to participate, they do not necessarily produce positive outcomes because one's actual abilities also play a role in success (Bandura, 1977). A person's self-efficacy beliefs generally determine the amount of time and effort spent working on the given situation (Bandura, 1982). Many people think before they act, and their self-efficacy beliefs shape their thoughts (Bandura, 1993). A fully capable person may excel, perform adequately, or perform poorly as a result of self-efficacy beliefs (Bandura, 1993).

According to Bandura (1977), the higher a person's self-efficacy, the more effort will be put into an activity. People with a high sense of efficacy respond to failure by being more persistent and working harder to become successful; people with a low sense of self-efficacy are usually less persistent and give up quicker (Bandura, 1993). Individuals with a high sense of self-efficacy embrace difficult tasks, set high goals for themselves, fully commit to these goals (Bandura, 1993), and appear to be calm and relaxed when they encounter difficulties (Pajares, 1996).

Constructivism

According to Greenes (2009), student performance on math tests has brought about the topic of mathematics reform. By the 1980s, problem solving along with conceptual and procedural understanding began to play a key role in the mathematics classroom, and by the late 1980s, many researchers of mathematics began to lean toward the constructivist theory (Woodward, 2004). During the math reform movement of the 1980s and 1990s, student assignments, tasks, and activities were designed and expected to help students construct their own knowledge through exploration (Williams, 1997).

According to Tobias and Duffy (2009), recent interest in constructivism can be traced back to Vygotsky, Piaget, and Dewey. Piaget's individual or cognitive constructivism is the first of two widely recognized types of constructivism (Powell & Kalina, 2009). The second is Vygotsky's social cognitive constructivism (Powell & Kalina, 2009). Constructivism is a theory about how people learn (Brandon & All, 2010; Colburn, 2000), and it involves many different teaching strategies (Colburn, 2000). The idea behind constructivism is that learning is an active process, and the foundation for new learning comes from current and past experiences (Brandon & All, 2010). In order for students to become better math students, teachers need to limit the number of topics covered and cover the ones they do in depth (Greenes, 2009).

Brandon and All (2010) compared constructivism to a spiral. In this spiral, students are at the center working together as a group and interacting with the teacher (Brandon & All, 2010). The teacher was constantly encouraging the students and interceded when necessary to help students gain a better understanding of the concept (Brandon & All, 2010).

“The National Council of Teachers of Mathematics (NCTM) has presented a vision of reform mathematics based upon constructivist approaches that has far-reaching implications for teacher practices in the mathematics classroom” (Swars, 2005, p. 139). According to Iran-Nehad (1995), it is imperative that students are taught to think for themselves. Furthermore, all teachers must have the same understanding of what thinking is as well as how to teach students to think (Iran-Nehad, 1995). According to Brooks and Brooks (1999), in a classroom using constructivism, the focus is on student understanding: students’ opinions are important and are used to teach the lesson; lessons are structured so that the students are able to see the relevance of the topic; and problems are challenging as to require students to think for themselves and explore possible solutions.

In traditional classrooms, teachers use hands-on approaches to learning, but these do not necessarily characterize constructivism (Mvududu, 2005). During these hands-on activities, the teacher is in control and most of the emphasis is placed on getting the correct answers rather than gaining a deeper understanding (Mvududu, 2005). Contrastingly, in a constructivist classroom, students learn how to think and how to be problem solvers (Brooks & Brooks, 1999). In order to have an effective classroom based on constructivism, teachers must use both social and cognitive constructivism (Powell & Kalina, 2009). Since the period of math reform, the teacher’s role has become the facilitator to guide student understanding (Brandon & All, 2010; Williams, 1997). Students are given more control of and responsibility for their learning (Mvududu, 2005). Constructivist teaching helps students gain a better understanding of the concepts being taught rather than just learning procedures (Williams, 1997). The teacher is an aide who guides and supports the students through activities and discussions (Brandon & All, 2010; Greenes, 2009; Iran-Nehad, 1995) rather than passively showing and explaining problems and even solutions (Brandon & All, 2010). Teachers can incorporate constructivism into their classroom in many ways. Some strategies suggested by Colburn (2000) include cooperative learning, question and wait time, and in-depth class discussions.

With social constructivism, ideas and concepts are introduced and learned by interacting with the teacher and collaborating with classmates (Powell & Kalina, 2009). The teacher will present students with a problem, and the students are responsible for organizing the information and overseeing their own learning (Iran-Nehad, 1995). With cognitive constructivism, ideas and concepts are introduced and learned by students through a personal process (Powell & Kalina, 2009). The most important part of both types of constructivism is that students' ideas must be constructed from experience in order to form a personal meaning (Powell & Kalina, 2009).

Research Questions

The following research questions guided this study

1. What are the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers in grades 3-5?
2. Do mathematical self-efficacy, mathematical teaching self-efficacy, and instructional practices have an influence on an individual teacher's QDI in relation to MCT2 math scores in grades 3-5?

Research Hypotheses

The following null hypotheses were investigated in this study:

H_1: There is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy.

H_2: There is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction.

Definition of Terms

The following is a list of terms relevant to this study:

Constructivism – Constructivism is a theory about how people learn (Brandon & All, 2010; Colburn, 2000). The idea behind constructivism is that learning is an active process and that the foundation for new learning comes from current and past experiences (Brandon & All, 2010).

Criterion-referenced tests – Criterion-referenced tests are used to measure student performance on a specific criterion that is being tested (Bond, 1996). Criterion-referenced tests allow the examinee to demonstrate whether or not he or she has met the criteria; cut scores are set and used to determine if a student passes or fails as well as the level of mastery attained (Bracey, 2000). Criterion-referenced tests identify and assess how much students know about a certain topic or how well they have mastered the skill being tested (Bond, 1996).

Mastery approaches to instruction – Mastery approaches to instruction "refers to teacher strategies that convey to students that the purpose of engaging in academic work is to develop competence" (Midgley et al., 2000, p. 35).

Mastery goal structure for students – Mastery goal structure for students "refers to teachers' perceptions that the school conveys to students that the purpose of engaging in academic work is to develop competence" (Midgley et al., 2000, p. 33).

Mastery learning – Mastery learning is an instructional strategy that can be used to increase achievement and motivation for a large number of students (Bloom, 1978). Mastery learning is based on the premise that students must learn at their own pace (Pulliam & Van Patten, 2003; Rollins, 1983). With mastery learning, students do not move on to the next level until they have demonstrated mastery at the current level (Pulliam & Van Patten, 2003).

Mathematical self-efficacy – “Mathematics self-efficacy is a situational or problem-specific assessment of an individual’s confidence in his or her ability to successfully perform or accomplish a particular task or problem” (Hackett & Betz, 1989, p. 262).

Mathematics content teaching self-efficacy – In this study, mathematics content teaching self-efficacy relates to a teacher’s level of confidence in his or her ability to teach mathematical content related to the NCTM 2000 standards for mathematical content (Kahle, 2008).

Mathematics self-efficacy problems – In this study, mathematics self-efficacy problems relates to a teacher’s level of confidence in his or her ability to solve certain math problems without the use of a calculator (Kahle, 2008).

Mathematics self-efficacy tasks – In this study, mathematics self-efficacy tasks relates to a teacher’s level of confidence in his or her ability to perform certain mathematical tasks related to the NCTM 2000 standards for mathematical content (Kahle, 2008).

Mathematics teaching self-efficacy – In this study, mathematics teaching self-efficacy relates to a teacher’s level of confidence in his or her ability to teach certain mathematical standards (Kahle, 2008).

Norm-referenced tests – Norm-referenced tests are standardized tests in which the student being tested is compared to other students taking the same test (Bracey, 2000). With norm-referenced tests, the test is initially given to a group of students, and the results of this initial testing are used to create the norm (Bond, 1996). Once the norm has been set, anyone taking the test in the future is compared to the original norm (Bond, 1996).

Performance approaches to instruction – Performance approaches to instruction "refers to teacher strategies that convey to students that the purpose of engaging in academic work is to demonstrate competence" (Midgley et al., 2000, p. 36).

Performance goal structure for students – Performance goal structure for students "refers to teachers' perceptions that the school conveys to students that the purpose of engaging in academic work is to demonstrate competence" (Midgley et al., 2000, p. 34).

Performance goals – "Performance goals refer to the desire to show competencies by trying to obtain positive judgments" (Darnon, Butera, & Harackiewicz, 2007, p. 61). Performance goals do not foster a deep understanding of the material being learned and may cause students to avoid tasks for which they lack confidence (Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000).

Quality Distribution Index (QDI) – QDI "measures the distribution of student performance on state assessments around the cut points for Basic, Proficient, and Advanced performance" (MDE, 2012b, p. 31). QDI can range from 0 to 300. QDI is calculated using the following formula: QDI = % Basic + 2(% Proficient) + 3(% Advanced) (MDE, 2012b).

Self-efficacy – “Self-efficacy is a context-specific assessment of competence to perform a specific task, a judgment of one’s capabilities to execute specific behaviors in specific situations” (Pajares & Miller, 1994, p. 194).

Teacher efficacy – “Teacher efficacy is the teacher’s belief in his or her capabilities to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context” (Tschannen-Moran, Hoy, & Hoy, 1998, p. 233).

Delimitations

1. The study was limited to the individual teacher’s QDI in relation to MCT2 Math scores for the 2012-2013 school year.
2. The study was a convenience sample that was limited to select schools in Mississippi.
3. Participants in the study were limited to third, fourth, and fifth grade math teachers employed in select schools during the 2012-2013 school year.

Assumptions

The study assumed that all people responding to the study were being honest in regards to mathematical self-efficacies, mathematical teaching self-efficacies, instructional practices, and 2012-2013 MCT2 Mathematics QDI. The researcher also assumed that all of the data were entered correctly.

Summary

The researcher investigated the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers and their influences on an individual teacher’s QDI in relation to MCT2 math scores in grades 3-5. Chapter II contains the review of literature pertaining to mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers.

CHAPTER II

REVIEW OF RELATED LITERATURE

Mathematics in the United States

History of Mathematics Education

Most schools were originally created as a way to educate the clergy and teach literacy (Willoughby, 1967). Arithmetic was first taught in elementary schools in the late 18th and early 19th centuries as a result of industrialization (National Council of Teachers of Mathematics, 1970). At this time, arithmetic was not taught in all schools; as a result of this industrialization, it was only taught in towns with commercial interests (Willoughby, 1967). There was very little advanced mathematics in the United States until the middle of the 19th century (Burton, 2007). Schools began incorporating mathematics into the curriculum in order to meet the needs of an ever-changing society, and math taught in the elementary schools was adapted in order to better prepare individuals for a life in the industrial world (NCTM, 1970). During this time, math was not meant to be advanced; students were taught basic math skills that revolved around arithmetic, algebra, and geometry (Burton, 2007).

During the early 1800s, a college education in the U.S. was primarily for gentlemen; the goal was to educate and produce upstanding, prepared young men through the classical curriculum (Burton, 2007). According to Burton (2007), there was public dissatisfaction because the U.S. K-12 education system was catering specifically to males in the upper class. “During the 1820s and 1830s, many of the states passed laws concerning the establishment of public schools, but these schools were neither free not compulsory” (Willoughby, 1967, p. 3). During the mid-1800s, in an effort to educate more children, compulsory attendance laws began being passed throughout the United States, and by the early 1900s, all but six states had passed these attendance laws (NCTM, 1970). These compulsory attendance laws vary by state; however, the Mississippi Code of 1972 mandates that students who are five or will turn five before September 1 of any given year must attend school. At the age of five, parents may choose to unenroll a child one time if they feel the child is not prepared or age appropriate (Mississippi Code, 1972). This code also states that any child who has not already turned seventeen by September 1 of the calendar year is also required to attend school for that calendar year (Mississippi Code, 1972). With the passing of these laws, more and more students began attending schools (NCTM, 1970). By 1940, free schools were common, but the curriculum was often limited to reading and writing due to the school teachers’ lack of education in other subject areas (Willoughby, 1967).

Up until that time, there was very little mathematical research in the United States; therefore, U.S. students wanting to study advanced mathematics had to study abroad, usually in Europe (Burton, 2007). According to Burton (2007), during the 19th century, it was estimated that about 20% of the faculty teaching math in U.S. colleges had studied abroad at some point. By the end of the 19th century, more and more individuals needed higher-level mathematics as a result of the industrial advances in the U.S. (NCTM, 1970). In 1876, Johns Hopkins University, modeled after the University of Berlin, was founded; it was the first research-based university and is given much credit for the mathematics explosion in the United States (Burton, 2007). Until this time, school mathematics was taught strictly because it was required rather than as a useful tool (NCTM, 1970).

During the 1800s, normal schools were established in the U.S. (Willoughby, 1967). By 1872, over 100 of these normal schools existed, and preparing teachers pedagogically and on subject matter became important (Willoughby, 1967). In the early 1890s, mathematics in the U.S. began to change; newly educated young men became enthusiastic about mathematics and began to raise the standards in the United States to reflect what they were learning in Germany and other parts of Europe (Burton, 2007). In 1890, due to people's unhappiness with the manner in which children were learning mathematics, committees and commissions began making recommendations to change the mathematics curriculum and teaching methods (Willoughby, 1967). In the early part of the 20th century, the manner in which mathematics was taught began to be questioned again, and there was a push to find newer, more innovative, and more concrete methods of instruction (NCTM, 1970). Also at this time, education in general in the United States was on the rise (Burton, 2007). There was a push to educate all children, and the number of students attending school was steadily increasing (NCTM, 1970).

In 1850, there were only eight graduate students in the United States, and by 1900, there were about 5,700 graduate students (Burton, 2007). According to Burton (2007), the increase in students enrolled in graduate classes allowed the faculty members to specialize; as a result, students excelling in mathematics no longer had to study abroad to earn a doctorate (Burton, 2007). By the end of the 19th century and the early 20th century, universities in the United States began training students in advanced mathematics; the University of Chicago played a major role in mathematics in the United States by awarding 10 doctoral degrees in the field of mathematics between 1896 and 1900 (Burton, 2007). By the beginning of the 20th century, the United States had a firm grasp on mathematics and actually began to surpass Germany in the number of doctoral degrees awarded in mathematics (Burton, 2007). Between 1900 and 1910, the number of doctoral degrees awarded in mathematics nearly tripled; this number doubled again during the next 10 years (Burton, 2007).

In 1916, the National Committee on Mathematical Requirements was formed by the Mathematical Association of America (Willoughby, 1967). In 1923, this committee published a report recommending plans and sequences for mathematics to be taught in junior high and high school (Willoughby, 1967). During the 20th century, women began to become more apparent in the math world; this was partly due to the founding of women’s colleges (Burton, 2007). The proportion of female college graduates approximately doubled between 1900 and 1929 from about one-fifth to about two-fifths, and nearly 15% of the students earning a doctorate in mathematics were women (Burton, 2007). However, between 1920 and 1945, mathematics in the United States was greatly affected by the Great Depression and World War II (NCTM, 1970). During this time, officials complained that the men entering the military were not prepared to handle all of the mathematical needs during the war (Willoughby, 1967). As a result of the Great Depression and World War II, the number of women earning doctoral degrees in mathematics decreased drastically from nearly 15% to only about 5% by the 1950s (Burton, 2007). It was not until 1979 that the percentage of women earning doctorates in mathematics equaled the percentages from the 1920s (Burton, 2007).

Woodard (2004) referred to the mathematics reform movement in the United States during the 1950s and 1960s as “The New Math” (p. 16). At this time, colleges, universities, and the professors at institutions of higher education were concerned that incoming students had not received adequate training in the K-12 educational system and could not understand mathematics conceptually in order to apply the skills in other areas (Woodward, 2004).

Two major influences on mathematics during this time were the development of atomic weapons during the 1940s and Sputnik in 1957 (Woodward, 2004). Along with Sputnik came a clear need to improve education in the U.S. (NCTM, 1970). It also became clear that the only way the American dream of happiness and prosperity could be a reality would be through education (NCTM, 1970). In response to the production of atomic weapons and the launch of Sputnik, the United States poured federal funds into research and mathematics (Woodward, 2004). In order to strengthen the math skills of students in secondary schools, it was determined that the math skills of students at the elementary level must be strengthened first (NCTM, 1970).

Due to concerns that mathematics at the elementary level might not be taught well enough, mathematicians began to look into potential changes and how elementary school mathematics could be improved (Kilpatrick, 1992). Federal funds were provided to help the United States produce more scholars, professors, and highly qualified math teachers who could help the United States compete with the rest of the industrialized world (Woodward, 2004).

In an effort to help students gain a better understanding of mathematical concepts and principles, the new math curriculum introduced during the 1950s and 1960s focused on teaching abstract mathematical concepts (Woodward, 2004). The teaching of these concepts started at the elementary level and continued through high school (Woodward, 2004). Woodward (2004) stated that according to Max Beberman, a mathematician at the University of Illinois, the new mathematics education had to be concept-based, promote a clear understanding of vocabulary, and target discovery learning. It was thought that allowing students to discover relationships in mathematics would help them understand the concepts more concretely, and "students would be in a much better position to understand and explain *why* than rather merely tell *what"* (Woodward, 2004, p. 17).

Riedesal (1967) discussed the importance of guided discovery. With guided discovery, students are actively involved in the learning process. Students do not wait for the teacher to show how to solve the problems but independently seek a solution (Riedesal, 1967). When students struggle, the teacher guides them by asking questions intended to make them think mathematically (Riedesal, 1967). In order for teachers to be able to teach mathematics through discovery, they must have a high content knowledge and must be able to ask appropriate questions at the right times to guide student learning (Woodward, 2004).

According to Woodward (2004), “The New Math” (p. 16) reform of the 1950s and 1960s that was based on introducing abstract concepts to elementary students was unsuccessful due to a lack of professional development for K-12 educators. During the 1970s, a new reform movement was introduced; this “back-to-basics” (Woodard, 2004, p. 18) movement emphasized reading, writing, and arithmetic (Woodard, 2004). With this reform, the teachers once again began playing a major role in the classroom, leaving little time for the discovery education introduced during the 1960s (Woodward, 2004). Woodward (2004) also stated that by the 1980s problem solving along with conceptual and procedural understanding began to play a key role in the mathematics classroom, and by the late 1980s, many researchers of mathematics began to lean toward the constructivist theory. According to Brooks and Brooks (1999), in a classroom using constructivism, the focus is on student understanding: students’ opinions are important and are used to teach the lesson; lessons are structured so that the students are able to see the relevance of the topic; and problems are challenging as to require students to think independently and explore possible solutions. In a constructivist classroom, students learn how to think and how to be problem solvers (Brooks & Brooks, 1999).

In 1981, the National Commission on Excellence in Education (NCEE) was founded by T. H. Bell, the Secretary of Education for the U. S. Department of

Education (NCEE, 1983). The NCEE was given the task of studying the American educational system and reporting back within 18 months (NCEE, 1983). As a result of this study, *A Nation at Risk* was written as a report to the nation published in 1983 (NCEE, 1983). Its purpose was to identify issues with the American educational system and make suggestions to help improve it (NCEE, 1983). The report was critical of the American educational system and stated the following:

> If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might have well viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in student achievement made in the wake of the Sputnik challenge. Moreover, we have dismantled essential support systems which helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament. (NCEE, 1983, p. 5)

In an effort to strengthen the American education system, the NCEE recommended that graduation requirements be made more rigorous and that all students receiving a high school diploma must complete one-half unit of computer science; three units of social studies, math, and science each; and four units of English (NCEE, 1983).

In response to *A Nation At Risk*, the National Council for Teachers of Mathematics (NCTM) published the *Curriculum and Evaluation Standards for School Mathematics* in 1989, and the National Research Council published

Everybody Counts in 1989 (Woodward, 2004). The purpose of the *Curriculum and Evaluation Standards for School Mathematics* was to help improve mathematics education in the United States (NCTM, 2000). *Everybody Counts* was a report to the nation about the future of mathematics; it was a cry for help with the mathematics reform efforts in the United States (National Research Council, 1989).

Woodward (2004) referred to the mathematics reform movement in the United States during the 1990s as “Excellence in Education, Again” (p. 22). According to Woodward (2004), the *Curriculum and Evaluation Standards for School Mathematics* developed by NCTM in 1989 were developed in an effort to once again push “excellence in education” (p. 22). These standards were also important during this time because they were viewed as a way to help move the U.S. to become the world leader in mathematics and science (Woodward, 2004). At this time, the U.S. had already begun using standardized testing as a way to measure student progress, and many people were not pleased (Woodward, 2004). As a result of the issues with standardized tests and the need to increase rigor, many states began to develop performance-based assessments based on the 1989 NCTM standards (Woodward, 2004).

In 1995, the National Center for Education Statistics (NCES) conducted the Third International Mathematics and Science Study (TIMSS) (U.S. Department of Education, 1996). This study included the participation of over 500,000 students from 41 countries (U.S. Department of Education, 1996). The TIMSS study was used to evaluate mathematics and science education by testing students in three different grades: fourth, eighth, and twelfth (U.S. Department of Education, 1996). As a result of this study, the United States was able to see how math and science education differed in the United States compared to other countries (U.S. Department of Education, 1996). Three reports were issued as a result of the 1995 TIMSS study: (a) *Pursuing Excellence: A Study of U.S. Fourth-Grade Mathematics and Science Achievement in International Context*, (b) *Pursuing Excellence: A Study of U.S. Eighth-Grade Mathematics and Science Teaching, Learning, Curriculum, and Achievement in International Context*, and (c) *Pursuing Excellence: A Study of U.S. Twelfth-Grade Mathematics and Science Achievement in International Context*.

Of the 41 countries participating in the TIMSS study, only 26 participated in the fourth-grade assessments (U.S. Department of Education, 1997). According to the TIMSS study, U.S. fourth graders scored above the international average in mathematics and were only outperformed by seven countries (U.S. Department of Education, 1997).

Eighth graders from the United States scored below the international average in mathematics and were outperformed by 20 countries (U.S. Department of Education, 1996). The TIMSS study also found that eighth-grade math classes in the United States were not as rigorous as those in other countries (U.S. Department of Education, 1996).

Of the 41 countries participating in the TIMSS study, only 21 participated in the twelfth-grade assessments (U.S. Department of Education, 1998). Twelfth graders in the United States scored below the international average on the general knowledge math test and were outscored by 14 other countries (U.S. Department of Education, 1998).

As a result of the TIMSS study, the United States began to question whether the expectations for students were high enough, whether the educational system was good enough, and whether the standards and curriculum were in line with the goals of being ranked number one internationally by the year 2000 (U.S. Department of Education, 1996). It was determined that

> Improving achievement in mathematics and science subjects, whether in basic skills or advanced critical thinking, will require the students to have, in combination, access to good teachers, good teaching materials, and agreement within the school on the goals of learning for all students. (U.S. Department of Education, 1998, p. 8)

Woodward (2004) referred to the mathematics reform movement in the 21st century as “Excellence and Accountability” (p. 25). In 2000, NCTM updated the 1989 *Curriculum and Evaluation Standards for School Mathematics*. The new NCTM standards were called *Principles and Standards for School Mathematics*. The purpose of these new standards was to guide curriculum, to set mathematical goals for students, to serve as a valuable resource to teachers, and to help teachers find the best ways to help students gain a true understanding of mathematics (NCTM, 2000).

The *Principles and Standards for School Mathematics* provide mathematical guidance to teachers, administrators, and school districts by using its six principles for school mathematics (NCTM, 2000). The first principle defined by the *Principles and Standards for School Mathematics* is the equity principle. In order to satisfy the equity principle, educators must set high expectations for all students, and teachers must be able to give students the support to reach goals. In order to reach every student, teachers must offer needed accommodations (NCTM, 2000).

The second principle defined by the *Principles and Standards for School Mathematics* is the curriculum principle. In order to satisfy the curriculum principle, teachers must be able to develop coherent lessons and mathematics units so that students are able to see how mathematical concepts are related. Teachers must also be aware of the curriculum at different grade levels to help students build on and make connections to what they already know (NCTM, 2000).

The third principle defined by the *Principles and Standards for School Mathematics* is the teaching principle. Classroom teachers must be effective. In order to satisfy this principle, teachers must know the content, must be able to create a classroom environment that is conducive to learning, and must be able to provide support to aid student learning. The most successful teachers always reflect on lessons and seek ways to improve instruction (NCTM, 2000).

The fourth principle defined by the *Principles and Standards for School Mathematics* is the learning principle. This principle stresses the importance of understanding with mathematics so that students will be able to make connections and use skills to solve problems in the future (NCTM, 2000).

The fifth principle defined by the *Principles and Standards for School Mathematics* is the assessment principle. Assessments used in the classroom can be formal or informal and should be used often. It is critical to use a variety of formative and summative assessments in order to gain a well-rounded picture of students' knowledge. These assessments do not have to be given only in the form of tests. Assessments can be done in a variety of ways that include tests, quizzes, projects, journals, activities, and performance tasks. In order to be effective, teachers should use the results of these assessments as a tool to guide future classroom instruction (NCTM, 2000).

The sixth and final principle defined by the *Principles and Standards for School Mathematics* is the technology principle. The technology principle stresses the value and importance of technology in the mathematics classroom. When used properly, technology can motivate students and be a valuable tool to aid in student understanding when teaching mathematics (NCTM, 2000).

In 2002, President George W. Bush reauthorized the Elementary and Secondary Education Act (ESEA) of 1965 by signing into law the No Child Left Behind (NCLB) Act of 2001. NCLB (2001) holds schools and districts accountable for student achievement (Simpson, LaCava, & Graner, 2004). NCLB set the goal to have all students proficient by the year 2014 (NCLB, 2001). The word proficient has many meanings (Rosenberg, 2004). With regard to NCLB (2001), each state had to set its own cut scores for measuring proficiency, and these cut scores vary for each test, subject, grade level, and state (Rosenberg, 2004). The purpose of NCLB was to ensure that all children had an equal opportunity to a quality education that would prepare them to score proficient or higher on state tests as well as become proficient in reading, language arts, and mathematics (NCLB, 2001).

Evolution of Assessments in the United States

Throughout modern history, students attending public schools have been subject to standardized testing at some point (Bracey, 2000). According to Stiggins (2003), the use of standardized assessments as a way to improve schools began in the 1930s. These assessments are used to determine how well individual students perform on a given set of standards (Calfee, 1993). According to Stiggins (2003) and Calfee (1993), student assessment results have played a role in school improvement. Furthermore, standardized tests have been used as a means to determine if schools are effectively educating students (Stiggins, 2003). Calfee (1993) added that these assessments have also played a role in classroom instructional practices as well as in evaluating the effectiveness of teachers. According to Calfee (1993), “assessment is a critical issue for the future of educational policy and practice” (p. 6).

The Scholastic Aptitude Test (SAT) was first administered in 1926 to approximately 8,000 men (Lawrence, Rigol, Van Essen, & Jackson, 2002). During this time, the SAT became a criteria for admission into college (Stiggins, 2003). Later, this test began to be used on a national scale to measure school accountability (Stiggins, 2003). If SAT scores were up, then school systems were considered to be doing well; however, if SAT scores were down, school systems were viewed negatively by the public as well as legislatures (Stiggins, 2003). The use of the American College Test (ACT) began in 1959 (ACT, 2009). Like the SAT, the ACT is an exam that students take for admittance into college (ACT, 2009). The ACT assesses students in the four areas of English, math, reading, and science (ACT, 2009). The ACT also has an optional writing assessment (ACT, 2009). Students' scores on both the SAT and ACT are still being used as criteria for admission into college.

According to Bracey (2000), standardized testing is often used to monitor students, diagnose problems in the system, and hold teachers, school boards, principals, and superintendents accountable. He also noted that many states are using standardized tests to hold students accountable for learning (Bracey, 2000). Failure to perform well on these tests may cause a student to repeat the grade and may even prevent the student from graduating (Bracey, 2000). Test results may also be a factor in college selection (Bracey, 2000). Currently, report cards are being issued to schools based on the results of the state and national tests given in schools (Ornstein, 2003). These report cards are published broadly and have been used to help determine school funding as well as whether or not to retain teachers and administrators (Ornstein, 2003).

The National Assessment of Educational Progress (NAEP), The Nation's Report Card, has been conducted since 1969 (The Nation's Report Card, n.d.). The NAEP is a national test that measures student achievement (Educational Testing Service, n.d.). A sample of students in the fourth, eighth, and twelfth grades is tested periodically (National Assessment Governing Board, n.d.). The content areas tested include math, science, reading, writing, geography, economics, U.S. History, civics, and the arts (Educational Testing Service, n.d.).

According to Bracey (2000), using standardized testing for teacher accountability can have a negative impact, and the students may be slighted in some areas of the curriculum because needed concepts may not be taught if they are not on the test. As a result of the high expectations for students to score well on standardized tests and the accountability placed on the teachers, many teachers teach to the test in an effort to increase student achievement (Bracey, 2000; Ornstein, 2003). Teachers are forced to spend class time reviewing facts that will most likely be asked on the standardized tests (Ornstein, 2003) and, therefore, tend to drill students on what is expected to be on the test rather than spending time teaching them how to think through problem-solving activities and open-ended questions (Ornstein, 2003). Many of the accountability tests used in the U.S. pose higher stakes for the teachers than for the students because, in many cases, jobs depend on results (Wiliam, 2010). According to Ornstein (2003), as a result of high-stakes testing, the need to improve test results for schools, and the desire to increase job security, some educators have actually excluded students from testing by labeling them as having special needs. Moreover, some teachers have helped increase scores by giving students more time than allowed to finish the test (Ornstein, 2003).

Standardized achievement tests are used to illustrate what students have learned in schools (Bracey, 2000). These achievement tests are considered a good predictor for student success (Ornstein, 2003). Some of these standardized tests include the Stanford Achievement Test, the Comprehensive Tests of Basic Skills, and the Iowa Test of Basic Skills (Bracey, 2000). The Stanford Achievement Test was first introduced in 1926 and has been updated many times since then (“Stanford Achievement Test Series,” 2012). Achievement tests were used to measure a student’s content knowledge and performance at the local, state, and national levels (Ornstein, 2003). Ornstein (2003) stated that achievement tests are not a valid test for assessing what was actually taught throughout the year because these tests measure cumulative knowledge. As a result of NCLB (2001), the Stanford Achievement Test was discontinued in many states and replaced with tests created at the state level (“Stanford Achievement Test Series,” 2012).

Tests given to students are generally either norm-referenced or criterion-referenced (Bond, 1996). During the 1950s and 1960s, districts began administering norm-referenced, standardized tests as a way to measure accountability at the local level (Stiggins, 2003). During the 1960s, another type of standardized test was developed; these new tests were criterion-referenced tests (Bracey, 2000). According to Bond (1996), each of these tests serves a different purpose. Bracey (2000) said that norm-referenced tests are standardized tests in which the student being tested is compared to other students taking the same test. Criterion-referenced tests are used to see how students performed on a specific criterion that is being tested (Bond, 1996). One example of a norm-referenced test is the SAT, which some colleges use to determine admittance (Bracey, 2000). One example of a criterion-referenced test is the ACT (ACT, 2009), which is also used by some colleges to determine admittance. In contrast to norm-referenced tests, when taking criterion-referenced tests examinees are not compared to the other students being tested (Bracey, 2000). Instead, criterion-referenced tests allow the examinee to demonstrate mastery of the criteria; cut scores are set and used to determine if a student passes or fails as well as the level of mastery that the student has attained (Bracey, 2000). Criterion-referenced tests allow educators to see how much students know about a certain topic or how well they have mastered the skill being tested (Bond, 1996).

The Iowa Test of Basic Skills, the California Achievement Test, and the Metropolitan Achievement Test are examples of norm-referenced tests that use a national sample to determine the norm (Bond, 1996). Norm-referenced test scores do not give much information relative to what the students can actually do or know (Bond, 1996). Instead, normative assessments demonstrate how students perform in relation to other students who took the assessment (Bracey, 2000).

With norm-referenced tests, the test is initially given to a group of students, and the results of this initial testing are used to create the norm (Bond, 1996). Once the norm has been set, anyone taking the test in the future is compared to the original norm (Bond, 1996). Due to the high costs and time expended, testing companies usually use the same norm for seven consecutive years (Bond, 1996).

Scores on norm-referenced tests are given as percentile ranks and are the result of comparing students currently being tested to the original group of students tested (Bond, 1996). For example, a student who earned a percentile rank of 45 is said to have performed as well or better than 45% of the students in the original norm group (Bond, 1996). With the implementation of these standardized tests, the added pressure of continually increasing scores was placed on teachers, principals, and superintendents (Stiggins, 2003). Norm-referenced tests can be used to help classify students and allow schools to separate students by ability so that school personnel will know whether a student needs to be placed in remedial, regular, or gifted programs and classes (Bond, 1996). According to Bond (1996), teachers may benefit from these test results by using them to differentiate instruction based on varied ability levels.

When choosing to use tests as part of a graduation requirement, states are generally using criterion-referenced tests that are designed around the state curriculum rather than using some type of achievement test (Bracey, 2000). These criterion-referenced tests can be useful tools in determining how well students performed on the material being tested and if their skills are at a level suitable enough to meet requirements at the school, district, and state level (Bond, 1996).

In the early 1970s there were only three states with assessments, but by the end of the 1970s, there were nearly 40 states giving statewide assessments (Stiggins, 2003). Today, nearly every state uses these tests (Stiggins, 2003). According to Thernstrom (2000), 48 states were using state testing programs with at least one of the tests being aligned to the standards for a specific subject. Wiliam (2010) believed that NCLB (2001) was an effort to help make strides in educational results in the U.S. through high-stakes testing. By the year 2000, academic standards were established in at least one subject area in all states except Iowa, and 44 states had already created standards in mathematics, history, science, and English (Thernstrom, 2000). “Thus accountability for test scores is viewed as the key to productive educational change” (Stiggins, 2003, p. 198). By the year 2003, students in 26 states were required to pass their state test in order to graduate (Thernstrom, 2000).

According to the Mississippi Department of Education (MDE), the Mississippi Statewide Assessment System was created in an effort to evaluate instructional programs at the state, district, and local school levels. This system helps to accomplish many goals as it evaluates performance, compares schools throughout the state, identifies deficiencies, and produces much needed data in today’s data driven educational system (Mississippi Department of Education, n.d.).

During the mid-1980s, Mississippi began implementing the Functional Literacy Exam (FLE) (MDE, n.d.). This was the first high-stakes test in Mississippi, and students were required to pass it in order to receive a high school diploma (MDE, n.d.). The FLE was used to test students’ skills in reading, writing, and math (MDE, n.d.). During the 2002-2003 school year, the FLE began being phased out as a result of the Subject Area Testing Program (MDE, n.d.).

In 2001, the state of Mississippi implemented the Mississippi Curriculum Test (MCT) (MDE, 2002). This test was used to assess the math, reading, and language arts skills of students in the second grade through the eighth grade (MDE, n.d.). The MCT was designed around the 2000 Mississippi Mathematics Framework and Language Arts Framework and was used to track academic achievement and growth, as well as to determine whether schools meet Adequate Yearly Progress (AYP) (MDE, n.d.). AYP is measured by tracking the academic growth of students. The students begin at a certain performance level and are expected to meet annual objectives, intermediate goals, and eventually score at the proficient level (U.S. Department of Education, 2002).

In 2006, Mississippi made revisions to the Language Arts Framework and made revisions to the Mathematics Framework in 2007, and as a result of these changes, the MCT was revised as well (MDE, n.d.). In May 2007, the Mississippi Curriculum Test, Second Edition (MCT2) was piloted and went live in May 2008 (MDE, n.d.). According to MDE, the MCT2 is a criterion-referenced test that is given to students in the third grade through the eighth grade, and like the original MCT, it tests students in reading, math, and language arts (MDE, n.d.). Mississippi uses the results of the MCT2 to comply with NCLB (2001) and hold schools accountable to the federal government (MDE, n.d.).

Beginning in 2006 and ending in 2012, as a part of state mandated tests, Mississippi students in the fourth grade, seventh grade, and tenth grade were also required to take a writing assessment (MDE, n.d.). Due to revisions of the writing test, it was not required each year for all grades; however, the test was still required for tenth graders and became high-stakes because these students had to pass this assessment in order to graduate (MDE, n.d.).

As a result of NCLB (2001), Mississippi also began implementing the Mississippi Science Test in 2007 as a means to increase student achievement (MDE, n.d.). This test is a criterion-referenced test that is aligned with the 2001 Mississippi Science Framework (MDE, n.d.). This original assessment was not used as part of the state's accountability system. However, this test was revised, and the new test was given in May 2012 (MDE, n.d.). Beginning in the 2012-2013 school year, this science assessment was incorporated into the school accountability model (MDE, n.d.).

As a result of the passage of NCLB (2001), high-stakes testing in Mississippi was on the rise. The Subject Area Testing Program (SATP) was created in 2000 as an end-of-course exam for the four core subject areas of U.S. History, Biology I, Algebra I, and English II (MDE, n.d.). The SATP replaced the FLE during the 2002-2003 school year (MDE, 2002). Students were and still are required to pass each of these tests in order to receive a high school diploma in Mississippi (MDE, n.d.). Since the 2007-2008 school year, the SATP tests have been gradually revised and are now referred to as SATP2 (Mississippi Department of Education, 2011). Not only do these tests hold students accountable since they must pass them to graduate, they also hold schools and teachers accountable for student learning (MDE, n.d.). According to Wiliam (2010), "the evidence from comparisons between states within the United States, and of comparisons of different national systems, suggests that high-stakes accountability systems can have a positive impact on student learning" (p. 108).

Instructional Practices

Many people in the U.S. have lost confidence in the education provided by public schools (Rollins, 1983). "There is widespread recognition that the quality of academic instruction in the United States needs to be substantially improved" (Zimmerman & DiBenedetto, 2008, p. 215). As a result, educators have been striving to find ways to increase student achievement and ensure that students can perform at levels deemed appropriate by society (Rollins, 1983). According to Bloom (1984), the ability to solve problems, apply principles, think analytically, and use creativity is necessary to promote learning in this ever-changing world.

Many students are apprehensive about math and, therefore, do not like it (Scarpello, 2010). "There is no universal best teaching practice" (Bransford, Brown, & Cocking, 2000, p. 22) that can be applied to any specific subject. However, teachers need to be confident about content and teaching practices because it will impact students (Scarpello, 2010). Teachers must appear confident when presenting math lessons in order for students to feel confident in their ability to master the lessons (Scarpello, 2010). If teachers are apprehensive about the lesson, the students are more likely to be apprehensive (Scarpello, 2010). In order to help prepare all students to meet high educational standards, teachers must be able to use the appropriate instructional practices (Maccini & Gagnon, 2006). Instructional practices that can be used to help students make connections in understanding are hands-on activities, but these should not be used as the sole method of instruction (Bransford et al., 2000). Teachers should present the lesson in a variety of ways (Bransford et al., 2000; Leinwand & Fleischman, 2004) and use manipulatives and models to help promote a better understanding of the concepts being taught (Leinwand & Fleischman, 2004).

Teachers should try to make connections between the concepts that the students are learning and the real world (Bransford et al., 2000). In the U.S., teachers often depend on textbooks during classroom instruction (Bloom, 1984). In general, these textbooks rely heavily on content to be remembered rather than real-world problems that require analytical thinking and problem-solving skills (Bloom, 1984). In order for students to gain a deeper understanding of the concepts being taught, teachers need to cover topics in more detail (Bransford et al., 2000). As a result, teachers may end up covering fewer concepts in greater detail, which will promote student understanding (Bransford et al., 2000). Teachers should not focus on one correct way to work a problem; rather, they should illustrate a variety of methods (Leinwand & Fleischman, 2004). According to Bransford et al. (2000), one way of presenting multiple methods of solving problems is to have student-centered classrooms that allow students to discover various methods of solving problems as opposed to being presented one method by the teacher. Teachers should be aware of students' abilities and attitudes and design assignments and tasks that are appropriate so that students can show progress and not become discouraged (Bransford et al., 2000).

Teachers must also be prepared to make special accommodations such as use of calculators, extended time on tests, and assistance with reading for students with disabilities so that they will have an equal opportunity to perform well on required state assessments (Maccini & Gagnon, 2006). Maccini and Gagnon (2006) conducted a study that included general and special education teachers teaching in public schools in the U.S to determine which instructional practices they commonly used with special needs students. This random sample consisted of teachers who taught mathematics to students with learning disabilities and/or emotional or behavioral disorders (Maccini & Gagnon, 2006). Maccini and Gagnon (2006) found that the most common instructional practices for special needs students used by special education teachers included individual instruction provided by the teacher, reading problems to the students, using calculators, and allowing extra time to complete assignments. These instructional practices were commonly used regardless of the level of difficulty of the task (Maccini & Gagnon, 2006). Maccini and Gagnon (2006) also found that three of the four instructional practices favored by general education teachers were the same as those favored by special education teachers.

Another strategy used by effective teachers is to make classrooms more like a community where students feel comfortable asking each other for assistance (Bransford et al., 2000). A community classroom exists when students work together to complete tasks (Bransford et al., 2000). Not only will this teach students how to work together, but the students will be given an opportunity to create a deeper understanding of the concepts while explaining concepts to other students (Bransford et al., 2000). One example of students explaining concepts to other students is peer tutoring.

Like Maccini and Gagnon (2006), Niesyn (2009) also found peer tutoring to be an effective instructional practice. Peer tutoring can be effective in increasing good behaviors of students who have emotional and behavioral disorders (Niesyn, 2009). Peer tutoring can be beneficial to the tutor as well as the tutee (Niesyn, 2009). With peer tutoring, the tutee can benefit by having the opportunity to have the concept presented in a different manner by someone else, and the tutor has an opportunity to gain a better understanding of the concept while explaining it to other students (Niesyn, 2009).

In summary, classrooms always have and will continue to have a diverse population with regard to ability. In order to reach every student, instruction must be differentiated. This is accomplished by incorporating a variety of instructional practices into the classroom. The use of multiple instructional practices in the classroom can have an impact on student learning.

Instructional Practices Based on NCTM Principles

According to McKinney, Chappell, Berry, and Hickman (2009), NCTM's six principles for school mathematics are the key to creating classrooms that promote conceptual understanding, problem-solving skills, and mathematical reasoning. NCTM's principles are (a) the equity principle, (b) the curriculum principle, (c) the teaching principle, (d) the learning principle, (e) the assessment principle, and (f) the technology principle (NCTM, 2000). McKinney and Frazier (2008) conducted a study of 64 middle school teachers teaching in high poverty schools to determine how frequently certain instructional practices were used in classrooms. In 2009, McKinney et al. conducted a study involving approximately

176 elementary math teachers teaching in urban schools to determine the math instructional practices commonly used in classrooms. In both studies, the survey given to teachers consisted of 44 instructional practices using a five-point Likert scale with one representing never and five representing very frequently (McKinney & Frazier, 2008; McKinney et al., 2009). For each of these studies, the instructional practices were grouped according to the six mathematics principles provided by NCTM in 2000 (McKinney & Frazier, 2008; McKinney et al., 2009). According to McKinney et al. (2009), these principles must be incorporated into the math classroom in order to improve mathematics in schools. The six NCTM principles are described below.

Equity principle. The equity principle involves the belief that students can be successful in math, and teachers must be ready and willing to make necessary accommodations to help students become successful (McKinney et al., 2009). In order to satisfy the equity principle, educators must set high expectations for students, and teachers must be able to give students the support needed to reach goals (NCTM, 2000). Some instructional practices that promote the equity principle include having high expectations for students, differentiating instruction, cooperative learning, incorporating higher level questions into the classroom (McKinney et al., 2009), and reinforcement techniques (McKinney & Frazier, 2008).

The equity principle is observed in the McKinney et al. (2009) study that found that elementary teachers set high expectations for students and use higher-level questioning in classrooms. However, the use of differentiated instruction and cooperative learning was less frequent among the elementary teachers surveyed (McKinney et al., 2009).

McKinney and Frazier (2008) found that the majority of middle school teachers reported using reinforcement techniques (82%) and high-level questioning (92%) either frequently or very frequently. Although this is in compliance with the equity principle, many other findings were not. Only 34% of teachers reported communicating high expectations to their students on a regular basis, and only 27% reported using differentiated instruction on a regular basis (McKinney & Frazier, 2008). They also found that 14% of the teachers surveyed never used cooperative learning groups and 30% seldom used them (McKinney & Frazier, 2008).

Curriculum principle. In order to satisfy the curriculum principle, teachers must be able to develop coherent lessons and math units so that students are able to see how mathematical concepts are related (NCTM, 2000). Teachers must also be aware of the curriculum at different grade levels in order to help students build on and make connections to prior knowledge (NCTM, 2000). Three instructional practices that are tied to the curriculum principle are the teacher connecting new learning to prior learning, the teacher adding creativity to the lessons, and the teacher strictly following the curriculum and pacing guides provided by the district (McKinney & Frazier, 2008; McKinney et al., 2009).

The curriculum principle is clearly observed in the McKinney et al. (2009) study that found 92% of the elementary teachers surveyed reported trying to help the students make connections between previously learned material and new learning. However, the study also found that the elementary teachers were far more likely (68%) to stick to following the curriculum and pacing guides that they were given rather than incorporating personal ideas into the curriculum (13%) (McKinney et al., 2009).

McKinney and Frazier (2008) found that over half (63%) of the middle school teachers reported connecting new learning to prior learning on a regular basis. However, approximately 80% claimed to strictly follow the curriculum and pacing guides and only about 8% reported adding personal creativity to the lessons very frequently (McKinney & Frazier, 2008).

Teaching and learning principles. Since the teaching and learning principles are closely related, they are addressed together as one (McKinney & Frazier, 2008; McKinney et al., 2009). In order to satisfy the teaching principle, teachers must know the content, must be able to create a classroom environment that is conducive to learning, and must be able to provide support to aid student learning (NCTM, 2000). The learning principle stresses the importance of creating understanding with mathematics so that students will be able to make connections between topics and use skills to solve other types of problems (NCTM, 2000). Researchers have identified 41 instructional practices that could be tied to the teaching and learning principles (McKinney & Frazier, 2008; McKinney et al., 2009).

All elementary teachers in the study conducted by McKinney et al. (2009) reported the use of modeling and demonstrations to help students understand math concepts, and nearly all tried to relate mathematics to the real world.

According to McKinney et al. (2009), teachers tried to incorporate effective instructional practices such as hands-on activities, problem-based learning, and the use of manipulatives; however, many of these instructional practices were overcome by the use of traditional teacher practices such as teacher-directed classroom instruction, lectures, and skill and drill practice. McKinney et al. (2009) found that elementary teachers in particular continued to use traditional math practices such as lecturing, skill and drill, and memorizing steps and procedures rather than using manipulatives, problem-based learning, and hands-on activities that enhance student learning.

Assessment principle. Assessments used in the classroom can be formal or informal and should be used often (NCTM, 2000). Assessments can be done in a variety of ways that include tests, quizzes, projects, journals, activities, and performance tasks. In order to be effective, teachers should use the results of these assessments as a tool to guide future classroom instruction (NCTM, 2000). Good assessments do not always have to be tests; other appropriate assessment tools include projects, presentations, performance tasks, reports, and so on (Guskey, 2007; NCTM, 2000). Teacher assessments must be designed to assess a deep understanding of the concepts rather than focusing on the knowledge that can easily be taught through skill and drill and memorization (Bransford et al., 2000). Feedback from assessments must guide instruction in order for it to be effective (Bransford et al., 2000; Guskey, 2007; NCTM, 2000). Formative assessments must be used to help teachers and students see progress (Bransford et al., 2000).

If teachers do not use feedback from assessments properly, students will not benefit (Guskey, 2007). Ten instructional practices were identified that could be tied to NCTM's assessment principle (McKinney & Frazier, 2008; McKinney et al., 2009). These instructional practices included reflections, writing, interviews, conferences, portfolios, rubrics, student self-assessment, authentic assessments, diagnostic assessments, teacher-made tests, and using assessments to guide instruction (McKinney & Frazier, 2008; McKinney et al., 2009).

Alternative assessments such as writing, portfolios, students' self-assessment, and interviews can give teachers a deeper understanding of students' abilities and level of understanding (McKinney et al., 2009). However, in a study by McKinney et al. (2009), 79% of elementary teachers surveyed used traditional forms of assessment such as teacher-made tests rather than alternative assessments such as reflections, portfolios, and interviews that are promoted by NCTM.

McKinney and Frazier (2008) found that only a small percentage of teachers incorporate new assessment techniques such as reflections, portfolios, writing, authentic assessments, etc. into classrooms, whereas the majority of teachers still reported using the traditional teacher-made tests or diagnostic tests provided by the district. Sadly, only 54% of these middle school teachers reported that they "sometimes" use assessments to guide instruction (McKinney & Frazier, 2008).

In their study, Maccini and Gagnon (2006) also looked at assessment accommodations made by special education teachers and general education teachers for students with special needs. They found that the four most commonly used assessment accommodations for special needs students used by special education teachers were the use of calculators, reading problems to the students, allowing extra time on tests, and actually decreasing the number of questions on the assessment (Maccini & Gagnon, 2006). Preferred accommodations provided by general education teachers were the same with one exception—general education teachers allowed students to receive individual help from a classroom aide (Maccini & Gagnon, 2006). These accommodations were commonly used regardless of the difficulty of the mathematics being assessed (Maccini & Gagnon, 2006).

Technology principle. The technology principle stresses the value and importance of technology in the mathematics classroom. When used properly, technology can be a valuable tool to aid in student understanding when teaching mathematics (NCTM, 2000). Four instructional practices were identified that could be tied to NCTM's technology principle (McKinney & Frazier, 2008; McKinney et al., 2009). These instructional practices include the use of software, calculators, websites, and virtual manipulatives (McKinney & Frazier, 2008; McKinney et al., 2009).

McKinney et al. (2009) found that elementary teachers frequently used calculators and software programs during classroom instruction but rarely used websites or other virtual manipulatives to promote learning. In a study by McKinney and Frazier (2008), all of the participants reported using calculators very frequently. Approximately 86% of the middle school teachers reported using websites, and approximately 53% report using software either frequently or very frequently (McKinney & Frazier, 2008).

The NCTM principle-based instructional practices serve as a guide for quality instruction (NCTM, 2000). Although some of the principles were not observed at all grade levels, each principle plays an essential role in K-12 education (NCTM, 2000). However, instructional practices used in the classroom are not only based on NCTM principles.

Instructional Practices Based on Mastery and Performance Goals

Mastery and performance are two main types of achievement goals used to drive instruction (Midgley, Kaplan, & Middleton, 2001). Performance goals involve showing one's ability, and mastery goals are designed to develop one's ability (Harackiewicz et al., 2000; Midgley et al., 2001). In order for students to be deemed successful with performance goals, they must perform better than peers (Midgley et al., 2001; Senko, Hulleman, & Harackiewicz, 2011). In contrast, in order for students to be considered successful with mastery goals, they must meet or exceed the predetermined score set for the task (Senko et al., 2011). Mastery goals direct the individual's focus on the task or objective being learned and how to master and better understand the task (Midgley et al., 2001). According to Harackiewicz et al. (2000), it is often believed that promoting mastery goals is the best manner of approaching coursework because performance goals do not foster a deep understanding of the material being learned and may cause students to avoid tasks for which they lack confidence.

Mastery goals are designed to promote understanding (Midgley et al., 2001). According to Ames (1992), research suggests that long-term learning as well as increased involvement in the learning process are promoted by mastery goals. Mastery goals should have a positive impact on student achievement because there is more room for success with mastery goals than there is with performance goals since students are required to repeat the task or activity until mastering it (Senko et al., 2011). However, as a result of testing and accountability, mastery goals may be being replaced with performance goals (Midgley et al., 2001). “Performance goals refer to the desire to show competencies by trying to obtain positive judgments” (Darnon et al, 2007, p. 61). Senko et al. (2011) reviewed criticisms of performance goals and found that performance goals may result in an increase of students cheating and may also negatively impact cooperative learning. Midgley et al. (2001) said that performance goals may have negative outcomes for students because of the risk of failure.

Mastery learning. According to Bloom (1978), mastery learning is an instructional strategy that can be used to increase achievement and motivation for a large number of students. Not all students are the same; therefore, some will need more time and help than others (Bloom, 1978). “Mastery goals correspond to the desire to understand a task, acquire new knowledge, and develop abilities” (Darnon et al., 2007, p. 61). Mastery learning is based on the premise that students must learn at their own pace (Pulliam & Van Patten, 2003; Rollins, 1983). Bloom (1978) and his students used the idea of mastery learning to help slow learners. These researchers determined that given the appropriate amount of time and help, many slower learners could reach the same level of achievement as faster learners (Bloom, 1978). Bloom (1978) also reported that when slower learners are able to reach the same levels of achievement as faster learners, interest in and attitude toward the subject matter is improved. With mastery learning, it is important to remember that initial mastery is just the beginning, not the end (Lalley & Gentile, 2009). If students and teachers do not continually go over and expand upon the objectives that have been mastered, the students may begin to forget the material learned (Lalley & Gentile, 2009).

Teachers must teach in a way that is suitable for all learners, not just the best students (Bloom, 1978). Teaching methods need to be adaptive to provide an equal opportunity for all learners (Bloom, 1978). When implementing mastery learning, objectives must be clear, mastery standards must be set, assessments must be criterion-referenced, and there must be some type of motivation so that students will want to learn more (Lalley & Gentile, 2009).

Mastery learning is centered around whole group classroom instruction, provides much feedback, and is adaptive to provide individualized help to students who need it (Bloom, 1978). With mastery learning, the material being taught is divided into short units (Rollins, 1983). After the unit is taught, students are assessed to measure performance (Rollins, 1983). These assessments provide feedback to teachers and students to determine mastery levels (Rollins, 1983). The results of these assessments are then used to guide instruction (Rollins, 1983).

With mastery learning, objectives are identified and students continue learning these objectives until demonstrating mastery (Lalley & Gentile, 2009). Students who master objectives are given enrichment activities that allow them to learn beyond the initial mastery and help them gain a more in-depth understanding of the concept (Guskey, 2007; Lalley & Gentile, 2009; Zimmerman & DiBenedetto, 2008). Students must be able to master the fundamental objectives of a given course (Lalley & Gentile, 2009). These fundamentals consist of material that is a prerequisite for a future concept or class (Lalley & Gentile, 2009). These fundamentals must be defined, and students must master them in order to pass the class (Lalley & Gentile, 2009). According to Bloom (1978), using mastery learning to introduce courses to students allows higher performance, and with less help, in classes that may follow.

According to Lalley and Gentile (2009), when learning for mastery, students are required to reach a predetermined level of achievement on a given set of objectives. When using mastery learning, students are assessed every one to two weeks (Guskey, 2007). This allows teachers to give students feedback on what they learned well and what they need to work on (Guskey, 2007). Since assessments are given frequently, teachers are able to correct minor problems as they arise, before they turn into major problems (Guskey, 2007). When teaching for mastery, students are assessed using criterion-referenced tests (Lalley & Gentile, 2009). When the assessments have been graded, one of two actions follow: students reaching mastery are given enrichment activities, or students scoring below mastery are remediated (Lalley & Gentile, 2009).

“Feedback, corrective, and enrichment procedures are crucial to mastery learning, for it is through these procedures that mastery learning differentiates and individualizes instruction” (Guskey, 2007, p. 17). With mastery learning, students do not move on to the next level until demonstrating mastery at the current level (Pulliam & Van Patten, 2003). No specific percentage has been set to determine mastery for any situation; however, many fields consider a passing score of 75 to 80% to be sufficient to demonstrate mastery (Lalley & Gentile, 2009). Many times, the required percent correct to demonstrate mastery is determined by the class, material, or subject taught (Lalley & Gentile, 2009). Lalley and Gentile (2009) used mastery on multiplication tables as an example. When multiplication tables are initially taught, 80% correct might be sufficient. However, after multiplication tables have been learned and are seen again in another course, the percentage correct to show mastery may actually increase to 90% (Lalley & Gentile, 2009).

When formative assessments are given and students do not reach mastery, individualized help is provided to those students (Guskey, 2007). Students may be given extra examples, videos or DVDs to watch, study guides, collaborative activities, or alternative materials designed to help correct the deficiencies for each student and encourage mastery (Guskey, 2007; Zimmerman & DiBenedetto, 2008). In order to help all students attain mastery, the teacher will work with those students and reteach the material if necessary (Lalley & Gentile, 2009). Individualized help does not necessarily come from the teacher; it can come through additional instructional materials, other students in the class, or a teacher's aide (Bloom, 1978). Another way to help students reach mastery is through peer tutoring (Lalley & Gentile, 2009). Teachers may pair a student who passed with a student who did not pass so that they can help each other (Lalley & Gentile, 2009). Once the student shows improvements on these objectives through reteaching with more examples and additional methods and peer tutoring, retesting can determine whether a sufficient mastery level has been reached (Lalley & Gentile, 2009). If students fail the second attempt on the test, they are remediated and allowed to retest until demonstrating mastery (Zimmerman & DiBenedetto, 2008).

Much of Bloom's (1978) research involved groups of students taught by the same teacher. In Bloom's study, one group was taught through the concept of mastery learning, and the control group was taught using traditional teaching methods (Bloom, 1978). On average, students learning for mastery needed 10 to 15% more time on the same task or objective than those in the control class (Bloom, 1978). Bloom also noted that students in the control class became competitive, whereas students in the mastery learning class cooperated with one another. Bloom and his students found that both the mastery learning classes and control classes scored about the same on new material or tasks that were introduced. However, when additional tasks were given, the mastery learning classes showed improvement and the control classes generally stayed the same or even decreased (Bloom, 1978). In another study, Geeslin (1984) surveyed 1,013 students in grades one through 12 who had recently completed a unit using the strategy of learning for mastery. The survey was used to determine how students felt about mastery learning (Geeslin, 1984). Geeslin reported that approximately 79% of students in the survey reported that they liked mastery learning.

According to Bloom (1978), teachers continued to use mastery learning even when not required to because they saw how successful it was with students. As a result of mastery learning, students generally have more confidence when new material is introduced because of the knowledge learned when mastering the previous skills (Bloom, 1978). Higher levels of success lead to greater interest levels and better focus (Bloom, 1978).

Performance goals. According to Linnenbrink (2005), in performance-oriented classrooms, the teacher is in control of the class, the students are all working on the same assignment or activity, and students' abilities are compared. Brophy (2005) said that teachers may view performance goals negatively because they tend to create a competitive classroom that could be harmful to collaborative learning and other group activities (Brophy, 2005). According to Ross, Shannon, Salisbury-Glennon, and Guarino (2002), students who are performance-oriented are motivated by being able to do the task better than other students and by being able to show others what they are capable of doing.

According to Brophy (2005), students are more likely to follow performance goals when competing for grades. Performance-goal oriented individuals also tend to get frustrated when others perform better than they performed (Cianci, Schaubroeck, & McGill, 2010). Brophy determined that performance goals were not frequently used in the natural classroom environment. This low occurrence is good because competition in the classroom could negatively impact cooperative learning (Brophy, 2005). According to Brophy, students, as well as the class as a whole, would be better off if individual and group focus was on achieving goals rather than making it a competition.

Characteristics of performance-goal orientation include fear of being perceived negatively by others and responding negatively as a result of failure (Cianci et al., 2010; Magi, Lerkkanen, Poikkeus, Rasku-Puttonen, & Kikas, 2010). When given performance goals, individuals tend to respond to successful, positive feedback by trying harder and focusing more on the task at hand; whereas, negative feedback results in decreased performance, discouragement, and frustration (Cianci et al., 2010). When difficult tasks arise, performance-goal oriented individuals also tend to give less effort than with easier tasks in trying to preserve self-image (Cianci et al., 2010).

Linnenbrink (2005) noted that in performance-approach classrooms, teachers focused more on students' ability to get the correct answer rather than on how to get the correct answer. These performance-approach goals place more focus on being viewed as competent rather than the successful mastery of the task at hand (Elliot & Church, 1997). Students who are performance-approach oriented like to show what they are capable by outdoing others publicly (Brophy, 2005; Magi et al., 2010).

Elliot and Church (1997) reported that performance-approach goals are tied to achievement motivation as well as to a fear of failure. Performance-avoidance goals are tied to a student's fear of failure (Elliot & Church, 1997).

Brophy (2005) suggested that comparing students socially can cause students to be distracted from what they are trying to do. It can also cause students to worry, have increased anxiety, and display negative emotions (Brophy, 2005). As a result, students may resort to performance-avoidance goals (Brophy, 2005).

Magi, Haidkind, and Kikas (2010) warn against comparing students and creating a competitive environment during the early grades because students tend to increase task avoidance. Task avoidance can have a negative impact on student achievement (Magi, Haidkind, & Kikas, 2010). When individuals tend to avoid tasks due to a fear of failure or a fear of negative results, performance-avoidance goals are enacted (Elliot & Church, 1997). With performance-avoidance goals, students tend to shy away from tasks in an effort to avoid looking incapable in front of others and being viewed negatively by others (Magi et al., 2010). Students who are performance-avoidance oriented make every attempt to prevent looking incompetent in front of peers rather than trying to outdo them (Brophy, 2005; Elliot & Church, 1997).

In a study conducted by Magi et al. (2010), the authors suggested that students in math classes who see more successes in primary grades are less likely to demonstrate performance-avoidance goals and will put more effort into classwork. According to Brophy (2005), research suggested that students who focus on competing with peers are less likely to focus on the true task at hand. According to Brophy, as long as students are being compared to one another and are competing against one another, they will continually be distracted, which will prevent them from being able to focus on learning the material being taught and preparing for tests properly.

Efficacy

The efficacy beliefs held by students and teachers impact academic performance (Bandura, 1993). Student achievement can be improved as a result of the teacher having high teacher efficacy (Allinder, 1995).

> Efficacy beliefs help determine how much effort people will expend on an activity, how long they will persevere when confronting obstacles, and how resilient they will prove in the face of adverse situations—the higher the sense of efficacy, the greater the effort, persistence, and resilience. (Pajares, 1996, p. 544)

According to Bandura (1993), “efficacy beliefs influence how people feel, think, motivate themselves, and behave” (p. 118). According to Pajares (1996), a person’s efficacy beliefs not only affect thought; these beliefs also affect emotional reactions to situations.

Sources of Efficacy

Bandura (1977, 1982) discussed four sources that affect self-efficacy: (a) performance accomplishments (1977), performance attainments (1982), or enactive experiences (Zimmerman, 2000); (b) vicarious experiences; (c) verbal or social persuasion; and (d) physiological states. According to Alderman (1999), Bandura’s four sources of efficacy do not impact self-efficacy in equal ways. Alderman noted that performance accomplishments have the most influence, followed by an individual’s vicarious experiences, then verbal persuasion, and finally, physiological state has the smallest influence on an individual's self-efficacy beliefs.

Performance accomplishments or enactive experiences have the greatest influence on self-efficacy because it is determined by personal experiences (Alderman, 1999; Bandura, 1977; Zimmerman, 2000). In Lane, Lane, and Kyprianou's (2004) study of 205 post-graduate students, they found that a person's self-efficacy is tied to performance. However, self-efficacy is not automatically affected by an individual's performance; instead, it is affected as a result of psychological or mental judgments of the performance (Lane et al., 2004). When individuals perform successfully, self-efficacy usually increases, and when they fail, self-efficacy usually decreases unless a strong sense of self-efficacy has already been established (Bandura, 1977, 1982; Lane et al., 2004; Schunk, 1984). Once these strong efficacy expectations have been developed, the occasional setback or failure is not detrimental (Bandura, 1977).

Another source of self-efficacy is through vicarious experiences (Bandura, 1977, 1982; Margolis & McCabe, 2006). It can be helpful to see someone else perform the task first, especially when it is difficult or new because it gives observers guidance, strategies, and ideas of how to complete the task (Alderman, 1999; Margolis & McCabe, 2006). According to Bandura (1977, 1982), watching people perform activities can help observers increase expectations of being able to accomplish the task through hard work and persistence. Therefore, vicarious experiences have a greater influence when the model being observed has similar characteristics and abilities to the individual that is observing and learning (Zimmerman, 2000).

According to Bandura (1977, 1982), verbal or social persuasion is often used to make people believe that they are capable of successfully accomplishing a task. According to Alderman (1999), verbal persuasion such as “you can do it” (p. 62) can be effective in promoting self-efficacy, especially if it is similar to something previously done. According to Bandura (1977), most people can be easily convinced that they can accomplish a task even if unsuccessful in the past. However, efficacy beliefs as a result of verbal persuasion are weaker than those created through personal experiences (Bandura, 1977). Verbal persuasion does not play a major role in students’ self-efficacy because students are not able to actually observe someone perform; instead, the event is only described, and they have to determine if the source is valid and credible (Zimmerman, 2000).

The final influence on self-efficacy is physiological reaction (Bandura, 1977, 1982; Schunk, 1984; Zimmerman, 2000). According to Margolis and McCabe (2006), “Physiological reaction or state refers to how students feel before, during, and after engaging in a task” (p. 220). Examples of these physiological reactions are emotional symptoms such as sweating and trembling (Schunk, 1984), stress (Zimmerman, 2000), and anxiety (Alderman, 1999; Zimmerman, 2000). Students often view these feelings as a sign of their inability to perform the activity (Zimmerman, 2000), and these feelings determine how students will approach an activity or if they will even attempt it at all (Alderman, 1999; Margolis & McCabe, 2006).

Perceived Self-efficacy

According to Bandura (1983), “perceived self-efficacy is concerned not with what one has, but with judgments of what one can do with what one has” (p. 467). A person’s perceived self-efficacy is based on personal judgments of the ability to accomplish an activity or respond to a situation (Bandura, 1982). An individual’s perceived self-efficacy is based on mastery performance because it is based on how the individual thinks that he or she will perform on the task as opposed to how well that person thinks he or she will do compared to other individuals (Zimmerman, 2000). According to Bandura (1983), perceived self-efficacy plays a greater role on performance than fear. The more self-efficacious a person feels, the less fear he or she will encounter when attempting to perform the given task and vice versa (Bandura, 1983). When people who would generally be fearful display strong self-efficacy regarding the task or situation at hand, they are able to cope with the situation with fewer problems (Bandura, 1983). However, when they doubt their coping efficacy, they become fearful in anticipation of the activity, causing heart rates and blood pressure to rise (Bandura, 1983).

Self-efficacy

“Self-efficacy is a context-specific assessment of competence to perform a specific task, a judgment of one’s capabilities to execute specific behaviors in specific situations” (Pajares & Miller, 1994, p. 194). A person’s amount of confidence in ability determines how that individual will handle situations (Bandura 1977, 1983; Zimmerman, 2000). These self-efficacy beliefs play a role in the goals that individuals set for themselves, the amount of effort used to accomplish these goals, how long they are willing to work to be successful, and how they respond to failure (Bandura, 1977, 1993; Pajares & Miller, 1994). People usually embrace activities and situations that they feel capable of handling with confidence and shy away from and avoid activities where they feel threatened (Bandura, 1977, 1983).

According to Pajares and Miller (1994), personal self-efficacy is often a better predictor of the choices that people make in the future than past experiences because individuals often interpret performance outcomes differently. Self-efficacy helps individuals form an opinion about future performance expectations, and individuals use these judgments before attempting tasks (Zimmerman, 2000). Although efficacy expectations play a role in the activities in which people choose to participate, they do not necessarily produce positive outcomes because one’s actual abilities also play a role in success (Bandura, 1977). When hurdles or tough and unpleasant tasks arise, a person’s self-efficacy beliefs generally determine the amount of time and effort spent working on the given situation (Bandura, 1982).

The manner in which information is attributed with regard to performance also plays a role in self-efficacy (Lane et al., 2004). According to Lane et al. (2004), when individuals attribute failure to a lack of sufficient effort as opposed to ability, most likely self-efficacy will not change. Many people think before they act, and self-efficacy beliefs shape thoughts (Bandura, 1993). A person who is fully capable of performing a task may excel, perform adequately, or perform poorly as a result of self-efficacy beliefs (Bandura, 1993).

"It should come as no surprise that what people believe they can do predicts what they can actually do and affects how they feel about themselves" (Pajares & Miller, 1994, p. 200). People with a high sense of efficacy have visions of success and focus on how to make it happen, whereas people with a low sense of efficacy actually visualize failure along with everything that might possibly go wrong (Bandura, 1993). According to Bandura (1977), the higher a person's self-efficacy beliefs, the more effort will be put into an activity. People with a high sense of efficacy respond to failure by being more persistent and working harder to become successful, whereas people with a low sense of self-efficacy are usually less persistent and give up quicker (Bandura, 1993). Individuals with a low sense of self-efficacy usually avoid difficult activities, do not fully commit to personal goals, focus on what they cannot do as opposed to what they can do, and may become stressed and depressed easily (Bandura, 1993). However, individuals with a high sense of self-efficacy embrace difficult tasks, set high personal goals, fully commit to these goals (Bandura, 1993), and appear to be calm and relaxed when encountering difficulties (Pajares, 1996).

Math Self-efficacy

Self-efficacy impacts academics through students, teachers, and faculties (Bandura, 1993). Students' efficacy beliefs play a role in desire to learn, motivation, and efforts towards academics (Bandura, 1993). According to Hackett and Betz (1989), “mathematics self-efficacy is a situational or problem-specific assessment of an individual’s confidence in his or her ability to successfully perform or accomplish a particular task or problem” (p. 262).

Kitsantas, Cheema, and Ware (2011), Fast et al. (2010), Stevens et al. (2004), Pajares and Miller (1994, 1995), and Pajares and Kranzler (1995) all conducted studies involving the connection between math self-efficacy and student achievement in varying age groups. Each study concluded that higher math self-efficacy was linked to academic achievement. Fast et al. (2010) studied this relationship at the elementary level. Fast et al. (2010) also found that students who viewed their classrooms as challenging, caring, and mastery-oriented displayed significantly higher math self-efficacy than students who did not view their classroom environment in the same way. Kitsantas et al. (2011), Stevens et al. (2004), and Pajares and Kranzler (1995) studied the relationship between math self-efficacy and student achievement at the high school level. Kitsantas et al. and Stevens et al. all found that self-efficacy was a good predictor of math performance. Pajares and Kranzler agreed that student self-efficacy had a direct effect on math capability and problem solving but found that most students (86%) overestimated their abilities. Pajares and Miller (1994, 1995) and Hackett and Betz (1989) studied the relationship between math self-efficacy and student achievement at the college level. Hackett and Betz found a moderately strong correlation between math self-efficacy and math performance. The researchers also noted that only a small number of students accurately predicted math performance on the given set of math problems (Hackett & Betz, 1989).

Pajares and Miller (1994) also found that numerous college students in the study rated math abilities lower than they were. This lack of confidence in personal abilities could cause them to shy away from tasks that they are fully capable of performing (Pajares & Miller, 1994). Pajares and Miller (1994) also found that gender and previous high school and college math experience had a greater impact on performance through self-efficacy.

According to Bandura (1993), education must provide students with a sense of self-efficacy as well as the intellectual tools and self-regulatory skills needed that will allow them to continually be able to educate themselves. Teachers have the potential to gain much needed insight into students by identifying self-efficacy beliefs (Pajares, 1996; Pajares & Miller, 1994) and intervening to help prevent and correct false judgments that students have already made or make in the future (Pajares & Miller, 1994). Knowing how students will respond—confident, nervous, excited, anxious, sick, etc.—when faced with a task can help teachers help students (Margolis & McCabe, 2006). If a teacher knows in advance that a student may become anxious or even sick when certain activities arise, the teacher can work with the students throughout the year on coping and relaxation techniques (Margolis & McCabe, 2006).

According to Pajares and Kranzler (1995), it is beneficial for individuals to have a high sense of efficacy when solving math problems because this high efficacy makes them work harder and put in more effort. It would be beneficial to help students increase mathematical self-efficacy towards topics that have already been covered in class (Kitsantas et al., 2011). According to Fast et al.

(2010), performance and mastery goals both influence students' thoughts and actions; however, self-efficacy is frequently tied to mastery goals. Teachers can help students improve math self-efficacy by exposing them to mastery learning experiences in which they have the opportunity to see progress and success (Kitsantas et al., 2011).

Teachers can influence students' self-efficacy by motivating and encouraging them about the capability of success via hard work (Margolis & McCabe, 2006; Schunk, 1984). In a caring classroom environment, students tend to feel comfortable because the teacher shows personal interest and supports them in their endeavors (Fast et al., 2010). This care and concern displayed by the teacher can have a positive influence on a student's self-efficacy.

In order to help promote a higher sense of math self-efficacy among students, teachers should differentiate homework assignments based on individual students' ability levels (Kitsantas et al., 2011) and give students choices about required assignments (Margolis & McCabe, 2006). This differentiation may include reducing the number of problems assigned and adjusting the level of difficulty to meet the needs of individual students by choosing more difficult questions for the more advanced students and easier questions for the struggling learners (Kitsantas et al., 2011). However, it is important for the assignment to remain challenging for all students and to be ever-changing to match student progress (Kitsantas et al., 2011; Margolis & McCabe, 2006).

Teachers can also improve self-efficacy by using a reward system (Bandura, 1983; Schunk, 1984). With this system, rewards should be based on actual accomplishments rather than participation (Schunk, 1984). Tying rewards to participation may harm perceived self-efficacy because students may realize that they do not have to work as hard to get the rewards (Schunk, 1984). Schunk (1984) also noted that goal setting is an educational practice that can help improve self-efficacy. Teachers can also use verbal persuasion to persuade students to participate in an activity by encouraging them and ensuring them that they are capable of performing the task (Margolis & McCabe, 2006; Schunk, 1984). However, the persuasions and goals must be realistic; otherwise, they can be detrimental to self-efficacy if the student is not successful (Margolis & McCabe, 2006; Schunk, 1984). Students also base self-efficacy beliefs on vicarious experiences; therefore, using peer models is another educational practice that can promote student learning and increase self-efficacy (Margolis & McCabe, 2006; Schunk, 1984). However, teachers must choose the appropriate model based on the audience because choosing a master student to demonstrate a task for struggling learners may have the opposite effect desired causing them to feel incapable of performing the task (Margolis & McCabe, 2006).

Teacher Efficacy

"Teacher efficacy is the teacher's belief in his or her capabilities to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (Tschannen-Moran et al., 1998, p.

233). According to Khan (2011), there is a direct relationship between the quality of the education earned in schools and the quality of the teachers teaching students. “Effective teachers believe they can make a difference in children’s lives, and they teach in ways that demonstrate this belief. What teachers believe about their capability is a strong predictor of their effectiveness” (Gibbs, 2003, p. 3). Effective teachers know subject matter and set goals and objectives for both themselves and students (Khan, 2011). Effective teachers are good planners, are always prepared, display good pedagogical knowledge, display good classroom management skills, and incorporate interactive, hands-on activities into classroom instruction (Dibapile, 2012). According to Gibbs (2003), effective teachers are able to control how they think, act, and respond and are confident in the ability to teach students effectively.

As with any type of efficacy, teacher efficacy can be enhanced and strengthened through Bandura’s four sources of self-efficacy: (a) performance accomplishments, (b) vicarious experiences, (c) verbal persuasion, and (d) controlling emotional and physiological arousal (Gibbs, 2003; Tschannen-Moran et al., 1998). These sources of self-efficacy affect how teachers analyze content and how they view personal teaching qualities (Tschannen-Moran et al., 1998). Performance accomplishments provide the teacher with a personal understanding of what his or her ability as well as insight into complications or problems that may be encountered while teaching (Tschannen-Moran et al., 1998). Observing good educators teaching effectively and successfully can have a positive impact on a person’s teaching efficacy; however, observing unsuccessful teachers can have a negative impact leading the observer to believe that if the observee is unsuccessful, then that educator too will be unsuccessful (Tschannen-Moran et al., 1998). Verbal persuasion can be effective in promoting teacher efficacy (Tschannen-Moran et al., 1998). Examples of verbal persuasion include encouraging the teacher, giving suggestions and teaching strategies when needed, and providing instructional feedback gathered through observations (Tschannen-Moran et al., 1998). When teaching, physiological and emotional arousal can be good in moderation because these cause the teacher to focus more, which can impact learning (Tschannen-Moran et al., 1998). However, high amounts of physiological arousal can interfere with effective teaching (Tschannen-Moran et al., 1998).

Teacher efficacy can positively impact student achievement; therefore, it must be developed (Allinder, 1995). Teacher efficacy is comprised of two parts: personal teacher efficacy and teacher outcome expectancy (Allinder, 1995; Swars, 2005). Personal teacher efficacy is based on the teacher’s beliefs that he or she can effectively teach students (Alderman, 1999; Swars, 2005) and that he or she has the appropriate skills to be a teacher (Poulou, 2007). Teaching outcome expectancy is when teachers believe that they can teach and produce results regardless of socioeconomic status, family life, motivation, or other personal situations that may be influential (Swars, 2005).

Teachers’ instructional practices are shaped by efficacy (Alderman, 1999). Teachers need to place focus on increasing self-efficacy because it can lead to more persistence as well as to an increase in confidence that may better prepare them to try to incorporate new teaching practices (Gibbs, 2003). Since teacher efficacy is subject-matter specific and varies based on the circumstances and situation, teachers may feel very confident answering one student's math question and less confident answering another student's language arts question (Tschannen-Moran & Hoy, 2001). Teachers' sense of efficacy affects the confidence to teach students, how they communicate with students in the classroom, the amount of effort put into planning and teaching lessons, ambition, goals, and what they believe students are capable of doing (Alderman, 1999; Tschannen-Moran et al., 1998). Teachers' sense of efficacy also plays a role in class management and effectiveness (Dibapile, 2012). Tschannen-Moran et al. (1998) stated,

> Greater efficacy leads to greater effort and persistence, which leads to better performance which in turn leads to greater efficacy. The reverse is also true. Lower efficacy leads to less effort and giving up easily, which leads to poor teaching outcomes, which then produce decreased efficacy. (p. 234)

Teacher efficacy helps determine how much time and effort is devoted to teaching, as well as their demeanor in the classroom (Tschannen-Moran et al., 1998; Tschannen-Moran & Hoy, 2001). These efficacy beliefs also help determine how quickly teachers will recover from setbacks and how persistent they will be (Tschannen-Moran et al., 1998; Tschannen-Moran & Hoy, 2001). Teachers who are confident can teach any student regardless of personal circumstances such as home life, parental involvement, sibling influences, socioeconomic status, emotional state, or physical needs by using personal teacher efficacy to guide themselves (Poulou, 2007; Tschannen-Moran et al., 1998). This personal efficacy is expressed in skills and the ability to find a way to teach the most difficult students (Tschannen-Moran et al., 1998).

Teacher efficacy impacts student learning (Khan, 2011). Students learning from a teacher with high efficacy learn more than students being taught by a teacher with low efficacy (Khan, 2011). According to Swars (2005), “teacher efficacy is a significant predictor of mathematics instructional strategies, and highly efficacious teachers are more effective mathematics teachers than teachers with a lower sense of efficacy” (p. 139). Teachers with a high sense of instructional efficacy create classroom environments in which students have the opportunity to excel (Bandura, 1993). According to Bandura (1993), teachers with a low level of instructional efficacy are not very committed to teaching, focus less on academics, avoid academic problems, and are more likely to get burned out and give up (Bandura, 1993). Khan (2011) also found that teacher efficacy has a positive influence on student achievement. Teachers with high teacher efficacy often have faith in students’ abilities to learn and are determined to find a way to get through to those students (Alderman, 1999; Khan, 2011). Teachers displaying low teacher efficacy are more likely to believe that students cannot learn and to find a reason to justify this presumption (Alderman, 1999; Khan, 2011). Teachers with high self-efficacy have great classroom management skills; they are able to organize and structure classrooms so that disruptive students do not hinder student achievement (Dibapile, 2012). Teachers with high efficacy are also more likely to try new, innovative techniques and adjust and adapt teaching methods to meet the needs of students (Alderman, 1999).

Poulou (2007), Wolters and Daugherty (2007), Swars (2005), Allinder (1995), and Midgley, Feldlaufer, and Eccles (1989) conducted studies on teacher self-efficacy. Poulou (2007) and Swars (2005) studied sources of self-efficacy for student teachers. Poulou (2007) reported that student teachers viewed personal motivation, personality characteristics, and teaching competence to be contributors to teaching efficacy. Poulou (2007) also found that enactive mastery was the most influential of Bandura's sources of efficacy. Swars (2005) found that the strength of math teacher efficacy was connected to previous math experiences. These previous experiences also played a role in how teachers perceived teaching math effectively (Swars, 2005). Wolters and Daugherty's (2007) study of pre-kindergarten through twelfth-grade teachers revealed that first year teachers had lower efficacy for instruction than teachers with more experience. Teachers with only one to five years of experience also had lower efficacy for instruction that teachers with six or more years of experience, and there was no difference found in the levels of self-efficacy for instruction for teachers with six or more years of experience (Wolters & Daugherty, 2007). Allinder (1995) found that teachers with high efficacy set more rigorous goals for students than teachers with lower teacher efficacy (Allinder, 1995). Allinder (1995) also found that students whose teachers had a high sense of personal teaching efficacy showed significantly more growth than students taught by teachers with lower personal teaching efficacy. Furthermore, Midgley et al.

(1989) found that students taught by highly efficacious teachers had more confidence in their math performance than students taught by teachers with lower math efficacy.

Teacher training and school climate are two factors that may affect a teacher's level of self-efficacy (Alderman, 1999; Wolters & Daugherty, 2007). A teacher's self-efficacy is positively affected by feedback and support from administrators, appropriate professional development, and the ability to share ideas with fellow teachers (Alderman, 1999). One way to increase teacher efficacy is by giving new teachers smaller classes that they are capable of handling during the first year of teaching rather than giving them the worst classes because they are new (Tschannen-Moran et al., 1998). According to Gibbs (2003), teacher education programs should place some focus on enhancing the self-efficacy of future educators so that they will be better prepared for more successes while student teaching as well as early in their careers.

Summary

Upon review of the literature, it is evident that the teaching of mathematics has changed dramatically over the years. Through time, mathematics has progressed from only being taught as basic skills in grammar school to a field that is highly respected and needed in the industrialized society. Throughout this progression, assessments in the U.S. have evolved and created the need for improved instructional practices. The effectiveness of instructional practices is directly affected by the teachers' self-efficacy, the students' self-efficacy, and both the students' and teachers' math self-efficacy. Chapter III outlines the methodology used in this study.

CHAPTER III

METHODOLOGY

This chapter describes the research design, participants, instrumentation, procedures, limitations, and data analysis. The purpose of this study was to determine the relationships between the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers and their influences on an individual teacher's QDI in relation to MCT2 math scores in grades 3-5. The researcher surveyed teachers in grades 3-5 using Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000) and Mathematics Teaching and Mathematics Self-Efficacy Scale (MTMSE) (Kahle, 2008). The survey instrument also contained a demographic section to collect descriptive data.

Research Questions

The following research questions guided this study

1. What are the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers in grades 3-5?
2. Do mathematical self-efficacy, mathematical teaching self-efficacy, and instructional practices have an influence on an individual teacher's QDI in relation to MCT2 math scores in grades 3-5?

Research Hypotheses

The following null hypotheses were investigated in this study:

H_1: There is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy.

H_2: There is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction.

Research Design

A correlational design was used to examine the relationship among the independent variables of mathematical teaching self-efficacy, personal mathematical teaching self-efficacy, and instructional practices, and the dependent variable MCT2 Math grades 3-5.

Participants

The participants in this study were third, fourth, and fifth grade mathematics teachers who taught math in a public school in Central Mississippi during the 2012-2013 school year. Prior to collecting data, the researcher contacted superintendents (See Appendix A and B) to find districts that were willing to participate in the study. Participants were determined by a Mississippi school district's willingness to participate in this study as well as the teacher's willingness to participate.

Instrumentation

Quantitative data were collected using two survey instruments: Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000) and Mathematics Teaching and Mathematics Self-Efficacy Scale (MTMSE) (Kahle, 2008). Prior to using the instruments, the authors were contacted via email and permission was granted to use their survey instruments (See Appendix C).

The MTMSE Scale was created to study the relationship between mathematical self-efficacy and mathematical teaching self-efficacy (Kahle, 2008). Kahle (2008) created the MTMSE instrument and based it on Kranzler and Pajares's (1997) Mathematics Self-Efficacy Scale Revised (MSES-R) and Enochs, Smith, and Huinker's (2000) Mathematics Teaching and Efficacy Beliefs Instrument (MTEBI). "The MTMSE survey was divided into six parts as follows: parts one and three assessed teacher mathematics self-efficacy, parts two and four assessed teacher mathematics teaching self-efficacy, part five assessed conceptual and procedural teaching orientation and part 6 contained demographic questions" (Kahle, 2008, p. 70). Kahle found an overall reliability of .942 for the MTMSE instrument. Due to the relevance of this study, only parts one, two, three, and four were included. Therefore, for the purpose of this study, the reliability for each part of the MTMSE was used separately.

The Patterns of Adaptive Learning Scales was created using goal orientation theory to study the relationship between the environment in which students learn and how it affects students (Midgley et al., 2000). PALS was divided into two separate sections: (a) student scales and (b) teacher scales.

Due to the relevance of this study, the teacher scales were the only section of PALS used and discussed. Midgley et al. (2000) used the PALS teacher scales to measure teacher perceptions in four areas. The reliability for each part of PALS was used separately.

The survey (See Appendix D) used in this study was divided into six sections: (a) Mathematics Self-Efficacy Problems (MTMSE), (b) Mathematics Teaching Self-Efficacy (MTMSE), (c) Mathematics Self-Efficacy Tasks (MTMSE), (d) Mathematics Content Teaching Self-Efficacy (MTMSE) (Kahle, 2008), (e) Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000), and (f) demographic questions.

Part one of the survey consisted of the Mathematics Self-Efficacy Problems portion of the MTMSE (Kahle, 2008). Part one consisted of 18 multiple-choice questions with a Likert scale ranging from one (not confident at all) to six (completely confident). This portion of the survey related to mathematical self-efficacy and was used as the problem subscale for this study (Kahle, 2008). In this section, teachers were asked to rate their confidence in their ability to solve these multiple choice questions without the use of a calculator. Kahle found a reliability of .900 for Mathematics Self-Efficacy Problems; in this study, the Cronbach's alpha was .928.

Part two of the survey consisted of the Mathematics Teaching Self-Efficacy portion of the MTMSE (Kahle, 2008). Part two consisted of 13 multiple-choice questions with a Likert scale ranging from one (strongly disagree) to six (strongly agree). This portion of the survey related to mathematics teaching self-efficacy and was used to assess a teacher's personal mathematics self-efficacy in regards to teaching (Kahle, 2008). In this section, teachers were asked to rate how strongly they agreed with statements about their teaching. Kahle found a reliability of .855 for Mathematics Teaching Self-Efficacy; in this study, the Cronbach's alpha was .768.

Part three of the survey consisted of the Mathematics Self-Efficacy Tasks portion of the MTMSE (Kahle, 2008). Part three consisted of 13 multiple-choice questions with a Likert scale ranging from one (not confident at all) to six (completely confident). Part three of the survey also related to mathematical self-efficacy and was used as the tasks subscale in this study (Kahle, 2008). It involved tasks that were related to the NCTM 2000 standards for mathematical content (Kahle, 2008). In this section, teachers were asked to rate their confidence in their ability to perform certain tasks. Kahle found a reliability of .862 for Mathematics Self-Efficacy Tasks; in this study, the Cronbach's alpha was .877.

Part four of the survey consisted of the Mathematics Content Teaching Self-Efficacy portion of the MTMSE (Kahle, 2008). Part four consisted of 13 multiple-choice questions with a Likert scale ranging from one (not confident at all) to six (completely confident). Part four of the survey also related to mathematics teaching self-efficacy and was used to assess a teacher's self-efficacy in teaching mathematical content (Kahle, 2008). In this section, teachers were asked to rate their confidence in teaching specific mathematical content to students (Kahle, 2008). This content was related to the NCTM 2000 standards for mathematical content (Kahle, 2008). Kahle found a reliability of .880 for Mathematics Content Teaching Self-Efficacy; in this study, the Cronbach's alpha was .919.

Part five of the survey consisted of the Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000). PALS consisted of 29 statements on a Likert scale ranging from one (strongly disagree) to five (strongly agree). The PALS teacher scales were designed to measure teacher perceptions in four areas: (a) Perceptions of the School Goal Structure for Students: Mastery Goal Structure for Students, (b) Perceptions of the School Goal Structure for Students: Performance Goal Structure for Students, (c) Approaches to Instruction: Mastery Approaches, and (d) Approaches to Instruction: Performance Approaches (Midgley et al., 2000).

Mastery Goal Structure for Students "refers to teachers' perceptions that the school conveys to students that the purpose of engaging in academic work is to develop competence" (Midgley et al., 2000, p. 33). Midgley et al. (2000) used questions 3, 5, 14, 16, 20, 22, and 27 to measure Mastery Goal Structure for Students and reported an alpha of .81. In this study, the Cronbach's alpha was .730. Performance Goal Structure for Students "refers to teachers' perceptions that the school conveys to students that the purpose of engaging in academic work is to demonstrate competence" (Midgley et al., 2000, p. 34). Questions 7, 10, 12, 15, 25, and 29 were used to measure Performance Goal Structure for Students and had an alpha level of .70 (Midgley et al., 2000). In this study, the Cronbach's alpha was .630. Mastery Approaches to Instruction "refers to teacher strategies that convey to students that the purpose of engaging in academic work is to develop competence" (Midgley et al., 2000, p. 35). Questions 4, 11, 13, and 26 were used to measure Mastery Approaches to Instruction with a reported alpha of .69, which is slightly lower than the criteria of .70 (Midgley et al., 2000). In this study, the Cronbach's alpha was .571. Performance Approaches to Instruction "refers to teacher strategies that convey to students that the purpose of engaging in academic work is to demonstrate competence" (Midgley et al., 2000, p. 36). Questions 1, 9, 17, 19, and 21 were used to measure Performance Approaches to Instruction and had a reported alpha level of .69, which is slightly lower than the criteria of .70 (Midgley et al., 2000). In this study, the Cronbach's alpha was .720.

Part six of the survey consisted of demographic questions. This section of the survey was used to describe the sample of teachers participating in this study. These questions addressed educational background, years of teaching experience, and other pertinent information.

Procedures

Prior to collecting data, the researcher contacted superintendents to find districts that were willing to participate in the study (See Appendix A). The researcher used the Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000) and Mathematics Teaching and Mathematics Self-Efficacy Scale (MTMSE) (Kahle, 2008) as the survey instrument that was distributed to teachers. The survey instrument also contained a demographic section to collect descriptive data. These surveys were used to determine if mathematical self-efficacy and mathematical teaching self-efficacy had an influence on an individual teacher's QDI in relation to MCT2 math scores in grades 3-5. Prior to delivering surveys, permission was obtained from the Institutional Review Board (See Appendix E) at The University of Southern Mississippi. The researcher delivered surveys to a representative at each school or district. The surveys were distributed to elementary school teachers in grades 3-5 in participating districts. Since all participants were 18 years of age or older, willingness to participate was obtained through the teachers' submission of the survey. Surveys were anonymous. Teachers did not give their names, just the grade they taught and their QDI for the 2012-2013 school year. In an effort to maintain anonymity, teachers placed completed surveys in a wrapped box with a hole cut in the side of the box. Upon completion of the surveys, the researcher collected surveys from each participating school or district.

Data Analysis

The researcher collected surveys and entered data into Microsoft Excel. Upon completion, data were imported into SPSS where the researcher used multiple regression to determine if there was a significant relationship among the independent variables of mathematical teaching self-efficacy, personal mathematical teaching self-efficacy, and instructional practices, and the dependent variable MCT2 Math grades 3-5.

CHAPTER IV

RESULTS

The purpose of this correlational study was to examine the relationship among the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers. This study was also designed to determine how these variables influence an individual teacher's QDI in relation to MCT2 math scores in grades 3-5.

Research Questions

The research questions addressed in this study were

1. What are the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers in grades 3-5?
2. Do mathematical self-efficacy, mathematical teaching self-efficacy, and instructional practices have an influence on an individual teacher's QDI in relation to MCT2 math scores in grades 3-5?

Research Hypotheses

The following null hypotheses were investigated in this study:

H_1: There is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy.

H_2: There is no statistically significant relationship between MCT2 math

Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction.

Participants

The researcher used convenience sampling to select teachers for this study. The researcher delivered 341 surveys to schools in participating districts in Mississippi. Of the 341 surveys distributed, 117 (34.3%) were returned. SPSS was used to analyze the 117 surveys collected. This study included 43 third grade mathematics teachers, 42 fourth grade mathematics teachers, and 29 fifth grade mathematics teachers. Table 1 shows the frequencies and percentages of participants by the grade level taught.

Table 1

Frequencies and Percentages of Participants by Grade Taught (N=117)

Grade Taught	Frequency	Percentage
3^{rd} Grade	43	36.8
4^{th} Grade	42	35.9
5^{th} Grade	29	24.8
No Response	3	2.6

Table 2 shows the frequencies and percentages of participants by highest level of degree earned. The majority of these teachers held bachelor's degrees (59%) with the second highest holding master's degrees (36.8%). Only a small percentage (3.4%) of participants in this study held either specialist or doctoral degrees. The number of years of teaching experience for participants in this study ranged from 1 to 39 years. The researcher grouped years of experience in increments of five and calculated percentages as seen in Table 3.

Table 2

Frequencies and Percentages of Highest Level of Degree Earned (N=117)

Highest Degree Earned	Frequency	Percentage
Bachelor’s	69	59.0
Master’s	43	36.8
Specialist	3	2.6
Doctoral	1	0.9
No Response	1	0.9

Table 3

Frequencies and Percentages of Teaching Experience (N=117)

Years of Experience	Frequency	Percentage
0-5 years	36	30.8
6-10 years	26	22.2
11-15 years	24	20.5
16-20 years	10	8.5
21-25 years	7	6.0
26-30 years	7	6.0
31-35 years	2	1.7
36-40 years	4	3.4
No Response	1	0.9

Participants were asked which of the following subjects they were most confident and least confident teaching: (a) language arts, (b) mathematics, (c) reading, (d) science, or (e) social studies. The majority of the participants (N=95) reported that they are most confident teaching mathematics. Of the 95 participants (81.2%), 70 participants indicated that mathematics is the one subject they are most confident teaching and 25 participants indicated mathematics along with one or more other subjects. Only 13 participants (11.1%) indicated that they are least confident teaching mathematics.

The frequencies and percentages of participants by the hours of mathematics courses taken are shown in Table 4. The percentages ranged from 0.9% to 21.4%. Eleven participants left this question blank; therefore, a total of 9.4% is unaccounted for. The majority of the participants (41.9%) reported taking five or more mathematics courses in college (15 or more hours of mathematics).

Table 4

Frequencies and Percentages of Hours of Mathematics Courses (N=117)

Hours of Math	Frequency	Percentage
0-3 hours	1	0.9
3-6 hours	12	10.3
6-9 hours	16	13.7
9-12 hours	18	15.4
12-15 hours	10	8.5
15-18 hours	24	20.5
18+ hours	25	21.4

Table 4 (continued).

Hours of Math	Frequency	Percentage
No Response	11	9.4

Participants were asked which of the five strands of mathematics they were most confident teaching: (a) numbers and operations, (b) algebra, (c) geometry, (d) measurement, or (e) data analysis and probability. The majority of the participants in this study (N=85) reported that they are most confident teaching the numbers and operations strand. Of the 85 participants (72.6%), 74 participants indicated that the numbers and operations is the one strand that they are most confident teaching, and the other 11 marked numbers and operations along with at least one more strand.

Descriptive Analysis of Data

A descriptive analysis was conducted on the data collected. The survey (See Appendix D) used in this study was divided into six sections: (a) Mathematics Self-Efficacy Problems (MTMSE), (b) Mathematics Teaching Self-Efficacy (MTMSE), (c) Mathematics Self-Efficacy Tasks (MTMSE), (d) Mathematics Content Teaching Self-Efficacy (MTMSE) (Kahle, 2008), (e) Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000), and (f) demographic questions. The mean and standard deviation were calculated for each item. A summary of this information is presented in the following paragraphs.

Mathematics Self-Efficacy Problems

The Mathematics Self-Efficacy Problems portion of the MTMSE consisted of 18 multiple-choice questions using a Likert scale ranging from one (not confident at all) to six (completely confident) (Kahle, 2008). This portion of the survey related to mathematical self-efficacy and was used as the problem subscale for this study (Kahle, 2008). Teachers were asked to rate their confidence in their ability to solve these multiple choice questions without the use of a calculator. The means and standard deviations based on teachers' responses to questions on the Mathematics Self-Efficacy Problems portion of the MTMSE are reported in Table 5 in descending order by mean. Analysis indicated that teachers were most confident solving basic math problems involving making change when purchasing an item. The mean was 5.90 out of 6 with a standard deviation of .38 indicating that they had complete confidence in answering these types of questions. Teachers were least confident in their ability to solve questions that included geometric images with means ranging from 4.20 to 4.50 and standard deviations ranging from 1.40 to 1.36.

Table 5

Descriptive Statistics for Mathematics Self-Efficacy Problems (N=117)

	Mean	SD
Part 1 Question 11	5.90	.38
Part 1 Question 8	5.65	.74
Part 1 Question 7	5.55	.94
Part 1 Question 14	5.52	1.06

Table 5 (continued).

	Mean	SD
Part 1 Question 6	5.40	1.18
Part 1 Question 1	5.37	.92
Part 1 Question 13	5.28	1.02
Part 1 Question 9	5.28	.98
Part 1 Question 5	5.28	1.32
Part 1 Question 2	5.21	1.06
Part 1 Question 17	4.98	1.36
Part 1 Question 15	4.89	1.20
Part 1 Question 10	4.86	1.25
Part 1 Question 3	4.77	1.12
Part 1 Question 12	4.75	1.34
Part 1 Question 18	4.50	1.36
Part 1 Question 16	4.20	1.40

Note. Scale 1=not confident at all, 6=completely confident

Mathematics Teaching Self-Efficacy

The Mathematics Teaching Self-Efficacy portion of the MTMSE consisted of 13 multiple-choice questions using a Likert scale ranging from one (strongly disagree) to six (strongly agree) (Kahle, 2008). This portion of the survey related to mathematical teaching self-efficacy and was used to assess teachers' personal mathematics self-efficacy in regards to teaching (Kahle, 2008). Teachers were asked to rate how strongly they agreed with statements about their teaching. The means and standard deviations based on teachers' responses to questions on the Mathematics Self-Efficacy portion of the MTMSE are reported in Table 6 in descending order by mean. The majority of the sample strongly agreed that they are effective teachers, that they continue to find new teaching methods, and that they feel comfortable answering students' questions. The means ranged from 5.22 to 5.89 out of 6 and standard deviations ranged from .83 to .34. The majority of the sample strongly disagreed with statements involving their inability to teach mathematics effectively. The means ranged from 1.24 to 1.84 out of 6, and the standard deviations ranged from .73 to 1.41. This was expected since these were reverse questions.

Table 6

Descriptive Statistics for Mathematics Teaching Self-Efficacy (N=117)

	Mean	SD
Part 2 Question 1	5.89	.34
Part 2 Question 12	5.81	.66
Part 2 Question 6	5.75	.64
Part 2 Question 8	5.61	.68
Part 2 Question 3	5.22	.83
Part 2 Question 10*	1.84	1.41
Part 2 Question 13*	1.80	1.11
Part 2 Question 4*	1.74	1.36
Part 2 Question 9*	1.73	1.23
Part 2 Question 7*	1.71	1.23
Part 2 Question 2*	1.63	1.25
Part 2 Question 11*	1.45	.87

Table 6 (continued).

	Mean	SD
Part 2 Question 5*	1.24	.73

Note. Scale 1=strongly disagree, 6=strongly agree

*Items negatively worded on the questionnaire (reverse questions)

Mathematics Self-Efficacy Tasks. The Mathematics Self-Efficacy Tasks portion of the MTMSE consisted of 13 multiple-choice questions using a Likert scale ranging from one (not confident at all) to six (completely confident) (Kahle, 2008). This portion of the survey also related to mathematical self-efficacy and was used as the tasks subscale for this study (Kahle, 2008). Teachers were asked to rate their confidence in their ability to perform tasks that were related to the NCTM 2000 standards for mathematical content (Kahle, 2008). The means and standard deviations based on teachers' responses to questions on the Mathematics Self-Efficacy Tasks portion of the MTMSE are reported in Table 7 in descending order by mean. Analysis indicated that teachers were most confident performing daily tasks such as balancing a checkbook, estimating grocery costs, and tipping for dinner. The means ranged from 5.70 to 5.83 out of 6, and the standard deviations ranged from .59 to .44. The teachers were least confident with a mean of 4.85 out of 6 and a standard deviation of 1.39 in their ability to complete tasks requiring spatial and geometric reasoning.

Table 7

Descriptive Statistics for Mathematics Self-Efficacy Tasks (N=117)

	Mean	SD
Part 3 Question 3	5.83	.44
Part 3 Question 7	5.72	.55
Part 3 Question 9	5.70	.59
Part 3 Question 6	5.65	.67
Part 3 Question 8	5.64	.61
Part 3 Question 11	5.56	.95
Part 3 Question 2	5.50	.84
Part 3 Question 13	5.50	.80
Part 3 Question 1	5.49	.82
Part 3 Question 4	5.32	.97
Part 3 Question 12	5.25	1.00
Part 3 Question 5	5.15	1.13
Part 3 Question 10	4.85	1.39

Note. Scale 1=not confident at all, 6=completely confident

Mathematics Content Teaching Self-Efficacy

The Mathematics Content Teaching Self-Efficacy portion of the MTMSE consisted of 13 multiple-choice questions using a Likert scale ranging from one (not confident at all) to six (completely confident) (Kahle, 2008). This portion of the survey also related to mathematics teaching self-efficacy and was used to assess a teacher's self-efficacy in teaching mathematical content (Kahle, 2008). Teachers were asked to rate their confidence in their ability to teach specific mathematical content related to the NCTM 2000 standards for mathematical content (Kahle, 2008). The means and standard deviations based on teachers' responses to questions on the Mathematics Content Teaching Self-Efficacy portion of the MTMSE are reported in Table 8 in descending order by mean. The teachers indicated an overall confidence in their ability to teach all mathematical topics with means ranging from 5.06 to 5.85 out of 6 and standards deviations ranging from .99 to .41. Although they were confident overall in teaching all topics, they were most confident in their ability to teach multiplication and least confident in teaching the metric system.

Table 8

Descriptive Statistics for Mathematics Content Teaching Self-Efficacy (N=117)

	Mean	SD
Part 4 Question 2	5.85	.41
Part 4 Question 3	5.84	.41
Part 4 Question 12	5.80	.48
Part 4 Question 13	5.78	.51
Part 4 Question 4	5.74	.55
Part 4 Question 1	5.71	.59
Part 4 Question 11	5.71	.57
Part 4 Question 9	5.63	.71
Part 4 Question 5	5.49	.74
Part 4 Question 6	5.45	.75
Part 4 Question 8	5.41	.84
Part 4 Question 7	5.28	.90

Table 8 (continued).

	Mean	SD
Part 4 Question 10	5.06	.99

Note. Scale 1=not confident at all, 6=completely confident

Patterns of Adaptive Learning Scales

The Patterns of Adaptive Learning Scales consisted of 29 statements on a Likert scale ranging from one (strongly disagree) to five (strongly agree). The PALS teacher scales were designed to measure teacher perceptions in four areas: (a) Perceptions of the School Goal Structure for Students: Mastery Goal Structure for Students, (b) Perceptions of the School Goal Structure for Students: Performance Goal Structure for Students, (c) Approaches to Instruction: Mastery Approaches, and (d) Approaches to Instruction: Performance Approaches (Midgley et al., 2000).

Mastery Goal Structure for Students “refers to teachers’ perceptions that the school conveys to students that the purpose of engaging in academic work is to develop competence” (Midgley et al., 2000, p. 33). Questions 3, 5, 14, 16, 20, 22, and 27 were used to measure Mastery Goal Structure for Students. The means and standard deviations based on teachers’ responses to questions measuring Mastery Goal Structure for Students are reported in Table 9 in descending order by mean. Analysis indicated that teachers agreed with a mean of 4.67 out of 5 that their school stressed the importance of students working hard. Teachers only somewhat agreed with a mean of 3.63 out of 5 that their students were frequently told that learning should be fun. Teachers disagreed with a mean on 1.84 out of 5 that student work was boring. However, this was expected since this was a reverse question.

Table 9

Descriptive Statistics for Mastery Goal Structure for Students (N=117)

	Mean	SD
Part 5 Question 3	4.67	.78
Part 5 Question 5	4.39	.86
Part 5 Question 20	4.29	.92
Part 5 Question 22	4.16	.95
Part 5 Question 27	4.02	.94
Part 5 Question 16	3.63	1.04
Part 5 Question 14*	1.84	.85

Note. Scale 1=strongly disagree, 3=somewhat agree, 5=strongly agree

*Items negatively worded on the questionnaire (reverse questions)

Performance Goal Structure for Students “refers to teachers’ perceptions that the school conveys to students that the purpose of engaging in academic work is to demonstrate competence” (Midgley et al., 2000, p. 34). Questions 7, 10, 12, 15, 25, and 29 were used to measure Performance Goal Structure for Students. The means and standard deviations based on teachers’ responses to questions measuring Performance Goal Structure for Students are reported in Table 10 in descending order by mean. Analysis indicated that teachers agreed with a mean of 4.18 out of 5 that their school stressed the importance of getting high test scores. Teachers only somewhat agreed with a mean ranging from 2.47 to 2.91 out of 5 that the other performance goals in the questionnaire were met at their school. Teachers disagreed with a mean of 1.78 out of 5 that testing was not emphasized at their school. However, this was expected since this was a reverse question.

Table 10

Descriptive Statistics for Performance Goal Structure for Students (N=117)

	Mean	SD
Part 5 Question 12	4.18	.94
Part 5 Question 10	2.91	1.14
Part 5 Question 25	2.74	1.26
Part 5 Question 7	2.52	1.02
Part 5 Question 29	2.47	1.12
Part 5 Question 15*	1.78	1.06

Note. Scale 1=strongly disagree, 3=somewhat agree, 5=strongly agree

*Items negatively worded on the questionnaire (reverse questions)

Mastery Approaches to Instruction "refers to teacher strategies that convey to students that the purpose of engaging in academic work is to develop competence" (Midgley et al., 2000, p. 35). Questions 4, 11, 13, and 26 were used to measure Mastery Approaches to Instruction. The means and standard deviations based on teachers' responses to questions measuring Mastery Approaches to Instruction are reported in Table 11 in descending order by mean. Analysis indicated that teachers strongly agreed with a mean of 4.66 out of 5 that they recognize all students for individual progress. Teachers only somewhat agreed with a mean ranging from 3.30 to 3.63 out of 5 that they differentiate instruction to meet the needs of all students.

Table 11

Descriptive Statistics for Mastery Approaches to Instruction (N=117)

	Mean	SD
Part 5 Question 4	4.66	.59
Part 5 Question 26	3.63	1.01
Part 5 Question 11	3.30	1.10
Part 5 Question 13*	3.25	1.31

Note. Scale 1=strongly disagree, 3=somewhat agree, 5=strongly agree

Performance Approaches to Instruction "refers to teacher strategies that convey to students that the purpose of engaging in academic work is to demonstrate competence" (Midgley et al., 2000, p. 36). Questions 1, 9, 17, 19, and 21 were used to measure Performance Approaches to Instruction. The means and standard deviations based on teachers' responses to questions measuring Performance Approaches to Instruction are reported in Table 12 in descending order by mean. Overall, teachers somewhat agree with a mean ranging from 2.52 to 3.04 out of 5 that students should be compared and identified based on academic performance even if they are high achieving.

Table 12

Descriptive Statistics for Performance Approaches to Instruction (N=117)

	Mean	SD
Part 5 Question 21	3.04	1.18
Part 5 Question 1	3.00	1.19
Part 5 Question 17	2.63	1.14
Part 5 Question 9	2.57	1.16
Part 5 Question 19	2.52	1.19

Note. Scale 1=strongly disagree, 3=somewhat agree, 5=strongly agree

Subscales. Descriptive statistics for the entire survey were run to obtain an overall mean and standard deviation for each portion of the survey. The means and standard deviations are reported in Table 13. Analysis indicated that teachers' QDI ranged from 92 to 263 with a mean of 195.46 and a standard deviation of 33.31. This wide range could possibly be the result of the make-up of the students in the teacher's classroom. Classrooms may have consisted of special education students, regular education students, inclusion students, honor students, or any combination.

Results suggest that teachers were very confident in their ability to solve given mathematical problems without the use of a calculator (mean=5.14 out of 6, SD=.74). Teachers were very confident that they are effective mathematics teachers (mean=5.47 out of 6, SD=.52). Teachers were very confident in their ability to perform tasks related to the NCTM 2000 Standards for Mathematical Content (mean=5.47 out of 6, SD=.56). Teachers were very confident in their ability to teach specific mathematical content related to the NCTM 2000 Standards for Mathematical Content (mean=5.59 out of 6, SD=.49). Overall, teachers agree that their school stresses the importance of developing content mastery (mean=4.18 out of 5, SD=.56). Teachers mostly agree that they utilize instructional strategies to meet the goal of developing content mastery (mean=3.71 out of 5, SD=.68). Teachers only somewhat agree that their school stresses the importance of students demonstrating content mastery (mean=3.17 out of 5, SD=.64). Teachers somewhat disagree that they utilize instructional strategies requiring competition among the students (mean=2.75 out of 5, SD=.80).

Table 13

Descriptive Statistics for Subscales (N=117)

	Mean	SD
QDI	195.46	33.31
MTMSE Problems	5.14	.74
MTMSE	5.47	.52
MTMSE Tasks	5.47	.56
MTMSE Content	5.59	.49
PALS	3.61	.41
PALS: Mastery Goal Structure for Students	4.18	.56
PALS: Performance Goal Structure for Students	3.17	.64
PALS: Mastery Approaches to Instruction	3.71	.68

Table 13 (continued).

	Mean	SD
PALS: Performance Approaches to Instruction	2.75	.80

Note. Scale 1=strongly disagree, 3=somewhat agree, 5=strongly agree. (Applies to all PALS)

Scale 1=not confident at all, 6=completely confident. (Applies to MTMSE Problems, MTMSE Tasks, and MTMSE content).

Scale 1=strongly disagree, 6=strongly agree. (Applies only to MTMSE)

Statistical Analysis of Data

The first null hypothesis was there is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy. A multiple regression was used to determine if there was a statistically significant relationship between the dependent variable MCT2 math QDI and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy as indicated in Hypothesis 1.The null hypothesis was not rejected $F(4,109)=1.229$, $p=.303$, $R^2=.043$. Results of analysis indicated that there is no significant relationship. Therefore, self-efficacies as measured by MTMSE are not predictive of QDI.

The second null hypothesis was there is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction. A multiple regression was used to determine if there was a statistically significant relationship between the dependent variable MCT2 math QDI and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction as indicated in Hypothesis 2.The null hypothesis was not rejected $F(4,109)=1.186$, $p=.321$, $R^2=.042$. Results of analysis indicated that there is no significant relationship. Therefore, instructional practices as measured by PALS are not predictive of QDI.

Summary

The results of the statistical analysis of data indicated that there was no statistically significant relationship between MCT2 math QDI and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy. Therefore, Hypothesis 1 was not rejected. The results also indicated that there was no statistically significant relationship between MCT2 math QDI and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction. Therefore, Hypothesis 2 was not rejected. Further discussion and recommendations are presented in Chapter V.

CHAPTER V

DISCUSSION

Self-efficacy impacts academics through students, teachers, and faculties (Bandura, 1993). According to Allinder (1995), student achievement can be improved as a result of increasing teacher efficacy. Teachers' sense of efficacy affects the confidence to teach students, communication with students in the classroom, the amount of effort put into planning and teaching lessons, ambition, goals, and beliefs of what students are capable of doing (Alderman, 1999; Tschannen-Moran et al., 1998). Teachers' sense of efficacy also plays a role in management of students as well as effectiveness as teachers (Dibapile, 2012). According to Bandura (1993), people with a high sense of efficacy have visions of success and focus on how to make it happen, whereas people with a low sense of efficacy visualize failure and everything that might possibly go wrong. Individuals with a high sense of self-efficacy embrace difficult tasks, set high goals for themselves, fully commit to these goals (Bandura, 1993), and appear to be calm and relaxed when they encounter difficulties (Pajares, 1996). Education must provide students with a sense of self-efficacy as well as the intellectual tools and self-regulatory skills needed that will allow them to continually be able to educate themselves (Bandura, 1993). To do this, the teachers, themselves, must exhibit high levels of self-efficacy.

Summary of the Study

The purpose of this study was to examine the relationship among the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers. This study was also designed to determine how these variables influence an individual teacher's QDI in relation to MCT2 math scores in grades 3-5. This study included 117 elementary teachers who taught third, fourth, or fifth grade mathematics in Mississippi during the 2012-2013 school year. The researcher collected data using Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000) and Mathematics Teaching and Mathematics Self-Efficacy Scale (MTMSE) (Kahle, 2008). The survey instrument also contained a demographic section to collect descriptive data. A descriptive analysis was conducted on the data collected.

Research Questions

The research questions addressed in this study were

1. What are the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers in grades 3-5?
2. Do mathematical self-efficacy, mathematical teaching self-efficacy, and instructional practices have an influence on an individual teacher's QDI in relation to MCT2 math scores in grades 3-5?

Research Hypotheses

The following null hypotheses were investigated in this study:

H_1: There is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy.

H_2: There is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction.

Conclusions and Discussion

Research question one asked, “What are the mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers in grades 3-5?” To answer this research question, quantitative statistics were performed on the survey data using SPSS. From surveys collected, the researcher determined that teachers appeared to be most confident in their ability to solve basic math problems that involved making change when purchasing an item. These problems were related to the numbers and operations strand of the NCTM 2000 standards for mathematical content. Teachers appeared to be least confident in their ability to solve problems that involved geometric images. These problems were related to the geometry strand of the NCTM 2000 standards for mathematical content. The teachers felt most confident performing tasks such as balancing a checkbook, estimating grocery costs, and tipping for dinner. These tasks were related to the numbers and operations strand of the NCTM 2000 standards for mathematical content. Teachers appeared to be least confident performing tasks that require spatial and geometric reasoning. These tasks were related to the geometry strand of the NCTM 2000 standards for mathematical content.

The study also indicated that teachers were most confident in teaching mathematics as opposed to other subjects. The results of the study indicated that teachers are most confident teaching the numbers and operations strand of the NCTM 2000 standards for mathematical content. Based on teachers' preferences, the remaining NCTM 2000 standards were ranked in the following order: geometry, algebra, measurement, and data analysis and probability. These standards are ranked in order from most confidence in teaching to least confidence in teaching. Although teacher preference ranked the geometry strand of the NCTM 2000 standards for mathematical content as their second most confident strand to teach, this contradicts responses from teachers based on how confident they were to solve these types of problems and tasks. Based on results from the survey, teachers appeared to be least confident in the ability to solve problems and tasks based on the geometry strand. Teachers in the sample strongly agreed that they are effective teachers who continue to find new teaching methods and feel comfortable answering students' questions. Teachers also indicated an overall confidence in the ability to teach all mathematical topics related to the NCTM 2000 Standards for mathematical content. Furthermore, they were most confident in the ability to teach multiplication, which is related to the numbers and operations strand of the NCTM standards for mathematical content, and least confident teaching the metric system, which is related to the measurement strand of the NCTM standards for mathematical content.

According to Bransford et al. (2010), "there is no universal best teaching practice" (p. 22). However, teachers must be able to use the appropriate instructional practices (Maccini & Gagnon, 2006) because teacher efficacy can positively impact student achievement (Allinder, 1995) and teachers' instructional practices are shaped by efficacy (Alderman, 1999). Instructional practices can be tied to NCTM's principles for school mathematics. McKinney et al. (2009) believe that NCTM's six principles for school mathematics are the key to creating classrooms that promote conceptual understanding, problem-solving skills, and mathematical reasoning. NCTM's principles are (a) the equity principle, (b) the curriculum principle, (c) the teaching principle, (d) the learning principle, (e) the assessment principle, and (f) the technology principle (NCTM, 2000), and each principle can be tied to different instructional practices used in the classroom.

In this study, teachers agreed that they should incorporate instructional practices that stress the importance of students working hard. Teachers also agreed that instructional strategies should be fun and keep students from boredom. This relates to NCTM's curriculum principle, and one instructional practice involves the teacher adding creativity to the lessons (McKinney & Frazier, 2008; McKinney et al., 2009). However, in McKinney and Frazier's (2008) study of middle school teachers, only about 8% of the teachers reported adding personal creativity to lessons very frequently.

The equity principle involves the belief that students can be successful in math, and teachers must be ready and willing to make necessary accommodations to help students become successful (McKinney et al., 2009). In order to satisfy the equity principle, educators must set high expectations for students, and teachers must be able to give students the support needed

(NCTM, 2000). One such instructional strategy that relates to the equity principle is differentiated instruction (McKinney et al., 2009). Teachers can help promote a higher sense of math self-efficacy among students by differentiating homework assignments based on individual students' ability levels (Kitsantas et al., 2011) and giving students choices about required assignments (Margolis & McCabe, 2006). In this study, teachers agreed that students should be recognized for individual progress and that instruction should be differentiated based on students' needs. However, in McKinney and Frazier's (2008) study, only 27% of the teachers reported differentiating instruction on a regular basis.

Instructional practices used in the classroom are not only based on NCTM principles; they can be based on mastery and performance goals. According to Fast et al. (2010), performance and mastery goals both influence students' thoughts and actions; however, self-efficacy is frequently tied to mastery goals. Teachers can help students improve math self-efficacy by exposing them to mastery learning experiences in which they have the opportunity to see progress and success (Kitsantas et al., 2011). Mastery and performance are two main types of achievement goals used to drive instruction (Midgley et al., 2001). Performance goals involve showing one's ability, and mastery goals are designed to develop one's ability (Harackiewicz et al., 2000; Midgley et al., 2001). In order for students to be deemed successful with performance goals, they must perform better than peers (Midgley et al., 2001; Senko et al., 2011). In contrast, in order for students to be considered successful with mastery goals, they must meet or exceed the predetermined score set for the task (Senko et al., 2011). Results of this study indicated that teachers were split on whether or not students should be identified and compared based on academic performance. Comparing students based on academic performance is related to performance goals. Magi et al. (2010) warn against comparing students and creating a competitive environment during the early grades because students tend to increase task avoidance. Task avoidance can have a negative impact on student achievement (Magi et al., 2010). Midgley et al. (2001) warned that performance goals may have negative outcomes for students because of the risk of failure, and Senko et al. (2011) found that performance goals may result in an increase of students cheating. Brophy (2005) determined that performance goals were not frequently used in the classroom. He stated that this low occurrence is good (Brophy, 2005) because competition in the classroom could negatively impact cooperative learning (Brophy, 2005; Senko et al., 2011). According to Brophy, students, as well as the class as a whole, would be better off with an individual and group focus on achieving goals rather than encouraging competition.

Research question two asked, “Do mathematical self-efficacy, mathematical teaching self-efficacy, and instructional practices have an influence on an individual teacher’s QDI in relation to MCT2 math scores in grades 3-5?” To answer this research question, the following null hypotheses were formulated: (1) there is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy and (2) there is no statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction.

A multiple regression was used to determine if there was a statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mathematics self-efficacy problems, mathematics teaching self-efficacy, mathematics self-efficacy tasks, and mathematics content teaching self-efficacy. Findings in this study indicated that there is no significant relationship, so self-efficacy as measured by MTMSE is not predictive of QDI. A teacher's QDI is based on how well students perform on the given test. Each student's score is tied to one of four performance levels: (a) minimal, (b) basic, (c) proficient, and (d) advanced (MDE, 2012b). These performance levels are used to calculate the teacher's QDI. Therefore, this study indicated that there are factors other than self-efficacy that play a role in an individual teacher's QDI. These factors may include class size, student ability, and student attendance. This finding contradicts research by Kitsantas et al. (2011), Fast et al. (2010), Stevens et al. (2004), Pajares and Miller (1994, 1995), and Pajares and Kranzler (1995). These researchers all conducted studies involving the relationship between mathematics self-efficacy and student achievement. Each study concluded that higher mathematics self-efficacy was linked to academic achievement.

A multiple regression was also used to determine if there was a statistically significant relationship between MCT2 math Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction. According to Bloom (1978), mastery learning is an instructional strategy that can be used to increase achievement and motivation for a large number of students. However, findings in this study indicated that there is no significant relationship between MCT2 math Quality Distribution Index (QDI) and mastery goal structure for students, performance goal structure for students, mastery approaches to instruction, and performance approaches to instruction, so instructional practices as measured by PALS are not predictive of QDI. Therefore, this study indicated that there are factors other than instructional practices that play a role in an individual teacher's QDI. These factors may include class size, student ability, and student attendance. Mastery learning is based on the premise that students must learn at an individualized pace (Pulliam & Van Patten, 2003; Rollins, 1983). Findings in this study contradict the research of Bloom (1978) and his students. They used the idea of mastery learning to help slow learners (Bloom, 1978). From their research, they determined that given the appropriate amount of time and help, many of the slower learners could reach the same level of achievement as the faster learners (Bloom, 1978). Bloom (1978) also reported that when slower learners are able to reach the same levels of achievement as the faster learners, interest and attitude toward the subject matter is improved.

Elliot and Church (1997) reported that performance-approach goals are tied to achievement motivation as well as a fear of failure. Performance-avoidance goals are tied to a student's fear of failure (Elliot & Church, 1997).

Magi et al. (2010) caution against comparing students and creating a competitive environment because it can have a negative impact on student achievement. Magi et al. (2010) suggested that students in math classes who are able to see more successes in the primary grades are less likely to demonstrate performance-avoidance goals and will put more effort into their classwork. According to Brophy (2005), research suggested that students who focus on competition are less likely to focus on the true task at hand, which will prevent them from being able to focus on learning the material being taught and preparing well for tests.

Importance of the Study to the Field of Educational Leadership

Knowing about how teachers perceive their self-efficacy in teaching mathematics is important for the field of educational leadership because teacher efficacy can positively impact student achievement (Allinder, 1995). Teachers' sense of efficacy affects the confidence to teach students, communication with students in the classroom, the amount of effort put into planning and teaching lessons, ambition, goals, and beliefs about what students are capable of doing (Alderman, 1999; Tschannen-Moran et al., 1998).

Understanding how teachers perceive their self-efficacy in teaching mathematics is important for school leaders because there is a direct relationship between the quality of the education earned in schools and the quality of the teachers teaching students (Khan, 2011). For school leaders working in K-12 schools in Mississippi, knowing how teachers perceive their self-efficacy in teaching mathematics is important because Allinder (1995) found that students whose teachers had a high sense of personal teaching efficacy showed significantly more growth than students taught by teachers with lower personal teaching efficacy. Student growth is defined as the change in a student's achievement over a specified time period (Reform Support Network, n.d.). Schools and districts in Mississippi are held accountable for student growth because performance level is based partly on growth expectation (MDE, 2012b).

Limitations

This study had several limitations. First of all, the data collected by the researcher were all self-reported. Therefore, it is possible that some of the data are not accurate. Since the survey is an opinion survey about teachers' confidence in personal ability, it is possible that some participants are under-estimating abilities, some are over-estimating abilities, or some are on target. The instrument did not measure actual abilities but perception of abilities. Respondents did not have to actually work the problems, only to say they could work them. If participants had actually been asked to answer the questions on the survey, a more realistic view of what is known as opposed to what is thought to be known could have been gained.

Second, participants in the study may not be a good representation of the population of teachers in Mississippi. The researcher used convenience sampling; therefore, it is possible that the sample is not a good representation in regards to the socioeconomic status of students, teachers, schools, and districts in Mississippi. In an effort to maintain anonymity, the survey did not include descriptive questions that would allow the researcher to determine how well the sample actually represented the population in Mississippi.

Third, the participants in the study may not have been on a level playing field. QDI is often used by districts and schools as a means of measuring teacher performance. However, in some cases, this number is skewed due to variance in student ability in a given class. The students' ability levels may not have been the same for each class and teacher in the study. For example, the number of students in each class with individualized education programs (IEPs) may not have been the same for each teacher in the study. Some participants may have taught classes that consisted of regular education students while other participants may have taught classes that consisted of regular education students along with special education students.

Recommendations for Policy or Practice

Although this study did not find a direct relationship between self-efficacy, instructional practices, and student achievement as measured by QDI, there is evidence of this relationship from the review of literature. Therefore, the following recommendations are made for educational leaders:

1. The findings in this study indicated that self-efficacy and instructional practices may not be good predictors of an individual teacher's QDI. Self-efficacy may not correspond to a teacher's actual ability. When analyzing a teacher's QDI, practitioners should take into consideration the other factors that could affect QDI. These factors may include class size, student ability, socioeconomic status, and student attendance.

2. In an “era of high-stakes testing” (Zimmerman & DiBenedetto, 2008, p. 206), teachers may be tempted to teach based on performance learning by creating a competition among students. However, during the 2014-2015 school year, many states will be implementing a new educational framework called Common Core (National Governors Association Center for Best Practices (NGA Center), Council of Chief State School Officers (CCSSO), 2010a). In order to be successful with the Common Core State Standards, students are expected to master the material at each grade level so their teachers can continue instruction as they move into the next year (National Governors Association Center for Best Practices (NGA Center), Council of Chief State School Officers (CCSSO), 2010c). Therefore, it is important that teachers begin using instructional practices that are based on mastery learning rather than performance learning so that students will be better equipped to handle the next grade level of mathematics.
3. According to Allinder (2005), teacher efficacy can positively impact student achievement; therefore, it would benefit school leaders to help teachers enhance and strengthen personal teaching self-efficacy. A teacher’s self-efficacy is positively affected by feedback and support from administrators (Alderman, 1999). In Mississippi, the Mississippi Statewide Teacher Appraisal Rubric (M-STAR) may provide the vehicle for this feedback and support. One benefit of Mississippi's new teacher evaluation model is the increased accountability calling for

communication between administration and teachers (Mississippi Department of Education, 2012c). These pre-conferences and post-conferences provide valuable time for the administrator to offer coaching to teachers. Through coaching and feedback, administrators have the opportunity to build teacher confidence pedagogy, which in turn could increase self-efficacy.

Recommendations for Future Research

There is a need for more research involving mathematical self-efficacies, mathematical teaching self-efficacies, and instructional practices of elementary teachers. Recommendations for future studies include the following:

- All of the data collected in this study was self-reported. The current study should be replicated; however, an extra section should be added to the survey that would require participants to answer the questions in part 1 of the survey. This added component could allow the researcher to determine if participants are under-estimating abilities, over-estimating abilities, or on target.
- The current study should be replicated; however, participants should be chosen based on similar socioeconomic statuses of the students in the classrooms rather than convenience sampling. Ensuring that each group of students is similar could eliminate some variability.
- The current study could be replicated using a measure other than QDI. One other measure could be student growth. Growth provides important data that inform educators as to whether or not a student is

on track to be proficient (Mississippi Department of Education, 2013). In order to establish growth expectation for a school, students are tested annually, and progress is tracked from year to year (MDE, 2012b).

- The current study should be replicated on a national level to include other states that could possibly provide a broader teacher perspective. Much of the nation is moving toward a new educational framework—Common Core. In an effort to help better prepare students for college and career readiness, the Common Core State Standards were developed. The Common Core State Standards are intended to provide parents and teachers with a clear understanding of what students are expected to learn throughout their K-12 educational careers (National Governors Association Center for Best Practices (NGA Center), Council of Chief State School Officers (CCSSO), 2010b). These Standards are intended to align the curriculum among the states to help provide equal opportunities for all students, and so that student achievement could be compared from one state to another (Mississippi Department of Education, 2012a). Each state had to choose whether or not to adopt these Standards (MDE, 2012a). Currently, 45 states, the Department of Defense Education Activity, the District of Columbia, the U.S. Virgin Islands, the American Samoa Islands, the Northern Mariana Islands, and Guam have adopted the Common Core State Standards (NGA Center, CCSSO, 2010a). MDE suggested that districts in Mississippi begin implementing the Common Core State Standards in kindergarten through second grade during the 2011-2012 school year, in third grade through eighth grade during the 2012-2013 school year, and in the ninth grade through twelfth grade during the 2013-2014 school year (MDE, 2012a). Full implementation of the Common Core State Standards is scheduled for the 2014-2015 school year (MDE, 2012a). Along with this new curriculum comes new assessments, and two assessment consortia were chosen to develop assessments aligned to the Common Core State Standards. These two consortia were Smarter Balanced Assessment Consortium (SBAC) and Partnership for Assessment of Readiness for College and Careers (PARCC) (MDE, 2012a). States independently decided whether to use SBAC or PARCC to develop new assessments. In order to obtain a broader teacher perspective, this study should be replicated and include states that adopted the Common Core State Standards and are using the same testing consortia.

APPENDIX A

LETTER TO SUPERINTENDENTS

Researcher's Name
Address
City, State, Zip Code
Email Address

Superintendent
School District
Address
City, State, Zip Code

May 1, 2013

RE: Permission to Conduct Research

Dear Superintendent:

I am writing to request permission to conduct research in your school district. I am currently enrolled in the doctoral program in Educational Administration at The University of Southern Mississippi in Hattiesburg, MS, and am in the process of writing my dissertation. The study is entitled *Teacher's Self-Efficacy in Mathematics and Teaching Mathematics, Instructional Practices, and the Mississippi Curriculum Test, Second Edition in Grades 3-5.* The purpose of this research is to determine the relationship between elementary teachers' math self-efficacy, math teaching self-efficacy, and how these impact math instructional practices and MCT2 results.

If approval is granted, the intent is to have third, fourth, and fifth grade elementary teachers who taught math during the 2012-2013 school year complete the survey in August 2013. The survey process should take approximately 15-20 minutes. I will follow the guidelines and procedures established by your school district regarding research studies.

Principals and teachers will be informed that their participation is not required, nor will they be penalized for nonparticipation. Teachers' informed consent will be understood and indicated by the completion and submission of a survey form, and their identity will remain anonymous. To ensure that surveys are anonymous, teachers will not be asked to put their name, school, or school district on the surveys. The survey results will be pooled for the dissertation, and individual results of this study will remain absolutely confidential and anonymous. Should this study be published, only pooled results will be documented. No costs will be incurred by your school district or the individual participants. Once the study is complete, all participating individuals will have access to the results of the study.

Your approval to conduct this study will be greatly appreciated. Should you grant me permission, this information will be helpful in gaining IRB approval through The University of Southern Mississippi. I have enclosed a self-addressed envelope. Please submit a signed letter of permission on your district's letterhead acknowledging your consent and permission for me to conduct this survey/study in your district. I have enclosed a sample permission letter and a copy of the letter that will be attached to each teacher survey.

Sincerely,

Tracy H. Yates

APPENDIX B

LETTER TO TEACHERS

Researcher's Name
Address
City, State, Zip Code
Email Address

August 1, 2013

Dear Teacher,

I am a doctoral candidate at The University of Southern Mississippi. I am conducting a research study on the relationship between elementary teachers' math self-efficacy, math teaching self-efficacy, how these impact math instructional practices, and MCT2 results. I am asking third, fourth, and fifth grade math teachers to complete a survey regarding math self-efficacy, math teaching self-efficacy, and instructional practices. The survey should take approximately 15-20 minutes to complete.

Please DO NOT write your name, school, or school district on the surveys. The survey results will be pooled for the dissertation, and individual results of this study will remain completely confidential and anonymous. Should this study be published, only pooled results will be documented. Once the study is complete, all participating individuals will have access to the results of the study. Upon completion of this research study, I will shred all surveys.

I have received written permission from your school district. Completion and submission of the survey will serve as your consent to participate as well as your informed consent. Please note that you are NOT required to participate, and there is no penalty for nonparticipation.

If you agree to participate, please complete the survey and place it in the sealed box on the table as you leave the room. Should you have any questions, please feel free to contact me at (601) 906-5217 or tyates@pearl.k12.ms.us. This research is conducted under the supervision of Dr. David Lee at The University of Southern Mississippi (email: david.e.lee@usm.edu).

This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University

of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

Thank you for your help in participating in this study. If you would like to know the final results of the study, please contact me at the address listed above. Your time and input are greatly appreciated. Have a great 2013-2014 school year!

Sincerely,

Tracy H. Yates

APPENDIX C

PERMISSION TO USE INSTRUMENTS

UNIVERSITY of NEW HAMPSHIRE

March 13, 2013

Ms. Tracy Hardwell Yates
The University of Southern Mississippi

Dear Ms. Hardwell Yates,

Thank you for your interest in the Patterns of Adaptive Learning Survey (PALS). Our research team makes PALS available to researchers worldwide free of charge at our website www.umich.edu/~pals/pals. You have permission to use the scales and adapt them to your own context. Our only request is that you provide proper citation of our work.

Please let me know if I can be helpful as you progress with your research using PALS.

Sincerely,

Michael Middleton

Michael Middleton
Chair and Associate Professor

College of Liberal Arts
Department of Education
Morrill Hall 62 College Road Durham, New Hampshire 03824-3595 603-862-2310 603-862-2174 fax www.unh.edu/education

4631 Coach Rd.
Columbus, OH 43220
March 14, 2013

To Whom It May Concern:

I give Tracy H. Yates permission to use my survey titled *Mathematics Teaching and Mathematics Self-Efficacy (MTMSE) Scale* for her dissertation.

If you have questions, please contact me at the address above or at rkahle@columbus.rr.com.

Sincerely,

Diane K Kahle

Diane K. Kahle, Ph.D.

APPENDIX D

INSTRUMENT

Mathematics Teaching and Mathematics Self-Efficacy (MTMSE) Scale
Patterns of Adaptive Learning Scales (PALS)

TEACHERS FEELINGS, BELIEFS, AND PERCEPTIONS ABOUT MATHEMATICS
AND MATHEMATICS INSTRUCTIONAL PRACTICES

This survey will take approximately twenty minutes to complete. Your opinions are very important to me.
Thank you in advance for participating in this study.

DIRECTIONS
There are seven parts to this questionnaire. The directions for each part are written at the top of each new section. Please mark only one answer for each question. Again, thank you for your time and input.

What was your 2012-2013 Math QDI: _____

Part 1: Mathematics Teaching and Mathematics Self-Efficacy (MTMSE) Scale
Suppose that you were asked the following math questions in a multiple choice form. Please indicate how confident you are that you would give the correct answer to each question without using a calculator.

PLEASE DO NOT ATTEMPT TO SOLVE THESE PROBLEMS.

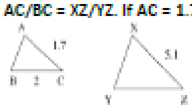
Please use the following scale.

1	2	3	4	5	6
Not Confident at all					*Completely Confident*

		Not Confident at all					*Completely Confident*
1.	In a certain triangle, the shortest side is 6 inches. The longest side is twice as long as the shortest side, and the third side is 3.4 inches shorter than the longest side. What is the sum of the three sides in inches?	1	2	3	4	5	6
2.	ABOUT how many times larger than 614,360 is 30,668,000?	1	2	3	4	5	6
3.	There are three numbers. The second is twice the first and the first is one-third of the other number. Their sum is 48. Find the largest number.	1	2	3	4	5	6
4.	Five points are on a line. T is next to G. K is next to H. C is next to T. H is next to G. Determine the position of the points along the line.	1	2	3	4	5	6
5.	If y = 9 + x/5, find x when y = 10.	1	2	3	4	5	6
6.	A baseball player got two hits for three times at bat. This could be represented by 2/3. Which decimal would most closely represent this?	1	2	3	4	5	6
7.	If P = M + N, then which of the following will be true? a. N = P – M b. P – N = M c. N + M = P d. All of the above	1	2	3	4	5	6
8.	Find the measure of the angle that the hands of a clock form at 8 o'clock.	1	2	3	4	5	6
9.	Bridget buys a packet containing 9-cent and 13-cent stamps for $2.65. If there are 25 stamps in the packet, how many are 13-cent stamps?	1	2	3	4	5	6
10.	On a certain map, 7/8 inch represents 200 miles. How far apart are two towns whose distance apart on the map is 3 ½ inches?	1	2	3	4	5	6
11.	Fred's bill for some household supplies was $13.64. If he paid for the items with a $20 bill, how much change should he receive?	1	2	3	4	5	6
12.	Some people suggest that the following formula be used to determine the average weight for boys between the ages of 1 and 7: W = 17 + 5A where W is the weight in pounds and A is the boy's age in years. According to this formula, for each year older a boy gets, should his weight become more or less, and by how much?	1	2	3	4	5	6
13.	Five spelling tests are to be given to Mary's class. Each test has a value of 25 points. Mary's average for the first four tests is 15. What is the highest possible average she can have on all five tests?	1	2	3	4	5	6
14.	$3\frac{4}{5}-\frac{1}{2}=$ _______.	1	2	3	4	5	6
15.	In an auditorium, the chairs are usually arranged so that there are x rows and y seats in a row. For a popular speaker, an extra row is added, and an extra seat is added to every row. Thus there are x + 1 rows and y + 1 seats in each row. Write a mathematical expression to show how many people the new arrangement will hold.	1	2	3	4	5	6

Please use the following scale.

1	2	3	4	5	6
Not Confident at all					*Completely Confident*

		Not Confident at all					*Completely Confident*
16.	A Ferris wheel measures 80 feet in circumference. The distance on the circle between two of the seats S and T, is 10 feet. See figure below. Find the measure in degrees of the central angle SOT whose rays support the two seats. 	1	2	3	4	5	6
17.	Write an expression for "six less than twice 4 5/6"?	1	2	3	4	5	6
18.	The two triangles shown below are similar. Thus, the corresponding sides are proportional, and AC/BC = XZ/YZ. If AC = 1.7, BC = 2, and XZ = 5.1, find YZ. 	1	2	3	4	5	6

Part 2: Directions: Please use the following scale to answer each question.

1	2	3	4	5	6
Strongly Disagree					*Strongly Agree*

		Strongly Disagree					*Strongly Agree*
1.	I will continually find better ways to teach mathematics.	1	2	3	4	5	6
2.	Even if I try very hard, I will not teach mathematics as well as I will most subjects.	1	2	3	4	5	6
3.	I know how to teach mathematics concepts effectively.	1	2	3	4	5	6
4.	I will not be very effective in monitoring mathematics activities.	1	2	3	4	5	6
5.	I will generally teach mathematics ineffectively.	1	2	3	4	5	6
6.	I understand mathematics concepts well enough to be effective in teaching elementary mathematics.	1	2	3	4	5	6
7.	I will find it difficult to use manipulatives to explain to students why mathematics works.	1	2	3	4	5	6
8.	I will typically be able to answer students' questions.	1	2	3	4	5	6
9.	I wonder if I will have the necessary skill to teach mathematics.	1	2	3	4	5	6
10.	Given a choice, I will not invite the principal to evaluate my mathematics teaching.	1	2	3	4	5	6
11.	When a student has difficulty understanding a mathematics concept, I will usually be at a loss as to how to help the student understand it better.	1	2	3	4	5	6
12.	When teaching mathematics, I will usually welcome student questions.	1	2	3	4	5	6
13.	I do not know what to do to turn students on to mathematics.	1	2	3	4	5	6

Part 3: Directions: How much confidence do you have that you are able to successfully perform each of the following tasks.

Please use the following scale.

1	2	3	4	5	6
Not Confident at all					*Completely Confident*

		Not Confident at all					*Completely Confident*
1.	Add two large numbers in your head.	1	2	3	4	5	6
2.	Multiply quantities in a recipe to feed a larger group.	1	2	3	4	5	6
3.	Balance your checkbook.	1	2	3	4	5	6
4.	Figure out how long it will take to travel from City A to City B driving x mph.	1	2	3	4	5	6
5.	Understand a graph accompanying an article on business profits.	1	2	3	4	5	6
6.	Figure out how much you would save if there is a 15% markdown on an item you wish to buy.	1	2	3	4	5	6
7.	Estimate your grocery bill in your head as you pick up items.	1	2	3	4	5	6
8.	Figure out which of two summer jobs is the better offer; one with a higher salary but no benefits, the other with a lower salary plus room, board, and travel expenses.	1	2	3	4	5	6
9.	Figure out the tip on your part of a dinner bill.	1	2	3	4	5	6
10.	Figure out how much lumber you need to buy in order to build a set of bookshelves.	1	2	3	4	5	6
11.	Measure your height in centimeters.	1	2	3	4	5	6
12.	Determine how many boxes of a certain size will fit into a closet.	1	2	3	4	5	6
13.	Explain your chances of flipping tails on both of two coins.	1	2	3	4	5	6

Part 4: Directions: Please rate the following mathematics topics according to how confident you would be teaching elementary students each topic.

Please use the following scale.

1	2	3	4	5	6
Not Confident at all					*Completely Confident*

		Not Confident at all					*Completely Confident*
1.	Averages, Mean, Median & Mode	1	2	3	4	5	6
2.	Multiplication	1	2	3	4	5	6
3.	Number Patterns	1	2	3	4	5	6
4.	Shape Properties	1	2	3	4	5	6
5.	Fractions	1	2	3	4	5	6
6.	U.S. Customary Measurement System (e.g. feet, pounds, gallons)	1	2	3	4	5	6
7.	Probability	1	2	3	4	5	6
8.	Decimals	1	2	3	4	5	6
9.	Order of Operations	1	2	3	4	5	6
10.	Metric System (e.g. meters, liters, grams)	1	2	3	4	5	6
11.	Division	1	2	3	4	5	6
12.	Perimeter & Area	1	2	3	4	5	6
13.	Tables & Graphs	1	2	3	4	5	6

Part 5: Patterns of Adaptive Learning Scales (PALS)

Please respond to the following statements according to how you believe they apply to your instruction in your mathematics classroom and the best practices of your school. Please circle only one answer.

1	2	3	4	5
Strongly Disagree		*Somewhat Agree*		*Strongly Agree*

		Strongly Disagree		*Somewhat Agree*		*Strongly Agree*
1.	I give special privileges to students who do the best work.	1	2	3	4	5
2.	If I try really hard, I can get through to even the most difficult student.	1	2	3	4	5
3.	In this school: The importance of trying hard is really stressed to students.	1	2	3	4	5
4.	I make a special effort to recognize students' individual progress, even if they are below grade level.	1	2	3	4	5
5.	In this school: Students are told that making mistakes is OK as long as they are learning and improving.	1	2	3	4	5
6.	Factors beyond my control have a greater influence on my students' achievement than I do.	1	2	3	3	4	5
7.	In this school: It's easy to tell which students get the highest grades and which students get the lowest grades.	1	2	3	4	5
8.	I am good at helping all the students in my classes make significant improvement.	1	2	3	4	5
9.	I display the work of the highest achieving students as an example.	1	2	3	4	5
10.	In this school: Students who get good grades are pointed out as an example to others.	1	2	3	4	5
11.	During class, I often provide several different activities so that students can choose among them.	1	2	3	4	5
12.	In this school: Students hear a lot about the importance of getting high test scores.	1	2	3	4	5
13.	I consider how much students have improved when I give them report card grades.	1	2	3	4	5
14.	In this school: A lot of the work students do is boring and repetitious.	1	2	3	4	5
15.	In this school: Grades and test scores are not talked about a lot.	1	2	3	4	5
16.	In this school: Students are frequently told that learning should be fun.	1	2	3	4	5
17.	I help students understand how their performance compares to others.	1	2	3	4	5
18.	Some students are not going to make a lot of progress this year, no matter what I do.	1	2	3	4	5
19.	I encourage students to compete with each other.	1	2	3	4	5
20.	In this school: The emphasis is on really understanding schoolwork, not just memorizing it.	1	2	3	4	5
21.	I point out those students who do well as a model for the other students.	1	2	3	4	5
22.	In this school: A real effort is made to recognize students for effort and improvement.	1	2	3	4	5
23.	I am certain that I am making a difference in the lives of my students.	1	2	3	4	5
24.	There is little I can do to ensure that all my students make significant progress this year.	1	2	3	4	5
25.	In this school: Students hear a lot about the importance of making the honor roll or being recognized at honor assemblies.	1	2	3	4	5
26.	I give a wide range of assignments, matched to students' needs and skill level.	1	2	3	4	5
27.	In this school: A real effort is made to show students how the work they do in school is related to their lives outside of school.	1	2	3	4	5
28.	I can deal with almost any learning problem.	1	2	3	4	5
29.	In this school: Students are encouraged to compete with each other academically.	1	2	3	4	5

Part 6: Demographic Questions

1. What is your highest level of degree earned? ❶ Bachelor's ❷ Master's ❸ Specialist ❹ Doctoral
2. How many years have you been teaching? ________
3. Circle all of the subjects that you teach: ❶ Language Arts ❷ Mathematics ❸ Reading ❹ Science ❺ Social Studies
4. What subject are you <u>most</u> confident teaching in elementary school?
   ❶ Language Arts ❷ Mathematics ❸ Reading ❹ Science ❺ Social Studies
5. What subject are you <u>least</u> confident teaching in elementary school?
   ❶ Language Arts ❷ Mathematics ❸ Reading ❹ Science ❺ Social Studies
6. How many hours of mathematics courses did you take in your college preparation?
   ❶ 0-3 ❷ 3-6 ❸ 6-9 ❹ 9-12 ❺ 12-15 ❻ 15-18 ❼ 18+
7. Which strand of mathematics are you <u>most</u> confident teaching?
   ❶ Numbers & Operation ❷ Algebra ❸ Geometry ❹ Measurement ❺ Data Analysis & Probability
8. What did you teach during the 2012-2013 school year? ❶ 3rd Grade Math ❷ 4th Grade Math ❸ 5th Grade Math
9. While completing this survey, did you actually attempt to solve any of these problems? ❶ Yes ❷ No

Please keep in mind that your answers will be kept confidential and your identity will be completely anonymous.

Thank you very much for your participation in my study!
Your input is very valuable.

APPENDIX E

INSTITUTIONAL REVIEW BOARD NOTICE OF COMMITTEE ACTION

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.6820 | Fax: 601.266.4377 | www.usm.edu/irb

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **13082101**
PROJECT TITLE: **Teacher's Self-Efficacy in Mathematics and Teaching Mathematics, Instructional Practices, and the Mississippi Curriculum Test, Second Edition for Mathematics in Grades 3-5**
PROJECT TYPE: **Dissertation**
RESEARCHER(S): **Tracy Yates**
COLLEGE/DIVISION: **College of Education and Psychology**
DEPARTMENT: **Educational Leadership and School Counseling**
FUNDING AGENCY/SPONSOR: **N/A**
IRB COMMITTEE ACTION: **Exempt Approval**
PERIOD OF APPROVAL: **08/21/2013 to 08/20/2014**

Lawrence A. Hosman, Ph.D.
Institutional Review Board

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