EXPLORING RELATIONSHIPS AMONG TEACHING STYLES, TEACHERS’ PERCEPTIONS OF THEIR SELF EFFICACY AND STUDENTS’ MATHEMATICS ACHIEVEMENT

by

Christi Davis-Langston

Liberty University

A Dissertation Presented in Partial Fulfillment
Of the Requirements for the Degree
Doctor of Education

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ABSTRACT

Christi Davis-Langston.  EXPLORING RELATIONSHIPS AMONG TEACHING STYLES, TEACHERS’ PERCEPTIONS OF SELF-EFFICACY, AND STUDENTS’ MATHEMATICS ACHIEVEMENT.  (Under the direction of Dr. Gary Kuhne, School of Education)  February 2012

The purpose of this study was to examine the relationships among elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement. Analysis of data collected from 95 teachers found small to moderate correlations between teaching style and measures of mathematics achievement. No statistically significant relationships were found between elementary school teachers’ self-efficacy and students’ mathematics achievement levels.

Mathematics achievement (numbers and operations, geometry, and percentage of students who exceeded standards on the CRCT) was predicted by teaching styles (delegator, facilitator, and expert). Although the relationships were statistically significant, little variance in achievement was explained by teaching styles. Educators must strive to pursue promising teaching strategies and styles in order to promote achievement in elementary mathematics.

Descriptors: adequate yearly progress; Criterion-Referenced Competency Test; early childhood education; Georgia Performance Standards; mathematics; performance level; quantitative research.
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CHAPTER ONE: INTRODUCTION

The No Child Left Behind Act (U.S. Department of Education, n.d.) spurred a nationwide accountability movement in elementary education. NCLB requires all schools to make adequate yearly progress (AYP) in meeting the same state-specific standards, to ensure instruction is provided by highly qualified teachers, and to use scientific research to increase educational gains for all students (U.S. Department of Education, n.d.). With the accountability pressures from NCLB, elementary schools were given the charge to raise and increase the performances of students academically and enhance student success in mathematics by developing programs (Zvoch & Stevens, 2006).

NCLB mandated that all schools hire only highly qualified teachers beginning in 2005 (U.S. Department of Education, 2002). This influential federal legislation defines highly qualified teachers in terms of the background characteristics they bring into the classroom, including state certification, a minimum of a bachelor’s degree, and for secondary teachers—demonstrated subject area competence. The universal purpose of this prerequisite was to increase the likelihood that classrooms are led by teachers who are effective in promoting student learning. However, despite the widespread interest in such characteristics, there is relatively little scientific evidence that these characteristics have a measurable and consistent direct impact on student achievement (Guarino, Santibanez, & Daley, 2006; Wayne & Youngs, 2003).

The stipulations established by NCLB may not be the best indicators of teacher effectiveness; rather aspects such as teachers’ teaching styles and their perceptions of
their self-efficacy to teach mathematics may be superior (Palardy & Rumberger, 2008).

The changes needed at the core of today’s educational school systems are processes. We need to provide students with (a) undeniable reasons to remain in school, (b) methods of cognitive science to enhance their learning, and (c) teacher created learning environments that enable students to be the center of learning that opens their minds to think critically and to be participative members of society. Hence, in an effort to meet teacher effectiveness, educational demands and state policies should be aimed toward enhancing teaching and learning aspects such as teachers’ instructional delivery and perceived self-efficacy.

**Background of Study**

Many elementary students are unable to make real-life connections between what is being taught and how the learned knowledge will be used (CORD, 2010). This is because the motivation for learning and the way students process learned information is not being touched by the traditional methods of teaching. Teachers are discovering their students’ achievement level and interest in core subjects improves dramatically when they are helped to make real-life connections. In addition to making real-life connections, students’ interest levels peak when connections between new taught information (knowledge) and experiences are connected with previously learned skills. Nearly all students learn more efficiently when they have opportunities to work in cooperative groups, allowing learning to be facilitated rather than delivered by the teacher in lecture format (CORD, 2010).

Understanding concepts of mathematics for the development of mathematical competence is essential; however, students may not have full access to instruction that
leads to conceptual understanding (National Council of Teachers of Mathematics, 2000). The majority of teachers will teach according to their preferred learning styles (Stitt-Gohdes, Crews, & McCannon, 1999). Teaching styles are defined as a range of specialized and consistent sets of teaching behaviors that do not waver by content (Fisher & Fisher, 1979). Gregorc (1979) believed teachers’ personal behaviors and teaching styles transmits learning to and from the learner. Sarasin (1998) indicated four questions teachers must ask themselves to be more effective: (a) How do you as the teacher learn? (b) How do you teach your students? (c) How do your students learn best? and (d) How do you accommodate the diverse learning styles? Sarasin believed that instructors can teach more effectively to all students if they can effectively answer these four questions.

There is also a growing confirmation that teachers’ sense of self-efficacy plays a major role in affecting important educational results (Klassen et al., 2009). Research has shown that teachers with a high degree of self-efficacy affect greater learning gains in their students (Lieberman & Miller, 2001). Teachers with positive self-efficacy beliefs tend to focus on student-centered instruction (Lockman, 2006), which increases students’ ownership of their learning. A highly efficacious teacher has a greater sense of self-efficacy, which is correlated to greater student achievement (Bandura, 1997; Overton, 2007; Tschannen-Moran & Barr, 2004).

The NCLB mandates research-based instructional teaching strategies; therefore, teachers should rely on proven instructional and pedagogical approaches to meet the needs of all diverse learners (U.S. Department of Education, 2009b). Teachers have to expand their teaching options by reorganizing and differentiating instruction daily to meet the needs of all learners. Tomlinson (2000) reported, “At the most vital level,
differentiated instruction is effort provided by teachers to meet a diversity of learners by incorporating the students’ learning styles. Therefore, teachers must assess and make the necessary adjustments so that all children can achieve” (p. 2).

**Theoretical Framework**

Effective teachers allow students the opportunity to interact, learn, succeed, and work to their topmost potential. When measuring teacher quality one must determine the one thing that is connected directly to student achievement and teaching (Barnes & Aguerrebere, 2006). Research suggests not one teaching method is best for everyone and many teaching styles can be motivational (McCombs & Miller, 2007).

The problem-solving theory and approach contributed by Schoenfeld (1985) presents a diverse view to student learning. The theory defines what constitutes an effective teaching approach, which includes a combination of intrinsic ability, measurable skills, and acquired practices. Schoenfeld theorized that understanding mathematics and the teaching of mathematics skills should be introduced as a problem-solving domain.

Four dimensions of problem-solving concepts and skills are essential in becoming successful in mathematics: (a) resources, proposition, and procedural knowledge of mathematics; (b) problem-solving heuristics to solve problems; (c) student choice of manipulatives and strategies; and (d) a mathematical worldview that determines how problems are approached. Because learning these critical skills begins early in the elementary school years, elementary school teachers are crucial to building a mathematical foundation.

However, problem solving is a vehicle for teachers to create opportunities for student to think critically and logically by reinforcing new and learned mathematical
knowledge. Problem-solving skills have the ability to enhance logical reasoning and deduction. Optimally in society, individuals can no longer function by only knowing the rules to follow and attain correct answers. Students need to solve problems by deciding through a process of logical deductions to develop rules to solve problems (NCTM, 1989, 1991, 2000).

Bandura’ (1977) theory of teacher self-efficacy is considered two-dimensional. The first dimension is personal teacher efficacy, which represents belief in one’s abilities and skills to be effective. The second dimension is teaching outcome expectancy–belief that teaching brings about student learning. Studies have shown that teachers’ sense of efficacy is related positively to the percentage of learning goals mastered and an overall improvement of student growth (Philipp, 2007). Teacher self-efficacy has been significantly associated with the use of instructional strategies that increase student achievement and the teacher’s willingness to embrace new ideas (Philipp, 2007).

**Problem Statement**

Of 98 schools in the district of study, 38 (39%) did not meet AYP (Georgia Department of Education, 2010). It is important that educators and educational administrators identify the gaps in student learning so that all schools and students are meeting state requirements by 2014. Accountability has become a focus word for all educators seeking to improve instructional practices, making their schools and systems more effective learning organizations that raise student academic achievement. At the same time, educational systems have rallied around a common set of standards for all grade levels, and teachers have come to the realization that classrooms are more heterogeneous than ever. The great diversity of students’ learning needs and learning
styles does not render one-size-fits-all approaches. These concerns prompted this study, which examined the relationship between elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement.

**Purpose Statement**

This correlational study’s purpose was to explore relationships among elementary school teachers’ teaching styles, their perceptions of self-efficacy, and student mathematics achievement. All Georgia elementary schools must obtain and reach specific requirements to achieve AYP based on standards set by the state. The NCLB mandates that states have standards and that those standards are met. Because of this mandated law, teachers are compelled to modify their instructional practices so all students become proficient in mathematics by 2014.

Elementary school teachers must be accountable for their personal professional development and administrators must encourage the best available research for what constitutes effective mathematical instruction and for providing students with engaging hands-on lessons that are relevant to real life. These lessons provide equitable opportunities for lifelong learning. The literature on teacher effectiveness and student achievement is extensive but there are shortcomings in regards to teachers’ teaching styles, teacher perception of self-efficacy, and student mathematics achievement. The outcome of this research may aid all educational stakeholders in addressing each subgroup of students’ needs. This research was intentionally set to provide a model for effective delivery of instruction in mathematics and valuable instructional planning in mathematics.
Significance of the Study

It is important that educators and educational administrators identify gaps in student learning so that all schools meet state requirements. The changes needed at the core of today’s educational school systems are processes. Students should be provided with (a) undeniable reasons to remain in school, (b) methods of cognitive science to enhance their learning, and (c) teacher created learning environments that open students’ minds to think critically and be participative members of society. These concerns prompted this study, which examined the relationship between elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement. Hence, in an effort to meet teacher effectiveness, educational demands and state policies should be aimed toward enhancing teaching and learning aspects such as teachers’ self-efficacy and instructional delivery.

To date, limited research has looked at ways of evaluating the use and effectiveness of teaching styles using student assessments (Rinaldi & Gurung, 2008). If teachers’ levels of efficacy in teaching mathematics are tracked to their students’ scores on mandated standardized tests, it may help quantify the teaching styles most effective in helping the different types of students to learn. There is no reservation that elementary schools can adopt teaching practices that improve student achievement and structure mutual awareness of teacher perceptions and outcome expectations but it has yet to be researched thoroughly.
**Research Questions**

This study was proposed on the belief that there is a relationship among teachers’ teaching style, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement levels. The following research questions guided the study.

1. What relationship exists between elementary school teachers’ teaching styles (as measured by the Grasha-Riechmann Teaching Style Inventory) and students’ mathematics achievement (as measured by the Criterion-Referenced Competency Test in mathematics)?

   $H_01$: There is no significant relationship between elementary school teachers’ teaching styles and student mathematics achievement.

2. What relationship exists between elementary school teachers’ perceived levels of self-efficacy in teaching mathematics (as measured by the Mathematics Teaching Efficacy Beliefs Instrument) and students’ mathematics achievement levels (measured by the Criterion-Referenced Competency Test in mathematics)?

   $H_02$: There is no significant relationship between elementary school teachers’ perceived levels of self-efficacy in teaching mathematics and student mathematics achievement.

3. Can students’ mathematics achievement (as measured by the Criterion-Referenced Competency Test in mathematics) be predicted by their elementary school teachers’ teaching styles (as measured by the Grasha-Riechmann Teaching Style Inventory) and their elementary school teachers’ perceived
levels of self-efficacy in teaching mathematics (as measured by the Mathematics Teaching Efficacy Beliefs Instrument)?

H$_0$3: Elementary school teachers’ teaching styles and their perceived levels of self-efficacy in teaching mathematics are not predictors of their students’ mathematics achievement.

**Overview of Methodology**

The researcher chose a correlational research design to explore relationships among teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and students’ mathematics achievement. The study used a sample of over 100 third- through fifth-grade teachers in an urban public school district in Georgia. The Grasha-Riechmann Teaching Style Inventory was used to gather quantitative data that identified and measured the teaching styles of the teachers. Teacher perceptions of self-efficacy were assessed with the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI). Enochs and Riggs (1990) developed two separate constructs of teacher self-efficacy: personal instructional efficacy and mathematics outcome expectancy.

**Identification of Variables**

The variables of interest in this study were measurement of teaching style, teachers’ perceptions of self-efficacy in teaching mathematics, and student mathematics achievement on the 2010 Georgia Criterion-Referenced Competency Test. Teaching styles were measured by the Grasha-Riechmann Teaching Style Inventory, a 40-item web-based assessment that used a Likert-type scale for responses (see Appendix A). The questions are designed to categorize the various teaching styles. Five scores are obtained from the teachers’ responses: (a) expert (transmits information), (b) formal authority
(structured instruction), (c) personal model (teach by example), (d) facilitator (consultant, guides students), and (e) delegator (assigns task, teacher as a resource). The instrument was chosen because it does not categorize a teacher with only one teaching style.

To measure mathematics teaching efficacy beliefs, the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI; see Appendix B) was chosen. The MTEBI, developed by Enochs, Smith, and Huinker (2000), measures teachers’ beliefs about their abilities to teach mathematics and foster student conceptual understanding. The inventory used Likert scales with five response categories, ranging from 1 (strongly disagree) to 5 (strongly agree) with higher scores indicating greater teaching efficacy.

In addition to the surveys, the Criterion-Referenced Competency Test (CRCT) mathematics scores were used to measure student achievement. The CRCT mathematics test measures Georgia students on (a) number and operations, (b) measurement, (c) geometry, and (d) data analysis and probability (Georgia Department of Education, 2010). The assessment scores were reported as average number of correct items in each domain and in performance levels at the class level for each teacher.

**Definition of Key Terms**

**Adequate yearly progress (AYP).** AYP measures the yearly progress of schools, different subgroups of students at the school, district, and state levels (Ed.gov, 2010).

**Criterion-Referenced Competency Test (CRCT).** The Criterion-Referenced Competency Test measures students’ acquired skills described in the Georgia Performance Standards (Georgia Department of Education, 2010).
**Georgia Performance Standards.** Georgia Performance Standards are curriculum standards used by the state of Georgia and take the place of learning objectives. The Georgia Performance Standards integrate content standards and provide suggested framework tasks, student work samples, and commentary by teachers (Georgia Department of Education, 2010).

**Performance level.** Scores on standardize tests that define levels of performances. The CRCT has three performance levels: (a) *does not meet the grade level standards*, (b) *meets the grade level standards*, and (c) *exceeds the grade level standards*. The first performance level (*does not meet the standard*) describes a CRCT score below 800 points, which does not meet standard under the Georgia Performance Standards. The second performance level (*meets the standard*) describes a CRCT score between 800 and 850 points. The third performance level (*exceeds the standard*) describes a CRCT score 850 points or above (Georgia Department of Education, 2010).

**Assumptions and Limitations**

No study is without risk. However, teachers who respond to the study’s survey had no more risk than they experience in a normal day. This study was limited to data collected in one state and one public school district. Therefore, results may not be generalized beyond the population used. The following assumptions were made:

1. The sample of teachers provided adequate representation for conducting statistical analysis.

2. The mathematics portion of the CRCT is a valid measure of student achievement.

3. Teachers provided honest responses to the survey instruments.
4. The teaching strategies employed by mathematics teachers can influence student achievement.

5. Teachers’ efficacy levels influence student outcome.

6. Growth on state standards-based assessments is a good indicator of student achievement in mathematics.

**Summary**

In order to shift from a pedagogy of poverty of teaching and learning to a pedagogy of plenty for all (Tomlinson, 2005) and meet the accommodations of a diverse number of learners, effective teachers should be aware of an array of teaching styles (Kulinna & Cothran, 2003). If teacher effectiveness is a key ingredient in student learning, every opportunity must be presented to enhance mathematics achievement. Through awareness of their teaching styles, teachers may gain a better understanding of themselves to improve their instructional delivery. This research may create a sense of urgency for elementary school administrators and teachers to find appropriate ways to help elementary students meet and exceed their academic grade level requirements.

School districts, teachers, administrators, and professional development organizations can benefit from an increased awareness concerning the impact of teachers’ teaching styles on student achievement. If teaching styles are tracked with student scores on state standardized tests, it may be possible to identify teaching styles that enhance student learning. The outcome of this research may aid all educational stakeholders in addressing the teaching styles and strategies of teachers to meet the learning needs of students in each subgroup. This research was intentionally set to provide a model for effective delivery of instruction in mathematics and valuable instructional planning in
mathematics. Additionally, the results of this research may serve as a template for instructional lead teachers and staff development coordinators in the continuous effort to improve teacher training. In preparing for the future needs of students, teachers and creators of educational professional develop programs may need to take in consideration which teaching styles are best suited for the diverse needs of learners.

A lack of research examining the relationship between teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and students’ mathematics achievement is presented in Chapter One. By assessing the relationships between teaching styles, their self-efficacy, and student mathematics achievement, the results will be beneficial to all stakeholders in the educational arena. Chapter Two is a review of literature linking the relationship between elementary school teachers’ teaching styles, their perceived levels of efficacy in teaching mathematics, and student mathematics achievement. A description of the research methodology, data collection procedures, and analysis is presented in Chapter Three. Chapter Four contains the results of the data analysis. A summary of the study, a discussion of results, and recommendations for further research are presented in Chapter Five.
CHAPTER TWO: REVIEW OF LITERATURE

This chapter contains a comprehensive review regarding the relationship between elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and the mathematics achievement of students. McCombs and Miller (2007) suggested there is no one teaching method best for everyone and many teaching styles can be motivational. Teaching styles and the curriculum should accommodate the variety of learning style preferences for all students. It is important for teachers (and those providing instruction to them) to be aware of learning style differences so teachers can offer an inviting learning environment, maximize learning, and minimize stress (Gresham, 2007).

Over the past decades, the word accountability has become the focus for all educators looking to improve their instructional practices, enhancing their effective learning environments, and raising student achievement. However, teachers must realize that accountability is not some fixed concept in American education; the message intended by administrators have changed and evolved with each generation. When the Age of Accountability in education began some 30 years ago, its catchphrase, “All children can,” was simplistic and general. This generality was known as a loophole in accountability. Of course, all children can learn; it is just when given the proper tools and efforts some can learn advance skills and concepts while others will struggle in basic mathematics. The language of schools changed, but the schools themselves did not. While research has shown that teachers play the greatest roles in bringing about student achievement in any pedagogical program (Alexander & Fuller, 2005; Goldhaber,
there is still a great need to explore the degree in which teachers’ style of instruction and their self-efficacy impacts student achievement.

Teaching styles are thus a key part of mathematics instruction. However, the new core standards in mathematics affect the style mathematics teachers employ in their instruction. The new standards lean more toward problem solving, spatial relations, geometry, and measurements (Kilpatrick, Swafford, & Findell, 2009). This is because previous mathematics instruction has been faulted as being too ‘weak’ in a conceptual sense, especially when compared to countries like Hong Kong, Singapore, and Korea (Ginsburg, Leinwand, & Decker, 2009). This constitutes the birth of the second generation of accountability, complete with its armory of standards. Educators search for efficient and motivating ways to teach, to connect with students, and to encourage success in the classroom. The movement of higher demands and expectations for schools comes by way of the second generation of accountability. This accountability became a nationwide movement by the government and reflects a new level of ambition (American Preparatory Institute, 2007). In this second generation of accountability, the disparities in what students learn led to dramatic changes in the way students were assessed by their state. Abruptly, the emphasis of focus became higher-level thinking, rigorous reading content, and problem solving. The voice of all public schools was changed, but the schools themselves did not know how to address these new changes.

While there is now support for the notion that teaching styles as well as teachers’ self-efficacy influence positive student outcomes (Alexander & Fuller, 2005; Goldhaber, 2002; Good & Brophy, 2003; Sanders, 1998, 2000; Tschannen-Moran & Hoy, 2001), it is notable that this acceptance is quite recent, dating from the late 1990s to the present.
Individuals’ beliefs have been determined by the way one view the world (Philipp, 2007) and in essence, teachers’ beliefs greatly influence their daily classroom rituals and routines. Several researchers found through their research that mathematics teachers’ beliefs and preferred styles are tied directly to their individual instructional methods (Philipp, 2007; Wilson & Cooney, 2002). In essence the educational system has rallied around these new unified sets of standards not fully understanding the diversity of student needs and that that teacher classrooms are more heterogeneous than ever, which may effect their individual learning preferences. This great diversity of individual student needs and interest in learning does not lean towards one-size-fits-all teaching and learning approach. Thus, we now begin the third generation of accountability (Silver, Strong, Perini, 2004).

The challenge of the third generation of accountability is in realizing the American education dream: levels of achievement are rising for students while preserving each student’s unique learning styles and the individual gifts of all (Silver et al., 2004). This means there are gaps in the research supporting the positive influence of teachers and those who find that teachers’ roles are not that important; thus placing more emphasis on the role of students in their own achievement as a product of their efforts. This literature review describes the theories that support this study. Current literature regarding elementary school teachers’ teaching styles and the influences it has had on student mathematics achievement is presented. In addition, the researcher reviews teaching styles, teacher perceptions of their self-efficacy when teaching mathematics, and student mathematics achievement.
Theoretical Framework

Effective elementary teachers embrace theoretical frameworks that drive student improvement and develop their teaching methods. There are many theories. Each theory has a different purpose for student learning. Guthrie (2009) stated that, “The most effective instructional practices of the teachers are influenced by theoretical frameworks” (p. 29). Guthrie also reported that theory is the vehicle to effective instructional practice and student outcomes and improved student achievement is verified. The theoretical framework that supports this study is Schoenfeld’s (1985) mathematical problem-solving theory, problem-solving approach, and theories of self-efficacy.

Mathematical Problem-Solving Theory

Schoenfeld (1985) theorized that understanding mathematics and teaching mathematics is approached as the problem-solving domain. Schoenfeld placed more emphasis on meta cognition and the cultural components of learning in mathematics (i.e., belief systems) than on his original formulation. Schoenfeld used problems that illustrated his theory: In geometry, one is given two straight lines that intersect and a point marked P on one of the lines, and then is asked to show how to make a circle with both lines being tangent. This problem aligns to his belief that teachers should allow students to do engaging and hands-on mathematics to reach a solution.

Problem solving is considered an important, daily component of mathematics because of these three key points: functional, logical, and aesthetic. Approaching mathematics through problem solving can create stimulating real-life experiences and support justification in mathematics itself. The National Council of Teachers of Mathematics (NCTM, 1989) recommended that problem solving be the focus of
mathematics teachings because it encompasses skills and functions that are important components of everyday life. Furthermore, problem-solving skills can help students adapt to unforeseen changes that may appear in their future careers and other aspects of their lives. The Council endorsed this recommendation with the statement that problem-solving strategies should underlie all areas of math processes and skills in an effort to give students the power of the knowing the mathematics around them (NCTM, 1989).

The NCTM presents problem solving as an integral focus for all students to construct, evaluate, and refine their own thoughts and theories about mathematics. Resnick (2006) expressed the belief that schools should focus their desired efforts on preparing students to be learners who can adapt, so they are able to perform in everyday life and relate effectively when real-life situations are unpredictable and demands change. Cockcroft (1982) also advocated problem solving as a mean of increasing mathematical thinking and developing critical-thinking skills as tools for daily living by stating that problem-solving ability lies “at the heart of mathematics” (p. 73) because mathematics can and should be incorporated in various unfamiliar encounters.

Problem solving is a vehicle that reinforces and teaches increased mathematical knowledge by helping students deal with everyday challenges. Problem solving enhances logical reasoning with routine and non-routine problems. Individuals must know the process to solving problems by deciding through a process of logical deductions. Algorithms can be formed or previously learned algorithms may be used to develop answers. For these reasons, the incorporation of daily problem solving can be a valuable asset within itself (NCTM, 1989). Many researchers emphasize the importance of problem solving for creating logical thinkers in mathematics. Polya (1980) reported that,
“If the educational system prevents the development of the intelligence process it is perceptibly incomplete. Nevertheless, intelligence is a critical factor to solving or having the ability to solve everyday problems inside and outside of the classroom” (p. 1).

Modern definitions of intelligence define practical intelligence as that which enables “individuals to solve genuine problems that one may encounter” (Gardner, 1985, p. 60). These new definitions also encourage the individual to find or create problems, “Thereby setting the groundwork for new profound knowledge by teachers” (Gardner, 1985, p. 85).

Problem solving is also valuable because of its aesthetic form elements. Problem solving allows students to engage and create experiences that foster a range of emotions related to stages in the explanation process. Many mathematicians who solve problems successfully say the experience contributes to an appreciation of the “power and beauty of mathematics” (NCTM, 1989, p. 77). Being involved and having the willingness or yearning to participate in or with tasks for extended periods of time causes the task to cease being a puzzle or a problem. Therefore, this student involvement may motivate the student to continue by involving previous taught skills, prior knowledge, or higher-order thinking to help one to continue being successful. For this reason, more techniques should be integrated throughout core subjects to increase student engagement, motivation, and high levels of rigor. Students have varied learning abilities, interests, and needs. Therefore, teachers must meet the needs of all learners through this type of engagement. Teachers have to make real-life mathematics connections. Students need to learn basic computation to compute fluently and solve mathematics problems routinely and non-routinely (NCTM, 2000).
The foundation of the problem-solving theory and approach contributed by Schoenfeld (1985) presents a diverse view to student learning. The theory defines what constitutes a combination of intrinsic ability, measurable skills, and acquired practices. Guthrie (2009) included the teacher’s mindset and the actual student as factors to determine the mastery of teaching that results in enhanced academic achievement. The teacher’s approach and perception will determine the intervention process for a struggling student.

**Theories on Self-Efficacy**

Akbari, Naeeni, Kiany, and Allvar (2009) stated that a teacher’s sense of self-efficacy is a “judgment of one’s capabilities to seek and bring about outcomes of student learning and active engagement” (p. 201). Self-efficacy has been found to play a vital role in enhancing student achievement in many research studies, such as Bandura (1995, 1997), Zimmerman (1995), and Good and Brophy (2003). Bandura (1977) popularized the concept of self-efficacy. Previously, self-efficacy was considered part of social learning theory.

Over time, several theories have attempted to define the concept of self-efficacy and its interaction with other dynamics such as student achievement. However, the concept of self-efficacy as laid down by Bandura remains the most popular. Bandura (1977) described the theory of self-efficacy as one that deals with individuals’ belief in their ability when confronted by various situations. The theory finds that people with different senses of efficacy behave differently when placed in similar situations. Usually, persons with a higher sense of efficacy set a higher standard for themselves and are more willing to take greater risks than are their less efficacious counterparts (Akbari et al.,
2009). Good and Brody (2003) posited that persons with a sense of high levels of efficacy have a tendency to be innovative and proactive. These efficacious people do not pass responsibility to other people. Instead, they come up with logical ways to face their daily challenges. These individuals are very persistent and do not give up easily when confronted by a tough situation. On the other hand, Bandura (1995) stated that a teacher with low self-efficacy “presents commitment that is weak to teaching, dedicates lesser time in academic growth, and spends lesser time in content perceived inefficacy” (p. 93).

**Social Learning Theory**

Social learning theory is one of the earliest theories on behavior. It deals with individuals’ acquisition of socially valuable skills that are mainly learned or developed from interaction in a group. Social learning is dependent on group dynamics and an individual’s level of interaction (Akbari, 2007). Self-efficacy as an aspect of social learning influences the level of interaction and learning from the group. Therefore, in social learning theories, self-efficacy is necessary because individuals’ feelings of being efficacious in a group will determine their level of interaction and eventually, social learning (Ormrod, 2006).

**Attribution Theory**

Attribution theory deals with how individuals explain or attribute the cause of an event (Heider, 1958). The theory suggests that this attribution is related to individuals’ internal perceptions of themselves. Heider posited that every cause has three elements: locus, stability, and controllability. An internal locus of the cause of the event affects self-efficacy and self-esteem depending on whether the event is positive or negative.
Stability can be dynamic or stationary. If individuals perceive the cause of an event as stationary, their self-efficacy is lowered because they feel they will not succeed. The reverse is true when the cause is perceived as dynamic. Controllability is defined by the individuals’ feelings of being in or out of control of the cause of the event. If individuals feel they are in control, their self-efficacy improves because they feel they can still achieve success (Heider, 1958).

If one considers the attribution theory in terms of teachers’ self-efficacy, the elements of locus, stability, and controllability come into play. Locus influences teachers’ feelings of efficacy whether they perceive the mathematical challenge as internal or external. If the teacher perceives the challenge as internal, efficacy is low. If teachers believe the teaching problem is static, they will feel less efficacious. Finally, controllability influences efficacy in that teachers who feel they are in control of the teaching process will feel more efficacious. These teachers spend more time monitoring and allowing students to work in small-group instruction, providing means for levels of high student engagement and hands-on learning (Good & Brophy, 2003).

**Narrowing the Mathematics Achievement Gap**

Research shows that highly effective top performing teachers make a difference in the achievement of students. It has been suggested that the impact of being instructed by a top-performing teacher year after year will significantly narrow achievement gaps (U.S. Department of Education, n.d). Teacher qualifications are important but do not ensure effectiveness on the job. The NCLB provisions relating to highly qualified teachers require that all teachers have a bachelor’s degree and state certification, and have demonstrated subject matter expertise in core academic subjects they teach, or actively
working toward full certification as a participant in an alternative route to teaching. The percentage of classes taught by teachers who meet these requirements has steadily increased over the past decade to an average of 95% (U.S. Department of Education, 2009a). This is an important step, but research on teacher effectiveness shows that meeting these requirements does not predict or ensure teacher success increasing student learning (Goldhaber & Brewer, 2000; Hanushek, 1997; Toch & Rothman, 2008).

The 2010 Phi Delta Kappa/Gallup Poll (Bushaw & Lopez, 2010) revealed that Americans believe the most essential improvement in education is improving the quality of teaching. For the first time Americans were asked, “What are the things schools have to do to receive or earn an A?” The top three responses from the poll were (a) improve the quality of teaching, (b) implement a challenging curriculum, and (c) help students be more successful. One interpretation suggested that Americans support greater investments in teacher recruitment and professional development trainings that help to keep only the better teachers. It also suggested that Americans believe schools should focus on challenging students and providing the support students need to meet greater challenges.

The sense of urgency for improving mathematical achievement is soaring. American students today trail other nations (U.S. Department of Education, 2009a). Since the 1950s, schools, districts, and states have been ranked and compared based on standardized test scores; and now nations are being ranked and compared (Stiggins, 2007). Emphasis on the state mandated component of NCLB has left teachers feeling overwhelmed. Teachers are concerned that their students achieve basic mathematics proficiency levels. Because students learn at varied rates and gain knowledge of skills at
different rates, teachers are experiencing difficulties serving all students properly. In an
effort to meet the needs of all learners, educators have a commitment to tailor their
personal belief systems that determine their philosophy of education.

The full understanding of basic mathematical skills and concepts is essential for the conceptual development of competence; all students must have daily access to instructional practices that lead to conceptual understanding (NCTM, 2000). Knowing students and their learning differences is an essential component for teacher preparation in order to facilitate and structure a learning environment for all students. The new standards for students in elementary grades promote the growth of arithmetical understanding by means of manipulatives and independent and cooperative groups to solve routine and non-routine problems, and encourage students to understand the concept rather than following a specific order of operations. As a result, the implementation of Georgia’s Performance Standards places a greater emphasis on reasoning, representation, problem solving, connections, and communication (U.S. Department of Education, 2009b).

**Teaching Styles and Strategies**

Effective teachers allow students chances to learn, succeed, and interact at their fullest potentials. Teacher quality can be directly linked to student achievement (Barnes & Aguerrebere, 2006). Teaching styles are thus a key part of mathematics instruction. However, the new core standards in mathematics are definitely going to affect the style mathematics teachers employ in their instruction. The new standards lean more toward numbers, spatial relations, geometry, and measurements (Kilpatrick et al., 2009). This is because previous mathematics instruction has been faulted as being too weak in a
conceptual sense especially when compared to states like Hong Kong, Singapore, and Korea (Ginsburg et al., 2009).

Teaching styles may also vary from instructor to instructor because they are heavily influenced by the instructor’s personal qualities, philosophy in life, educational philosophy, and attitude (Beyond Crossroads, 2006). However, teaching styles in mathematics can be classified into two different categories: (a) a student-centered approach or a teacher-centered approach and (b) a thematic approach or a topic-based approach.

**Student- and Teacher-Centered Approaches**

A student-centered approach is one that emphasizes the student. In a student-centered approach, students attempt to explore the subject on their own; taking charge of the learning process and relying on the teacher only for guidance purposes. Springer, Stanne, and Donovan (1999) found that where a student-centered approach takes an active and constructivist approach, there is a greater chance of success, especially among students not used to traditional learning methods.

Results of research implied that various student-centered educational activities were linked with student achievement and observed that the style in which educational activities are offered in classroom framework affects student achievement (Guthrie, 2009). Educational activities that are student-centered consist of variables that explain aspects of classroom education; for instance, quality of teaching style and viewpoint to learn.

In a teacher-centered approach, the teacher takes active control of the entire process of instruction that affects student learning. This is the most common method
employed in public schools in the United States. Normally, teachers prepare lesson plans before class and use them to guide the teaching of mathematics. If teachers are considered or taken as the one who imparts knowledge, the students will not take ownership of their own learning. In addition, teachers are responsible for accessing students’ prior knowledge, extend their learning, and use that learning to build new knowledge (Duffy & Cunningham, 1996; Hoover, 1996). A single catchy phrase that describes a teacher’s role should be based on “not a sage on the stage, but a guide to the side.” Teachers then assess the performance of students and assign work for students to do independently or in small cooperative groups.

While the teacher-centered approach is more common, its success is more dependent on the teachers’ individual style. As Jarvis (2004) reported, “The teacher’s style is the totality of one’s philosophy, beliefs, values, and behaviors, and it incorporates the full implementation of this philosophy; it consists of substantiation and support of beliefs about values and attitudes toward elements of the student learning and teacher-learning exchange” (p. 40). Akbari et al. (2009) described these characteristics as pervasive, holding out even with changes in situational conditions. Brown (2003) stated that due to the diverse needs of students in mathematics instruction, there is need for mathematics teachers to be sensitive to the students’ learning styles. However, matching the teaching and learning styles is not a guarantee for success (Brown, 2003). There is thus need for caution when deciding to change teaching styles.

**Thematic- and Topic-Based Approaches**

Handal and Bobis (2006) found that most teachers prefer to teach by topics rather than in themes. Nevertheless, both thematic- and topic-based approaches to mathematics
teaching have been shown to yield successful results depending on the manner in which they were applied (Grimison, 2001; Handal & Bobis, 2006). The thematic approach to mathematics instruction involves a deeper focus on the application of mathematical concepts. It is from the application of these concepts that lessons and assignments are based. A thematic approach chooses to focus on a particular branch of mathematics and students are expected to understand the application of these concepts in a progressive manner (Bobis, Mulligan, & Lowrie, 2006).

A topic-based approach is one in which teachers use a particular textbook or curriculum guide from which they draw lessons and teach according to the topics in the material. While nothing is wrong with this approach, the teachers’ coverage of all areas of the subject is likely to be hindered by the limitations in the teaching material. Due to the new core standards in mathematics in the United States, a thematic approach is considered more realistic (Kilpatrick et al., 2009). This is because the thematic approach allows the teacher to exhaust one theme before moving to the next.

**Effective Teaching Strategies**

Effective teaching styles focus on teachers’ delivery and their distinct approach to teaching (Evans, Harkins, & Young, 2008). Effective teaching strategies help students foster a deeper understanding of the information (Franzoni & Assar, 2009). Awareness of a teacher’s teaching styles brings an understanding of the elements in students’ learning processes (Nielson, 2007; Rosenfeld & Rosenfeld, 2007). It is critical for teachers to self -reflect and examine their delivery of instruction and their cognitive styles so they can teach in a manner that respects learners’ diverse learning styles and different learning situations (Conti & Wellborn, 1986).
A discussion of teachers’ teaching strategies and styles may provide for constructive talks about individuals’ philosophy and the barriers to addressing individuals’ learning needs (Evans et al., 2008). Teachers who are aware of their individual teaching styles could be encouraged to meet the challenges in their classes to meet the diverse levels of learners. Awareness of their styles tends to help teachers change or adjust their styles to meet the different learning styles of the learners (Evans et al., 2008). When students are involved in their individual learning plans, their involvement in class has a direct impact on their academic achievement. Creating an environment where students have a voice allows the teacher to be more of a facilitator of teaching (Opdenakker & Van Damme, 2006). Teaching styles identify the student as a major factor in enhancing student achievement. The teacher-focused style puts control for learning in the hands of teachers who resolve what learners learn and how the teachers use their knowledge in content knowledge to assist students in making relationships.

Gregorc (1979) believed that teaching styles consist of personal teaching behaviors and the media used to receive and transmit. The one-teaching-style-fits-all credited to a teacher-focused teaching style is not working for the increasing number of diverse learners. Teaching styles are identified by teaching preferences, classically acknowledged by the delivery of instruction, assessment of learning tools, and the support of student individual learning needs (Hunt, 1971; Grasha, 1996).

Grasha (1996) believed that teaching styles represent not only a system of belief, but also needs and behaviors that teachers exhibit. Grasha identified five distinct teaching styles that represent teachers’ orientations or beliefs about teaching: (a) expert
teaching, (b) formal authority teaching, (c) personal model teaching, (d) facilitator teaching, and (e) delegator teaching. The expert possesses knowledge and expertise. This teacher focuses on students receiving taught information and prepares fully for the discipline being taught. Experts gain respect from students because of the knowledge they possess. The disadvantage of the expert is the overconfidence of knowledge the teacher exhibits, which can be intimidating to students. In addition, the expert is an outcome-based teacher, with no true focus on the thought process and does not tend to foster the higher-order thinking skills.

The formal authority teaching style is practiced by teachers who are perceived by students as experts in their field of study (Grasha, 1994). The formal authority is focused on being accurate with the delivery of transmitting the standards to students. One disadvantage for this style as noted by Grasha is that the lesson has little or no flexibility. It is often revealed as rigid and standardized.

A teacher who displays the personal model of teaching is focused on how to behave and think (Grasha, 1996). This teacher often models rather than telling students what is expected. A disadvantage noted by Grasha to this teaching style is that students feel inadequate if they cannot live up to the high expectations and standards established by the teacher.

The facilitator and the delegator teaching styles focus merely on the instructors being more of guide than a sage on the stage (Grasha, 1996). The facilitator guides, leads, and directs students by letting them have a voice of reason in the learning process. The facilitator incorporates multiple teaching styles and methodologies. The goal of the facilitator is to foster student learning through independent thoughts and actions. One
disadvantage of this teaching style is time management. The facilitator has to know how to facilitate within the set time of the class in order to meet all standards. The delegator focuses on students’ ability to work in any relationship displayed by teacher and students. The teacher delegates various learning tasks and projects for the students to complete throughout the course. The teacher is often referred to as a resource person instead as the only knowledge source. One disadvantage with this teaching style is that students, especially at the lower level, often times are uncomfortable and may feel lost without teacher-directed instruction (Grasha, 1996).

Since one instructor rarely falls into one teaching style category, and most instructors employ parts of many styles, (Grasha 1996) clustered the teaching styles into the most common groups. The first cluster, the expert/formal authority style, leans towards teacher-centered instruction in which the teacher delivers instruction and students receive knowledge taught. Cluster 2, the personal expert and formal authority style, is a teacher/student-centered approach that involves modeling and demonstrations by teacher and students. This approach by the teacher fosters students’ attention to observe and process learning.

The third cluster, facilitator/personal model/expert style is a teacher- and student-centered model for the classroom. The teacher incorporates learning activities that foster social interactions and/or problem-solving experiences that allow students to think critically and process course content through real experiences. The final cluster, the delegator places emphasis on independent learning and the burden is on the students. Teachers in this cluster provide multifaceted tasks that students have to take full initiative to complete. Nevertheless, students learn in many ways. Teaching methods and
strategies for this style varies. Some teachers lecture solely, model, or demonstrate; others show no flexibility on rules; some accentuate memory; and others emphasize student processes and understanding.

Administrators repeatedly advocate teaching strategies and models that rarely produce academic improvement. This is especially critical because diverse learners, both global and analytic processors, learn content differently. Regardless of the approach, it can be argued that the foundation of teaching and learning lies within the individual (Davis, 2010). Teachers with a background in assessing students’ learning style backgrounds may recognize these traits immediately and know how to help students with diverse learning styles.

In response to global, kinesthetic, and tactual students, mathematics teachers are expected to reach them all. The resources and instructional methods must be carefully selected prior to each lesson. Educators must do more to give all levels of learners an opportunity to meet the standards; teachers must do more to ensure that all students have a top-performing teacher who provides every child an equal opportunity to meet and exceed learning goals established by the state (U.S. Department of Education, n.d.). Tactual learners need manipulatives to stimulate their minds and foster social patterns in which they feel comfortable. The five strategies, called contextual teaching, are (a) relating, learning in the context of one’s life experiences; (b) experiencing through exploration and hands-on learning; (c) applying, learning by putting the concepts to use; (d) cooperative learning; and (e) transferring, learning in the context of using knowledge in a new context or novel situation.
Teacher Perceptions/Beliefs and Self-Efficacy

Bandura (1986) asserted that individuals’ previous experiences and performances shape their efficacy beliefs. These beliefs maturate around individuals’ involvement in activities and tasks—their own previous actions. Akbari et al. (2009) stated that teachers’ sense of self-efficacy is considered one of the most influential factors affecting teacher performance and student achievement. There is a strong link between teacher efficacy and student achievement in all areas of study (Good & Brophy, 2003).

Effects of High and Low Teacher Self-Efficacy

Self-efficacy in teachers is important because it affects the effort teachers invest in instruction (Ware & Kitsantas, 2007). A high sense of efficacy also leads to a higher feeling of inspiration in the teacher and this directly affects student morale. Lower self-efficacy means weaker commitment toward teaching and less time invested in the areas teachers perceive themselves as being less efficacious (Bandura, 1995).

Students are likely to be negatively affected in terms of cognitive development and sense of efficacy when a teacher is less efficacious. This is because teachers with lower self-efficacy tend not to apply themselves when student challenges occur. This makes students feel that the area of study is particularly difficult; thus, causing the students to lack the right attitude needed to learn. This is especially true in mathematics instruction since new concepts are introduced in almost every lesson (Ware & Kitsantas, 2007).

Hoy (2000) found that less efficacious teachers tend to project their inefficacy on students. They are more likely to resort to punishing students, creating a hostile and controlled classroom that undermines learning. They are also pessimistic toward
students’ motivation and rely more on extrinsic methods of motivation. To hide their inefficacy, Akbari et al. (2009) found that these teachers prefer to be in control and do not allow an open learning forum in their classes.

In contrast, highly efficacious teachers are more likely to adopt an open style of teaching where they allow students to contribute actively in the teaching process by asking questions or attempting to solve mathematics problems with the teacher’s supervision. These teachers motivate students intrinsically, thus building a strong foundation for students to understand mathematics, and never shy away from a challenging problem (Ware & Kitsantas, 2007).

In addition, highly efficacious teachers go out of their way to ensure that rather than merely covering the curriculum, their students fully understand the concepts being taught. Tschannen-Moran and Hoy (2001) found that these teachers are highly innovative and are more inclined to take risks in their methods of instruction. When these new techniques fail, the persistent characteristic of efficacious teachers enables them to try again.

Teaching styles and teacher efficacy are important factors in student mathematics achievement. Akbari et al. (2009) found that these two variables show a positive correlation with student achievement. Highly efficacious teachers have been shown to be less critical of underperforming students. These teachers are more likely to help these struggling students to catch up with the rest. Akbari et al. reported that greater efficacy in teachers makes them more enthusiastic toward learning. They have lower stress levels and are likely to continue in teaching longer than are their less efficacious counterparts.
Research on Teachers’ Mathematical Self-Efficacy

Adu and Olatundun (2007) proclaimed the role of teachers as of paramount importance in the education system. Teachers are the custodians of knowledge and instructors of instruction. Effective teacher beliefs are critical components of being an effective teacher (Rosenfeld & Rosenfeld, 2007). Teachers who have an interventionist belief about their students tend to express more sincere delivery of instruction versus teachers with pathognomonic beliefs.

Hoffman and Spatariu (2008) researched influences of teacher self-efficacy and metacognitive thinking on problem-solving efficacy. The participants in the study completed background inventory assessments in mathematics and assessed their self-efficacy. Participants were categorized in two groups—a prompting group and a group with no prompting. The data collected showed that self-efficacy and metacognitive prompting highly increased the participants’ mathematics problem-solving performance.

A professional development course sensitized 234 teachers to individual learning differences (ILDs), using five learning/cognitive styles tools (Rosenfeld & Rosenfeld, 2007). Teachers’ responses to a pretest and posttest questionnaire about their teacher beliefs in reference to weak students were analyzed and correlated with their ILD scores. Before the professional development course, those teachers with strong ILD preferences matched with traditional learning contexts had fewer interventionist beliefs than did the other teachers; these teachers were significantly overrepresented in the sample. The length of the course (28 hours or 56 hours) affected the teachers’ internal beliefs about students. A mediated, constructivist, and collaborative professional development course that sensitizes teachers to their learning differences individually can increase effective
teachers overall beliefs about student learning. Rosenfeld and Rosenfeld concluded that teacher professional development is needed for teachers to increase effective teacher beliefs and practices.

Teacher self-efficacy is a predictor of effective mathematics instructional teaching strategies, and efficacious teachers are more effective than are teachers with low self-efficacy (Swars, 2005). Swars conducted research on perceptions of low and high teacher self-efficacy and the effectiveness among elementary preservice teachers. Participants in this research study included four preservice elementary teachers in the southeastern United States who had recently completed a mathematics methods course. The Mathematics Teaching Efficacy Beliefs Instrument and interviews were used as data sources. Analysis of the interview data concluded that mathematics instructional strategies and previous experiences with teaching mathematics were associated with increased mathematics teacher efficacy.

These successful experiences directly led to levels of comfort with mathematics that transcended into positive teaching effectiveness. Negative experiences with mathematics had prepared teachers to be better teachers in mathematics. In addition to the instructional strategies, preservice teachers, regardless of their high or low levels of mathematics teacher efficacy, indicated motivation being the key component in learning mathematics (Swars, 2005).

Finson, Pedersen, and Thomas (2006) reported that research now shows that teachers who believe they have the ability to perform what are viewed as good quality teaching behaviors are more likely to use instruction mirroring those qualities. Teachers who hold such beliefs are more likely to deliver instruction that engages children in
actively constructing knowledge, using this knowledge to promote effective functioning within their ever-changing environments. Stevens, Olivarez, and Hamman (2006) reported self-efficacy as a strong indicator of mathematics achievement versus basic mental ability. Even though mathematics ability had an influence on the performance, it had an indirect relation on self-efficacy judgments. There are four sources of information used to judge self-efficacy: (a) an individual’s own past performance, (b) performances of others through explicit experiences, (c) verbal persuasion that one possesses certain capabilities, and (d) physiological states. The four sources of efficacy beliefs tie together the influence of academic and self-regulation (Usher & Pajares, 2006).

McCoach andSiegle (2007) conducted a study to determine if classroom teachers who received personal staff development on self-efficacy teaching strategies would affect changes in students’ mathematics self-efficacy. The teacher training developed for the study provided specific instructional strategies using three sources of self-efficacy information: (a) past experiences, (b) observations of others as models, and (c) persuasion verbally. Specifically, the training focused on feedback from teachers who incorporated their goal settings, attention to students, attitude toward their students’ performances, and verbal praise to students. The study focused on two groups. The teachers in the treatment group were trained on self-efficacy and effective strategies to use in their classrooms and implemented the self-efficacy strategies during a 4-week unit in mathematics. The control group taught the identical mathematics unit but did not receive training in self-efficacy. The students who received instruction from a trained teacher with self-efficacy skills showed a greater relationship between their pre and post assessments.
Self-efficacy has been established to be a more constant predictor of behavioral results than have any other motivational concepts (Çakir, 2007). Self-efficacy is reported to be an important variable in studies regarding goal accomplishment, academic accomplishment, problem solving, professional growth, and teacher training. Usually, the methods used to boost self-confidence can also be used to increase efficacy. Schools should identify less efficacious teachers and place them in programs that would assist them to bolster their sense of efficacy. Additionally, they should identify the most successful teaching styles and recommend them to their teachers. However, caution should be taken because different teachers have different success levels when using a particular teaching style (McCoach & Siegle, 2007).

McMahon, Wernsman, and Rose (2009) studied the relationship between the classroom environment and school belonging to academic self-efficacy. McMahon et al. concluded that high levels of satisfaction, school belonging, and less resistance are connected to higher efficacy in language arts. Less difficulty showed evident that contextual variables allied with high levels of self-efficacy in science and mathematics. Teacher perceptions and student perceptions of the classroom and school environment have to be aligned to the academic success and outcomes of achievement. A vital part of any educational environment is the teaching style. Research outcomes implied that teaching styles and environment promoted impacts on student achievement.

**Constructivism in Mathematics Classrooms**

The constructivist approach is increasingly being incorporated into teaching and teacher training core curriculums (Arslan, 2007). Constructivism has its basic academic scope and philosophy in Dewey’s educational thinking; works of Gestalist intellectuals
like Bartlett and Bauer; and works of educational thinkers like Vygotsky, Piaget, and Bruner (Duman, 2007). Constructivism symbolizes a standard shift from education founded on established behaviorism to education rooted in cognitive theory. Proponents of constructivist education believe it is fundamental to allow students to generate learning for themselves (Arslan, 2007; Savaş, 2007). Constructivist classroom methods allow students to identify the subjectivity and inclinations of existing explanations and arrive at their own inferences. Vygotsky (1978), the initiator of social constructivism, claimed that learning is a social attempt. Vygotsky’s sociocultural theory describes a social relationship as a fundamental cause in the growth of cognition. In accordance with Vygotsky, learning happens with involvement in social or culturally rooted skills and students learn by social relationships, which happen in frameworks. It is critical for preservice and inservice teachers to rebuild their teacher beliefs in order to perform constructivist teaching from the students’ viewpoints.

**Summary**

The literature review provided coverage of the elements that involved a relationship between elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement. Teachers are faced with the responsibility of providing a quality education for children to prepare them for a future in a world altered by steady growth in new technology, universal competitiveness, economic globalization, and increasing demographic shifts. While the basic principles have not changed much, the style of teaching has definitely evolved with time. The current research study was designed to look at how teaching styles and the mathematics teacher’s self-efficacy affect the achievement of students in elementary
mathematics. While self-efficacy stems from individuals’ beliefs that they are capable of succeeding and overcoming a particular challenge, teaching styles are more skills related and are not as dependent on the human internal state. The study attempted to bring the two together to establish their contribution to students’ achievement in mathematics.
CHAPTER THREE: METHODOLOGY

It is important that educators and educational administrators identify the gaps in student learning so that all schools are meeting state requirements. These concerns prompted this study, which examined the relationship between elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement. This chapter presents the rationale for the research design, the research questions and hypotheses, setting, participants, instrumentation, procedures, and data analysis of the study.

Background and Rationale

The inquiry strategies for this quantitative approach included a correlational research design. The study was designed to explore relationships among elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement in a metropolitan public school system. In order to measure teacher quality, one must determine the things that are connected directly to student achievement and teaching (Barnes & Aguerrebere, 2006). Research suggests not one teaching method is best for everyone and many teaching styles can be motivational (McCombs & Miller, 2007). The judgment to pursue this research study using a quantitative rather than a qualitative method was based on the statistical comparison provided by the quantitative approach that provides a more specialized, identifiable, and accessible profile of the variables of interest.
Research Questions

This study was proposed on the belief that there is a relationship among teachers’ teaching style, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement levels. The following research questions guided the study.

1. What relationship exists between elementary school teachers’ teaching styles (as measured by the Grasha-Riechmann Teaching Style Inventory) and students’ mathematics achievement (as measured by the Criterion-Referenced Competency Test in mathematics)?

H₀₁: There is no significant relationship between elementary school teachers’ teaching styles and student mathematics achievement.

2. What relationship exists between elementary school teachers’ perceived levels of self-efficacy in teaching mathematics (as measured by the Mathematics Teaching Efficacy Beliefs Instrument) and students’ mathematics achievement levels (measured by the Criterion-Referenced Competency Test in mathematics)?

H₀₂: There is no significant relationship between elementary school teachers’ perceived levels of self-efficacy in teaching mathematics and student mathematics achievement.

3. Can students’ mathematics achievement (as measured by the Criterion-Referenced Competency Test in mathematics) be predicted by their elementary school teachers’ teaching styles (as measured by the Grasha-Riechmann Teaching Style Inventory) and their elementary school teachers’ perceived
levels of self-efficacy in teaching mathematics (as measured by the Mathematics Teaching Efficacy Beliefs Instrument)?

H₀₃: Elementary school teachers’ teaching styles and their perceived levels of self-efficacy in teaching mathematics are not predictors of their students’ mathematics achievement.

Setting

The site of the study was an urban public school system. In an effort to meet and exceed educational targets, elementary schools in the district adopted many reform models. Of 98 schools in the district of study, 38 (39%) did not meet AYP (Georgia Department of Education, 2010). According to the district’s website (2010), reform movements seek to improve school achievement performance by aligning a school’s learning environment with a direct student-focused vision. The goals of reform efforts are to implement cost-effective, research-based proven strategies for addressing all students’ educational needs of an urban-city school system.

Since 2000, the school district’s signature program has aimed to improve student mathematics success and achievement under the Constructivist theory. The signature program provides in-school and out-of-school community-based services to improve student instruction. The district’s reform program cultivates a pre-college to college-going mindset among parents and students. The signature reform ensures an education program for all students in Grades K-5 who are economically disadvantaged. The reform is intended to increase student mathematics achievement, increase graduation rates, and prepare students to enter and be successful in college.
Thirty-three of the schools, with more than 13,000 students, adopted the signature reform. Students in Grades K-5 and continuing through high school are involved in this learning process. Of the 33 schools, 16 are elementary schools. The researcher focused on elementary math teachers and students in Grades 3 through 5 in these 16 elementary schools.

The researcher focused on mathematics, one of the five core components of the program. The schoolwide mathematics programs focuses on daily problem solving, student discovery in whole- and small-group settings, reasoning, and open communication to help students to form concrete understanding and to articulate mathematical concepts rather than simply memorizing them. Other featured components of the chosen reform include teacher classroom resources, on-going professional development for teachers and of school-based mathematics coaches, and district-level instructional support personnel.

Participants

The population identified for this study consisted of third- through fifth-grade elementary mathematics teachers in 16 elementary schools in an urban public school system. Of the 16 schools, six schools did not meet AYP (Georgia Department of Education, 2010). The 16 elementary schools within the same school system use the same reform efforts to promote student success in mathematics, setting the foundation for lifelong learners in mathematics.

These 16 schools are located in economically disadvantaged communities. Eighty-nine percent of the population in the school system is low-income students,
almost double the 50% average poverty rate in Georgia public schools. Ninety-six percent of the students are African-American and most students are the first in their families to attend college. The teachers of these 16 schools consist of approximately 114 mathematics teachers in Grades 3, 4, and 5. All third-through fifth-grade elementary mathematics teachers in these 16 schools were given the opportunity to participate in the study.

**Instrumentation**

The quantitative approach of this research necessitated statistical analysis to provide an accurate and understandable basis for determining if teachers’ teaching styles and levels of self-efficacy can predict their students’ CRCT mathematics scores. Three different instruments were used to collect data. Two of the instruments assessed teachers’ teaching styles and their perceived levels of self-efficacy in teaching mathematics. Test data from the CRCT were used to measure student mathematics achievement.

**Grasha-Riechmann Teaching Style Inventory**

Grasha (1996) designed the teaching style inventory used in the study. The Grasha-Riechmann Teaching Style Inventory is a 40-item web-based assessment that uses a Likert-type scale for responses (see Appendix A). The questions are designed to categorize the various teaching styles. Grasha described five teaching styles: (a) expert (transmits information), (b) formal authority (structured instruction), (c) personal model (teach by example), (d) facilitator (consultant, guides students), and (e) delegator (assigns task, teacher as a resource). The instrument was chosen because it reflects the fluidity of
teaching style and does not categorize a teacher with only one teaching style. Five scores are obtained from the teachers’ responses to the 40-item questionnaire.

**The Mathematics Teaching Efficacy Beliefs Instrument**

To measure mathematics teaching efficacy beliefs, the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI; see Appendix B) was chosen. The MTEBI, developed by Enochs et al. (2000), measures teachers’ beliefs about their abilities to teach mathematics and foster student conceptual understanding. The instrument was derived from the original Science Teaching Efficacy Beliefs Instrument by Enochs and Riggs (1990), a widely used scale in science teacher efficacy literature. This instrument was used because of its wide use in previous research and because it was designed specifically to measure mathematics teaching efficacy.

The MTEBI contains 21 items, 13 on the personal mathematics teaching efficacy (PMTE) subscale and 8 on the mathematics teaching outcome expectancy (MTOE) subscale (Enochs et al., 2000). The two subscales on the inventory are consistent to the two-dimensional aspect of teaching efficacy. The subscales on the inventory tool has high reliability (Cronbach’s alpha = .88 for PMTE and .81 for MTOE) and represents independent constructs based on confirmatory factor analysis (Enochs et al., 2000).

The PMTE subscale addresses teachers’ individual beliefs and capabilities to be mathematical effective teachers. The subscale of the MTOE addresses teachers’ individual beliefs that teaching of mathematics can be effective and enhance student learning and reasoning despite external factors. The inventory uses Likert scales with
five response categories, ranging from 1 (strongly disagree) to 5 (strongly agree) with higher scores indicating greater teaching efficacy.

**The Criterion-Referenced Competency Test**

In addition to the surveys, the Criterion-Referenced Competency Test (CRCT) mathematics scores of the students in the third- through fifth-grade teachers’ classes for the 2010–2011 school year were used to measure student achievement. All Georgia elementary students in Grades 3 through 5 are required to take the CRCT. The CRCT assesses whether students have met standards required throughout the state. This assessment is a diagnostic tool that assesses whether students have mastered the performance standards required by the state. The CRCT mathematics test measures Georgia students on five domains: (a) number and operations, (b) measurement, (c) geometry, (d) algebra, and (e) data analysis (Georgia Department of Education, 2010.)

The scores determine if schools make adequate yearly progress in meeting the same state-specific standards. This accountability ensures highly qualified teachers are providing instruction and that scientific research is being used to increase educational gains for all students. The assessment also provides statistics on academic achievement at the different levels. The data are read on an individual student, class, school, system, and state level. The data are used to score and rank students’ strengths and weaknesses in content subjects. The instruction of the core subjects from the Georgia Performance Standards is diagnosed also by the quality of teaching and learning throughout Georgia (Georgia Department of Education, 2008).
The assessment scores are reported as scale scores and in performance levels. The CRCT scale scores are derived by converting the number correct and incorrect on the test (the raw score). The scale score ratings are equivalent across test and grade level forms within the same content area. Students scoring at or above 850 signify a level of performance that exceeds the standard set for the test. Scores from 800 to 849 indicates a level of performance that meets the standard. Scores below 800 indicates a level of performance that does not meet the standard (Georgia Department of Education, 2008). The scores for measuring the classroom performance of each teacher were determined by the students’ average number of correct items on each domain. The percentage of students who performed at each level of performance (did not meet, met, and exceeded standards) was also reported by each teacher.

Procedure

The researcher sought approval of the study from the university’s Institutional Review Board following approval from the local school district. In order to conduct research within the local school district, the researcher submitted a completed research request application and a detailed proposal package to the school board's Department of Research, Planning, and Accountability office. The Research Screening Committee under the direction of the Department of Research, Planning, and Accountability has specific guidelines set to standardize research activities effectively within the district in order to protect individual rights of students and staff in the school system, and to avoid all interference with ongoing instructional programs in the schools.
After gaining approval, the researcher followed the local school district’s primary protocol. The primary protocol set by the district included receiving permission from principals of each elementary school that was involved in the research study prior to gathering data from teachers. Sixteen elementary schools within the school system used the same reform efforts to promote student success in mathematics. Therefore, the researcher sent an email to all 16 elementary school principals explaining the study and requesting permission to conduct the research using third- through fifth-grade mathematics teachers at each of their schools (see Appendix C).

After receiving permission from the elementary school principals to conduct the study at their school, a list of teacher email addresses was requested from the principal or designated representative. Participants were recruited via email/survey invitation. The researcher emailed the mathematics teachers about the purpose of the research, benefits, confidentiality involved, survey instruments, institutional affiliation of the researcher, and contact information for the researcher. The email invitation directed participants to the online survey, where they provided consent before beginning the survey (see Appendix D). All potential teachers were encouraged to participate but were able to decline if they chose.

Almost over 100 potential participants (n = 114) were recruited for this research study and participation required 15 to 20 minutes. Participants were allowed to complete the survey in one sitting or several sittings. Teachers completed the online questionnaire containing the MTBEI, the Grasha-Riechmann Teaching Style Inventory, and demographic questions used to describe the sample. Teachers provided their overall class
percentage scores for each domain from the 2011 CRCT (see Appendix E). If teachers completed the entire survey, the researcher sent each teacher a $10 Wal-mart eGift card via email. The researcher used this method to help motivate respondents with a reward for completing survey.

The researcher ensured that the data were kept secure and that all participants and schools remain unidentified. The data collected from the survey was stored on a password- and firewall-protected computer. School names will never appear in any data collected for the study. Finally, no participants were identified personally. The school district’s name was not identified by name in research reports, but rather referred to only as “a large urban school system.” All files collected throughout the research study will be kept for 3 years in a locked fireproof file cabinet located in researcher’s home office. After 3 years, the researcher will purge all related documentation through shredding.

**Design of Study**

To explore relationships among elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement, a quantitative approach using a correlational research design was used. It is important that educators and educational administrators identify the gaps in student learning so that all schools are meeting state requirements. If teachers’ teaching styles and their perceived levels of self-efficacy are aligned to their students’ mathematics scores, it may be possible to quantify their teaching styles to help students learn. The framework of this research study is based on a quantitative design as explained by Creswell (2003),
Quantitative research studies use logic and theory deductions and places it in the beginning of their plan of study. With objectives of researching and testing or verifying a theory rather than developing it, researchers may advance a theory, collects data based on theory to test it, and reflects on results. The proven theory then becomes a guide or model for the study for the research questions or hypotheses and for the data collection procedure. (pp. 49–62)

Data Analysis

The data from the survey and from the CRCT scores were entered into an Excel spreadsheet. All identifying information was stripped from the database. The data were inputted into the Statistical Package for Social Sciences and analyzed. The variables included two scale scores from the MTEBI, and five scores from the Grasha-Riechmann Teaching Style Inventory, and the class averages from the five CRCT mathematics domains.

A correlational matrix was created, using Pearson product-moment correlation, to determine if significant relationships existed amongst elementary school teachers’ teaching styles and student mathematics achievement and if a significant relationship exists between elementary school teachers’ perceived levels of efficacy in teaching mathematics and student mathematics achievement. A series of multiple regression analyses was conducted to determine if students’ mathematics achievement could be predicted by their elementary school teachers’ teaching styles and their perceived levels of efficacy in teaching mathematics. A significance level of .05 was used to determine statistical significance.
Summary

Chapter 3 contains the research methodology and research design for this study. Mathematics is a vital content subject area and it is a significant area for determining decisions regarding student achievement. It is vital for teachers to aid students in developing their maximum potential by involving them in classroom experiences that challenge them intellectually and prepare them for continuous learning. Without effective instruction or delivery of instruction, many students will show little interest. They will eventually turn away from mathematics and never realize their potential. This study was conducted with teachers from a large inner-city school system in Georgia. Using data collected from surveys and student achievement, the researcher sought to reveal relationships among elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement.
CHAPTER FOUR: RESULTS

This study was proposed on the belief that there is a relationship between elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement. Complete results were collected from 95 teachers who taught third- to fifth-grade mathematics in a large inner-city school system in Georgia. The data describing these teachers and the results of the analysis of three research questions are presented in this chapter.

Data Cleaning

Scale scores were calculated from the teachers’ responses. Scales were created for each teacher if at least 75% of the items in each scale were completed by the teachers. An average across the responses was calculated. The data were then screened for multivariate outliers using Mahalanobis distance in a regression procedure. Mahalanobis distance is evaluated as $\chi^2$ with degrees of freedom equal to the number of independent variables at $p < .001$. In this study, seven independent variables (five teaching style scales and two self-efficacy scales) were screened for multivariate outliers at $\chi^2 = 24.32$. One case was found to be a multivariate outlier and removed. Therefore, 95 cases were used to analyze the research questions.

To assess normality of each measure, measures of skewness and kurtosis were computed. Table 1 contains the means and standard deviations and the skewness and kurtosis values for each scale of the Teaching Styles Inventory and the MTEBI (see Table 1). Skewness and kurtosis values of zero are indicative of a normal distribution, and
### Table 1

**Description of the Data**

<table>
<thead>
<tr>
<th>Scale</th>
<th>$M$</th>
<th>$SD$</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching styles inventory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expert</td>
<td>4.01</td>
<td>.55</td>
<td>-.65</td>
<td>.22</td>
</tr>
<tr>
<td>Formal authority</td>
<td>4.05</td>
<td>.46</td>
<td>.03</td>
<td>-.63</td>
</tr>
<tr>
<td>Personal model</td>
<td>4.28</td>
<td>.43</td>
<td>-.55</td>
<td>-.45</td>
</tr>
<tr>
<td>Facilitator</td>
<td>4.15</td>
<td>.48</td>
<td>-.79</td>
<td>.18</td>
</tr>
<tr>
<td>Delegator</td>
<td>3.58</td>
<td>.58</td>
<td>-.12</td>
<td>-.70</td>
</tr>
<tr>
<td>Mathematics Teaching Efficacy Beliefs Instrument</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal mathematics teaching efficacy belief</td>
<td>3.76</td>
<td>.58</td>
<td>-1.55</td>
<td>2.26</td>
</tr>
<tr>
<td>Transformation of personal mathematics teaching</td>
<td>.19</td>
<td>.13</td>
<td>.79</td>
<td>.27</td>
</tr>
<tr>
<td>efficacy belief scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome expectancy</td>
<td>3.72</td>
<td>.48</td>
<td>-.32</td>
<td>.20</td>
</tr>
</tbody>
</table>

Values between -2 and +2 signify no problematic deviations from normality (Kendall et al., 1999). All measures of skewness and kurtosis for all variables except the Personal mathematics teaching efficacy belief scale were between the values of -2 and +2.

Because the nonnormal variable had substantial negative skewness (see Table 1), the variable was transformed by reflecting the variable (subtracting it from the largest number in the distribution plus 1) and then taking the logarithm of the resulting values (Tabachnick & Fidell, 1999). This new, transformed variable was found to have no skewness or kurtosis. The standard deviations were also within normal parameters.

According to Saliu (2011), “The data series is uniform (less dispersed, spread), therefore easier to analyze and control, if its standard deviation is less than or equal to the mean average and especially the median” (para. 10). Therefore, the six normal variables and
the transformed variable were deemed sufficiently normally distributed that parametric statistics could thus be appropriately applied in the analysis.

**Description of the Sample**

The teachers were asked four questions to describe their teaching environment (see Tables 2, 3, and 4). Approximately 25% of the teachers held specialist or doctorate degrees. The teachers’ experience ranged from 1 to 30 years, with an average of 12 years in the professional and 5 years in their current positions. Approximately a third of the teachers taught each of the three grades in the study.

**Table 2**

*Highest Degree Obtained*

<table>
<thead>
<tr>
<th>Degree</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA/BS</td>
<td>34</td>
<td>37.4</td>
</tr>
<tr>
<td>MA/MS</td>
<td>35</td>
<td>38.5</td>
</tr>
<tr>
<td>Specialist</td>
<td>19</td>
<td>20.9</td>
</tr>
<tr>
<td>EdD/PhD</td>
<td>3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

**Table 3**

*Years of Teaching Experience*

<table>
<thead>
<tr>
<th>Experience</th>
<th>n</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>As a teacher</td>
<td>92</td>
<td>1 – 30</td>
<td>11.65</td>
<td>6.63</td>
</tr>
<tr>
<td>In current position</td>
<td>92</td>
<td>1 – 30</td>
<td>5.20</td>
<td>4.82</td>
</tr>
</tbody>
</table>
Table 4  

*Grade Taught*

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third</td>
<td>27</td>
<td>28.4</td>
</tr>
<tr>
<td>Fourth</td>
<td>36</td>
<td>37.9</td>
</tr>
<tr>
<td>Fifth</td>
<td>32</td>
<td>33.7</td>
</tr>
</tbody>
</table>

**Reliability of the Scales**

The computed scales were analyzed using Cronbach’s alpha coefficient to determine the reliability of each scale. The values obtained from this analysis are presented in Table 5. The values range from .44 to .76. Less than optimal coefficient alpha reliability values were obtained for the formal authority and personal model teaching styles.

Table 5  

*Reliability of Scales*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Number of items</th>
<th>Cronbach’s alpha coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching styles inventory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expert</td>
<td>8</td>
<td>.60</td>
</tr>
<tr>
<td>Formal authority</td>
<td>8</td>
<td>.44</td>
</tr>
<tr>
<td>Personal model</td>
<td>8</td>
<td>.54</td>
</tr>
<tr>
<td>Facilitator</td>
<td>8</td>
<td>.63</td>
</tr>
<tr>
<td>Delegator</td>
<td>8</td>
<td>.66</td>
</tr>
<tr>
<td>Mathematics Teaching Efficacy Beliefs Instrument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal mathematics teaching efficacy belief</td>
<td>13</td>
<td>.76</td>
</tr>
<tr>
<td>Outcome expectancy</td>
<td>8</td>
<td>.60</td>
</tr>
</tbody>
</table>
Analysis of the Research Questions

The following questions guided the study:

Research Question 1

What relationship exists between elementary school teachers’ teaching styles and students’ mathematics achievement?

A correlation matrix was created using Pearson’s product moment correlation procedure (see Table 6). Correlational was used to look for relationships between teachers’ teaching styles and measures of student achievement. There were three possible results for the research question: a positive correlation, a negative correlation, and no correlation. The data indicated both positive and negative results. Bear in mind, the negative signs does not specify anything about strength. It symbolizes rather the correlation was negative in direction. The degrees of correlation between the variables were low when measuring the teachers’ teaching styles and measures of student achievement. The statistically significant relationships barely showed statistical significance levels. The relationships certainly did not show strong relationships amongst any of the five teaching styles and the measures of student achievement.

However, predictions can be made about the quantitative variables. The correlational studies suggest there is a relationship between the variables, but cannot prove that one variable caused a change in another. Small to moderate correlations were found between the five teaching styles and measures of student mathematics achievement. Statistically significant, positive correlations were found between three
teaching styles (personal model, facilitator, and delegator) and the level of student achievement in numbers and operations (Domain 1). Statistically significant, positive relationships were found between the formal authority and facilitator teaching styles and student achievement in geometry (Domain 3). A final, statistically significant, negative correlation was found between the expert teaching style and the percentage of students who exceeded CRCT mathematics standards. Therefore, the null hypothesis was rejected. There are statistically significant relationships between teachers’ teaching styles and measures of student mathematics achievement.

The statistically significant correlations found in Research Question 1 highlight the relationship between the teaching styles of personal model, facilitator, and delegator and mathematics achievement. The relationship showed that as teachers’ perceptions of their use of these teaching styles increased, so did their students’ achievement in numbers and operations and geometry. However, a negative correlation was found between the expert teaching style and achievement. Grasha (1996) acknowledged that the expert possesses knowledge and expertise. However, the disadvantage of the expert is the overconfidence of knowledge the teacher exhibits, which can be intimidating to students. In addition, the expert is an outcome-based teacher, with no true focus on the thought process and does not tend to foster higher-order thinking skills.
Table 6

*Correlation of Teachers’ Teaching Styles and Student Achievement*

<table>
<thead>
<tr>
<th></th>
<th>Numbers/operations</th>
<th>Measurement</th>
<th>Geometry</th>
<th>Algebra</th>
<th>Data analysis and probability</th>
<th>Percentage did not meet standards</th>
<th>Percentage met standards</th>
<th>Percentage exceeded standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert</td>
<td>.17</td>
<td>.05</td>
<td>.12</td>
<td>-.10</td>
<td>.02</td>
<td>.16</td>
<td>.03</td>
<td>-.24*</td>
</tr>
<tr>
<td>Formal authority</td>
<td>.03</td>
<td>-.01</td>
<td>.21*</td>
<td>-.17</td>
<td>.07</td>
<td>.08</td>
<td>-.08</td>
<td>-.01</td>
</tr>
<tr>
<td>Personal model</td>
<td>.20*</td>
<td>-.05</td>
<td>.10</td>
<td>-.10</td>
<td>-.03</td>
<td>.08</td>
<td>.01</td>
<td>-.12</td>
</tr>
<tr>
<td>Facilitator</td>
<td>.20*</td>
<td>.03</td>
<td>.22*</td>
<td>.04</td>
<td>.15</td>
<td>.00</td>
<td>.07</td>
<td>-.09</td>
</tr>
<tr>
<td>Delegator</td>
<td>.37*</td>
<td>.07</td>
<td>.14</td>
<td>.05</td>
<td>.15</td>
<td>-.01</td>
<td>.14</td>
<td>-.16</td>
</tr>
</tbody>
</table>

*p < .05

**Research Question 2**

What relationship exists between elementary school teachers’ perceived levels of self-efficacy in teaching mathematics and students’ mathematics achievement levels?

A correlation matrix was created using Pearson’s product moment correlation procedure (Table 7). Correlational was used to look for relationships between teachers’ teachers’ perceived levels of self-efficacy in teaching mathematics and students’ mathematics achievement levels. Small correlations were found between the two self-efficacy scales and measures of student mathematics achievement. However, no relationship was statistically significant. Therefore, the null hypothesis was not rejected.
Table 7

Correlation of Teachers’ Perceptions of Their Self-Efficacy to Teach Mathematics and Student Achievement

<table>
<thead>
<tr>
<th></th>
<th>Numbers/operations</th>
<th>Measurement</th>
<th>Geometry</th>
<th>Algebra</th>
<th>Data analysis and probability</th>
<th>Percentage did not meet standards</th>
<th>Percentage met standards</th>
<th>Percentage exceeded standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal mathematics teaching efficacy belief (transformed)</td>
<td>.03</td>
<td>.07</td>
<td>.02</td>
<td>.02</td>
<td>.03</td>
<td>.04</td>
<td>.11</td>
<td>-.18</td>
</tr>
<tr>
<td>Outcome expectancy</td>
<td>.12</td>
<td>.12</td>
<td>-.06</td>
<td>.01</td>
<td>-.09</td>
<td>.07</td>
<td>.04</td>
<td>-.15</td>
</tr>
</tbody>
</table>

*p < .05

Research Question 3

Can students’ mathematics achievement be predicted by their elementary school teachers’ teaching styles and their perceived levels of self-efficacy in teaching mathematics?

Eight stepwise regression analyses were conducted to determine if measures of students’ mathematics achievement could be predicted by their elementary school teachers’ teaching styles and their perceived levels of self-efficacy in teaching mathematics. The independent (predictor) variables were the five teaching styles and two self-efficacy scales. The dependent variables were the five domains and the three performance levels of the mathematics portion of the CRCT. Each of the eight regression analyses used one of the measures of mathematics achievement as the dependent...
variable. The predictor variables (the independent variables of teaching styles and self-efficacy) were entered into each regression analysis in a stepwise fashion.

The computer analysis did not produce regression equations for Domain 2 (measurement), Domain 4 (algebra), Domain 5 (data analysis and probability), the percentage of students who did not meet standards, and the percentage of students who met standards. No significant predictor variables were found for those five measures of mathematics achievement. However, significant regression equations were created for Domain 1 (numbers and operations), Domain 3 (geometry), and the percentage of students who exceeded standards on the CRCT. Therefore, the null hypothesis was rejected. Some measures of student mathematics achievement can be predicted by their teachers’ perceived teaching styles. The significant regression equations are presented below.

**Domain 1 (numbers and operations).** A significant regression equation was obtained \([F(1,93) = 14.69, p < .001]\). Only the delegator teaching style was found to be a significant predictor of students’ performance in numbers and operations (Table 8). The \(R^2\) of .14 indicates that 14% of the variation in academic achievement in numbers and operations could be accounted for by teachers’ perceptions of their delegator teaching style. The use of the delegator teaching style is considered significant when considering a teaching strategy to increase students’ mathematics achievement.
Table 8

*Teachers’ Teaching Styles and Perceptions of Their Self-Efficacy to Teach Mathematics as Contributing Factors to Student Achievement in Numbers and Operations*

<table>
<thead>
<tr>
<th>Dependent/Independent Variables</th>
<th>β</th>
<th>SE(β)</th>
<th>Beta</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers and operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>9.64</td>
<td>2.34</td>
<td>4.11*</td>
<td></td>
</tr>
<tr>
<td>Delegator teaching style</td>
<td>2.41</td>
<td>.63</td>
<td>.37</td>
<td>3.83*</td>
</tr>
</tbody>
</table>

$R^2 = .14$. *$p < .05$

**Domain 3 (geometry).** A significant regression equation was obtained [$F(1,93) = 4.63, p < .05$]. Only the facilitator teaching style was found to be a significant predictor of students’ performance in geometry (Table 9). The $R^2$ of .05 indicates that 5% of the variation in academic achievement in geometry could be accounted for by teachers’ perceptions of their facilitator teaching style. The use of the facilitator teaching style is considered significant when considering a teaching strategy to increase students’ mathematics achievement.

Table 9

*Teachers’ Teaching Styles and Perceptions of Their Self-Efficacy to Teach Mathematics as Contributing Factors to Student Achievement in Geometry*

<table>
<thead>
<tr>
<th>Dependent/Independent Variables</th>
<th>β</th>
<th>SE(β)</th>
<th>Beta</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.12</td>
<td>1.84</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>Facilitator teaching style</td>
<td>.95</td>
<td>.44</td>
<td>.22</td>
<td>2.15*</td>
</tr>
</tbody>
</table>

$R^2 = .05$. *$p < .05$
**Percentage of students exceeding CRCT mathematics standards.** A significant regression equation was obtained \[ F(1,93) = 5.70, p < .02 \]. Only the expert teaching style was found to be a significant predictor of the percentage of students exceeding CRCT mathematics standards (Table 10). The \( R^2 \) of .06 indicates that 6% of the variation in the percentage of students exceeding CRCT mathematics standards could be accounted for by teachers’ perceptions of their expert teaching style. However, this relationship is a negative one. The beta weight for the expert teaching style is a negative value (-.24), indicating for the study that the influence of this teaching style on the students’ mathematics achievement is harmful.

**Table 10**

*Teachers’ Teaching Styles and Perceptions of Their Self-Efficacy to Teach Mathematics as Contributing Factors to Percentage of Students Exceeding CRCT Mathematics Standards*

<table>
<thead>
<tr>
<th>Dependent/Independent Variables</th>
<th>( \beta )</th>
<th>( SE(\beta) )</th>
<th>Beta</th>
<th>( t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of students who exceeded standards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>36.45</td>
<td>8.68</td>
<td>4.20*</td>
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<tr>
<td>Expert teaching style</td>
<td>-5.13</td>
<td>2.15</td>
<td>-.24</td>
<td>-2.39*</td>
</tr>
</tbody>
</table>

\( R^2 = .06. *p < .05 \)

**Summary**

Data collected from 95 teachers were used to analyze three research questions. Correlational was used to look for relationships between teachers’ teaching styles, teachers’ perceived levels of self-efficacy in teaching mathematics and students’
mathematics achievement levels. There were three possible results for the research question: a positive correlation, a negative correlation, and no correlation. The degrees of correlation between the variables were low when measuring the teachers’ teaching styles and measures of student achievement. The statistically significant relationships barely showed statistical significance levels. The relationships certainly did not show strong relationships amongst any of the five teaching styles and measures of student achievement.

Small to moderate correlations were found between the five teaching styles and measures of student mathematics achievement. Statistically significant, positive correlations were found between some of the teaching styles and several measures of student achievement. No statistically significant relationships were found between elementary school teachers’ perceived levels of self-efficacy in teaching mathematics and students’ mathematics achievement levels. Student mathematics achievement (as measured by numbers and operations, geometry, and the percentage of students who exceeded standards on the CRCT) can be predicted by their teachers’ teaching styles (delegator, facilitator, and expert). Although the relationships were statistically significant, little variance in student mathematics achievement was explained by the different teaching styles. The results are discussed and conclusions are drawn in Chapter Five.
CHAPTER FIVE: DISCUSSION

This study investigated the relationship among elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement. A sample population of over 100 potential teachers who taught third- to fifth-grade mathematics in a large inner-city school system in Georgia was surveyed. Data from 95 respondents who provided information were analyzed. In addition to creating a correlational matrix using Pearson product-moment correlation, a series of multiple regression analyses was also used to analyze the results.

Summary of Findings

A correlational research design was used to conduct the study. The study was designed to explore relationships among elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement in a large inner-city school system. The major findings from the study were driven by the three research questions. The three research questions were answered by determining if each null hypothesis was accepted or rejected.

Research Question 1

What relationship exists between elementary school teachers’ teaching styles and students’ mathematics achievement?

Research suggests not one teaching method is best for everyone and many teaching styles can be motivational (McCombs & Miller, 2007). Results of the analysis of Research Question 1 indicated that statistically significant positive correlations were
found between three teaching styles (personal model, facilitator, and delegator) and the level of student achievement in numbers and operations (Domain 1). Additionally, statistically significant, positive relationships were found between the formal authority and facilitator teaching styles and student achievement in geometry (Domain 3). A final, statistically significant, negative correlation was found between the expert teaching style and the percentage of students who exceeded CRCT mathematics standards.

The significant relationships showed that as teachers’ perceptions of their use of the personal model, facilitator, and delegator teaching styles increased, so did their students’ achievement in numbers and operations and geometry. The facilitator and the delegator teaching styles focus on the instructors being guides to learning rather than as deliverers of information. The personal model of teaching is focused on showing how students should behave and think (Grasha, 1996). All three teaching styles guide, lead, and direct students by letting them have a voice in the learning process.

However, predictions can be made about the quantitative variables. The correlational study suggest there is a relationship among the variables, but cannot prove that one variable caused a change in another. No strong significant relationship was found regardless of the teaching style approach and student mathematic achievement therefore, it could be argued that the foundation of teaching and learning lies within individuals (Davis, 2010). This is especially critical because diverse learners, both global and analytic processors, learn content differently.

Additionally, students tend to relate more to the math achievement domain of number sense and operations. Students can make real-life connections with numbers.
Numbers and operations are a basic number skill, while geometry, algebra, and probability are more abstract. Both teachers and students may feel more comfortable teaching and learning numbers, while avoiding the abstract. However, elementary teachers should aim to teach an understanding of all mathematical skills, concepts, and procedures. The understanding of the why something works and not only the how something works is deemed necessary to reach diverse learners.

A negative correlation was found between the expert teaching style and achievement. Garsha (1996) acknowledged that the expert possesses knowledge and expertise. However, the expert is an outcome-based teacher, with no true focus on the thought process and does not tend to foster higher-order thinking skills. The use of this teaching style to increase the students’ mathematics achievement is not encouraged.

**Research Question 2**

What relationship exists between elementary school teachers’ perceived levels of self-efficacy in teaching mathematics and students’ mathematics achievement levels?

Teacher self-efficacy has been significantly associated with the use of instructional strategies that increase student achievement and the teacher’s willingness to embrace new ideas (Philipp, 2007). Studies have also shown that teachers’ sense of efficacy is related positively to the percentage of learning goals mastered and an overall improvement of student growth (Philipp, 2007). The current study revealed little evidence of this after analysis of Research Question 2. Small correlations were found between the two self-efficacy scales and measures of student mathematics achievement.
However, no relationship was statistically significant. Therefore, the null hypothesis was not rejected.

**Research Question 3**

Can students’ mathematics achievement be predicted by their elementary school teachers’ teaching styles and their perceived levels of self-efficacy in teaching mathematics?

Nearly all students learn more efficiently when they have opportunities to work with cooperative groups, allowing learning to be facilitated rather than delivered by the teacher in lecture format (CORD, 2010). The current study revealed this in the results of the analysis of Research Question 3. A series of regression analyses was conducted to determine if measures of students’ mathematics achievement could be predicted by their elementary school teachers’ teaching styles and their perceived levels of self-efficacy in teaching mathematics. The null hypothesis was rejected. Student mathematics achievement can be predicted by their teachers’ teaching styles. The facilitator and delegator teaching styles focus on students’ ability to work in any relationships displayed by teacher and students. The teacher delegates various learning tasks and projects for the students to complete throughout the course. The teacher is often referred to as a resource person instead as the only knowledge source. Therefore, these two teaching styles may contribute to increasing student achievement.

Although the current study did not find a relationship between teacher self-efficacy and students’ mathematics achievement, there is a growing confirmation that teachers’ sense of self-efficacy plays a major role in affecting important educational
results (Klassen et al., 2009). Research also shows that teachers who have high self-efficacy about teaching may motivate students easier and enhance their cognitive development (Bandura, 1997; Woolfolk, Margolis, & McCabe, 2006) and a highly efficacious teacher has a greater sense of self-efficacy, which is correlated to greater student achievement (Bandura, 1997; Overton, 2007; Tschannen-Moran, & Barr, 2004). Conceivably, the current study did not find a relationship because there is a difference between assessment of learning and assessments for learning.

Awareness of a teacher's teaching styles brings an understanding of the elements in students’ learning processes (Nielson, 2007; Rosenfeld & Rosenfeld, 2007). It is critical for teachers to self-reflect and examine their delivery of instruction and their cognitive styles so they can teach in a manner that respects learners’ diverse learning styles and different learning situations (Conti & Wellborn, 1986).

**Limitations**

The findings from this research study exposed several limitations. The first limitation was the sample size and population. Although the sample population was enough to provide valid results for the study, it was limited to one urban public school system. The research focused on this school system because of its signature reform model. Thirty-three schools, with more than 13,000 students, adopted this reform. Of the 33 schools, 16 are elementary schools. The researcher focused on teachers and students in Grades 3 through 5 in these 16 elementary schools. However, the perspective from more than one school system and in more than one demographic area will allow for different voices.
The study was conducted specifically in a Title 1, urban public school system in the state of Georgia. These 16 schools are located in economically disadvantaged communities. Eighty-nine percent of the population in the school system is low-income students, almost double the 50% average poverty rate in Georgia public schools. Therefore, there may be limited generalizability to other school districts of more significant means.

The results of this study may have been slightly differently if the participants included more than elementary mathematics teachers. The researcher focused on mathematics, one of the five core components of the signature reform model program. The schoolwide mathematics program focuses on daily problem solving, student discovery in whole- and small-group settings, reasoning, and open communication to help students’ form concrete understanding and articulate mathematical concepts rather than simply memorizing them. Therefore, focusing on other content areas will allow a different viewpoint of teaching styles, self-efficacy, and achievement.

A further limitation to the study was the design of the survey. The survey presentation was online. Participants were recruited via email/survey invitation. The researcher emailed all third-fifth grade mathematics teachers about the purpose of the research. All potential teachers were encouraged to participate but were able to decline if they chose. This design was more advantageous for the researcher but the participants may have considered it impersonal because they did not know who sent the invitation.

Several attempts were made by email to invite the potential participants to complete the online survey; however, the school system’s web security rejected the
emails as spam. Because of the school’s IT security protocols, special permission had to be granted. This access is vital to conduct research and must be considered prior to sending emails to teachers.

The use of confidential surveys creates an additional limitation. Teachers may be reluctant to answer the survey questions honestly and objectively, they may not be able to resist the temptation to respond as they believe rather than how they should or ought to because they may feel this is the expected or proper thing to do. Teachers may also be hesitant to provide accurate test scores regarding their student’s academic abilities, especially if they are low.

Lastly, given that the Criterion-Referenced Competency Test is given to all students in the third through fifth grade in Georgia to measure student achievement in math, this test may not be the best form of measurement of student achievement. Research is also needed to determine if other assessments given incrementally instead of yearly may find different outcomes. Therefore, further research would be advantageous for educators to establish if relationships exist among other measures of student achievement.

Implications

The outcome of this study has direct importance for teachers, administrators, and governmental entities. Ten years ago, President Bush signed the No Child left Behind Act, setting the stage for a new and more aggressive phase of accountability in American Education. The NCLB (U.S. Department of Education, n.d.) spurred a nationwide accountability movement that requires all schools to make adequate yearly progress by
meeting the same state-specific standards, to ensure highly qualified teachers provide instruction, and to use scientific research to increase educational gains for all students. With the accountability pressures from NCLB, elementary school math teachers have been given the charge to increase the math academic performance and develop programs to enhance student success despite the widespread interest with the NCLB.

Little research exists showing that teaching styles and self-efficacy have a measurable and direct impact on student achievement. Therefore, teacher professional development needs to be a strategic balancing act. The goal of the current study was to move teachers and administrators from a key focus on teaching alone to a key focus on teaching and learning.

Self-efficacy or an individual’s belief in one’s ability of students and teachers may be directly linked to teacher and student success (Bandura, 1977). Self-efficacy’s broad application across various domains poses a concern to the direct relationship between self-efficacy and student achievement. Only a few studies have compared teacher self-efficacy and student achievement. This research study was conducted to provide insight into and a more in-depth examination of the sources involving student success by including teaching styles as another link to student success.

In lieu of little or no findings related to math achievement in correlation to self-efficacy, there were some statistically significant relationships between teachers’ teaching styles and measures of student mathematics achievement. Regardless of the approach, it can be argued that the foundation of mathematical teaching and learning lies within various teaching styles. Previous research has consistently shown that academic success
may be directly related to certain teaching styles and other known and unknown motivational constructs across various domains. Few researchers have attempted to explore the extent to what relationships are among the five teaching styles of Grasha (1994). Although matching the teaching and learning styles is not a guarantee for success, there is a need for caution when deciding to change teaching styles. Knowing students and their learning differences is an essential component for teacher preparation for facilitating and structuring a learning environment for all students.

The current research showed relatively little positive significant correlation among teaching styles contributing to mathematics achievement. Effective teaching styles focus on teachers’ delivery and their distinct approach to teaching (Evans, Harkins, & Young, 2008). In essence, the great diversity of individual student needs and interest does not lean toward a one-size-fits-all teaching method. Incorporating a use of multiple teaching styles brings an understanding of the elements of students’ learning processes (Nielson, 2007; Rosenfeld & Rosenfeld, 2007).

The study will provide the school district’s mathematics departments with additional support in raising student mathematics achievement. The NCLB also requires schools to make AYP and for students in Grades 3 and 5 to master the CRCT for promotion to the next grade. Therefore, this study can provide concrete evidence that it takes more than using multiple teaching styles to increase mathematics achievement. Regardless of the instructional approach, one can argue that the foundation of teaching and learning lies within the individual (Davis, 2010).
Understanding mathematics concepts procedurally and conceptually is essential for success; however, students must have access to instruction that leads to student mastery. Teachers in this reform and other schools have to expand their teaching options by reorganizing and differentiating instruction to meet all diverse learners’ needs. To date, limited research has looked at ways of evaluating the use and effectiveness of teaching styles using student assessment (Rinaldi & Gurung, 2008). Research can be furthered by helping administrators, teachers, and educational institutions find measures that connect directly to student achievement and teaching. Accountability is the focus for all educators today seeking to improve instructional practices that raise student academic achievement.

**Recommendations for Future Research**

The literature on teacher effectiveness and student achievement is extensive; however, there are shortcomings in the research regarding the relationships among teachers’ teaching style, self-efficacy, and student achievement. Analysis of the data in the current study found little significance in teaching styles related to student and teacher effectiveness (as measured by student mathematics achievement). As a result, additional research studies should be conducted to determine additional contributing factors to student achievement.

Noting the low reliability of the teaching style scales, a recommendation is made to determine if the sample the researcher surveyed is similar to the population sample Grasha (1996) used. Further research may find that the teaching style inventory does not adequately measure the teaching styles of the population used in the current study. Such
a finding could infer that it is necessary to revise the inventory in order to measure the
teaching styles of elementary teachers in the population from which was sampled in the
current study.

In order to meet their learners’ expectations and cultivate their learning style,
teachers must be aware of their own teaching styles and level of self-efficacy in teaching
elementary mathematics. Researchers should also consider further research by adding
qualitative data to this research. This research can be executed by observing classroom
teachers to determine how teachers’ practices align with their stated beliefs. Observing
classroom teachers will add insight into teachers’ teaching styles and their effectiveness
in increasing mathematics achievement.

There is no hesitation in suggesting that elementary school teachers adopt
teaching practices that improve student achievement. The outcome of this research is
intended to aid all educational stakeholders in addressing each subgroup of students’
needs. This research is intentionally set to provide a model for effective delivery of
instruction in mathematics and valuable instructional planning in mathematics. The study
was limited to third- to fifth-grade elementary teachers because students are only tested in
Grades 3–5 on the CRCT. Therefore, expanding the population to all elementary and/or
middle grades is advisable.

Finally, by becoming aware of teachers’ teaching styles and their perceptions of
their self-efficacy in teaching mathematics in relationship to student success, educators
can assess the effectiveness of mandated professional development for new or veteran
teachers in their schools. This form of collaboration may help promote visions necessary to increase student achievement.

**Conclusion**

Mathematics is a significant content area used to determine decisions regarding student and school performance. It is vital for educators to aid students in developing their maximum potential and prepare them for a life of continuous learning. The research on teaching styles, self-efficacy, and student achievement is still disputable. Additional research is needed in determine how to increase students’ achievement in mathematics. Although this study did not target the primary teaching styles for student mastery, it provided guidance so that teachers may begin to step in the right direction.

To make certain all students obtain a high-quality mathematics education, educators should still take measures to ensure that all students have opportunities to learn by continually researching best practices and improving their self-efficacy in teaching mathematics. There is unquestionably not a one-size-fits-all plan or approach for effective instruction; therefore, effective teaching and learning outcomes are required to develop a full awareness of students’ needs, potentials, and learning style preferences.

Teachers have to make the necessary adjustments so that all students will have many opportunities to meet or exceed their academic goals in all arenas. In order for teachers to meet their learners’ expectations, they must be aware of their own teaching styles and levels of self-efficacy. It cannot be clearly stated that teaching styles and self-efficacy play a vital role in student achievement; however, it is clear that they do not negatively affect student achievement.
Although significant, albeit small relationships were found between teaching styles and student achievement, further research is necessary to define what needs to be done to increase the effectiveness of teachers. Student success is and has always been critical in the evaluation of school initiatives; therefore, collaboration between teachers and administrators helps to maintain effective and necessary staff development that promotes a clear vision necessary to increase student achievement. Believing only in traditional teaching styles is a disservice to students because students learn at varied rates and gain knowledge of taught skills at varied rates.

Education has been and still is at the platform of educators, politicians and members of our society. The key focus is teacher and district accountability, student achievement, and the rate of levels of student achievement. The No Child Left Behind law which has existed for ten years mandates systems to adhere to the same state curriculum standards that is aimed to promote academic achievement and growth. Therefore, classroom teachers have been given the charge to incorporate strategies that will lead to increased academic achievement.

Based on the current research it is appropriate that improving students’ achievement is not solely based on relationships with teachers nor one particular teaching style that will produce gains in mathematics achievement. Meaningful learning in classrooms as measured by standards does not simply offers different instructional practices that can aid students and teachers in realizing their potential abilities, and talents. In light of this, the application of the multiple intelligence theory comes in the
form of making use of instructional techniques that align with the standards and practices (Gardner, 1993). Therefore, curriculums mandated by the state must include in-depth learning involving real-world activation and meaningful performance tasks for students. Furthermore, evaluating student achievement and teachers ability based on varying requirements dictated by lawmakers is a preferred area of need when exploring relationships among elementary school teachers’ teaching styles, their perceptions of self-efficacy in teaching mathematics, and student mathematics achievement.
REFERENCES


Brown, B. L. (2003). *Teaching style vs. learning style: Myths and realities.* Columbus, OH: The Ohio State University.


APPENDIXES
APPENDIX A: GRASHA-RIECHMANN TEACHING STYLE INVENTORY
Respond to each of the items below in terms of how you teach mathematics. Try to answer as honestly and as objectively as you can. Resist the temptation to respond as you believe you should or ought to think or behave, or in terms of what you believe is the expected or proper thing to do.

Respond to questions below by using the following rating scale:

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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td></td>
<td>Strongly disagree</td>
<td>Moderately disagree</td>
<td>Undecided</td>
<td>Moderately agree</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>

1. Facts, concepts, and principles are the most important things that students should acquire. | 1 2 3 4 5 |
2. I set high standards for students in this class. | 1 2 3 4 5 |
3. What I say and do models appropriate ways for students to think about issues in the content. | 1 2 3 4 5 |
4. My teaching goals and methods address a variety of student learning styles. | 1 2 3 4 5 |
5. Students typically work on course projects alone with little supervision from me. | 1 2 3 4 5 |
6. Sharing my knowledge and expertise with students is very important to me. | 1 2 3 4 5 |
7. I give students negative feedback when their performance is unsatisfactory. | 1 2 3 4 5 |
8. Students are encouraged to emulate the example I provide. | 1 2 3 4 5 |
9. I spend time consulting with students on how to improve their work on individual and/or group projects. | 1 2 3 4 5 |
10. Activities in this class encourage students to develop their own ideas about content issues. | 1 2 3 4 5 |
11. What I have to say about a topic is important for students to acquire a broader perspective on the issues in that area. | 1 2 3 4 5 |
12. Students would describe my standards and expectations as somewhat strict and rigid. | 1 2 3 4 5 |
13. I typically show students how and what to do in order to master course content. | 1 2 3 4 5 |
14. Small group discussions are employed to help students develop their ability to think critically. | 1 2 3 4 5 |
15. Students design one of more self-directed learning experiences. | 1 2 3 4 5 |
16. I want students to leave this course well prepared for further work in this area. | 1 2 3 4 5 |
17. It is my responsibility to define what students must learn and how they should learn it. | 1 2 3 4 5 |
18. Examples from my personal experiences often are used to illustrate points about the material. 1 2 3 4 5

19. I guide students’ work on course projects by asking questions, exploring options, and suggesting alternative ways to do things. 1 2 3 4 5

20. Developing the ability of students to think and work independently is an important goal. 1 2 3 4 5

21. Lecturing is a significant part of how I teach each of the class sessions. 1 2 3 4 5

22. I provide very clear guidelines for how I want tasks completed in this course. 1 2 3 4 5

23. I often show students how they can use various principles and concepts. 1 2 3 4 5

24. Course activities encourage students to take initiative and responsibility for their learning. 1 2 3 4 5

25. Students take responsibility for teaching part of the class sessions. 1 2 3 4 5

26. My expertise is typically used to resolve disagreements about content issues. 1 2 3 4 5

27. This course has very specific goals and objectives that I want to accomplish. 1 2 3 4 5

28. Students receive frequent verbal and/or written comments on their performance. 1 2 3 4 5

29. I solicit student advice about how and what to teach in this course. 1 2 3 4 5

30. Students set their own pace for completing independent and/or group projects. 1 2 3 4 5

31. Students might describe me as a “storehouse of knowledge” who dispenses the facts, principles, and concepts they need. 1 2 3 4 5

32. My expectations for what I want students to do in this class are clearly defined in the syllabus. 1 2 3 4 5

33. Eventually, many students begin to think like me about course content. 1 2 3 4 5

34. Students can make choices among activities in order to complete course requirements. 1 2 3 4 5

35. My approach to teaching is similar to a manager of a work group who delegates tasks and responsibilities to subordinates. 1 2 3 4 5

36. There is more material in this course than I have time available to cover it. 1 2 3 4 5

37. My standards and expectations help students develop the discipline they need to learn. 1 2 3 4 5

38. Students might describe me as a “coach” who works closely with someone to correct problems in how they think and behave. 1 2 3 4 5
39. I give students a lot of personal support and encouragement to do well in this course.  

40. I assume the role of a resource person who is available to students whenever they need help.
APPENDIX B: MATHEMATICS TEACHING EFFICACY BELIEF INSTRUMENT
Mathematics Teaching Efficacy Belief Instrument (MTEBI)

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate letters to the right of each statement.

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</table>
19. 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.

20. When teaching mathematics, I will usually welcome student questions.

21. I do not know what to do to turn students on to mathematics.
APPENDIX C: LETTER OF INQUIRY TO SCHOOL PRINCIPALS
Dear Name:

My name is Christi Langston. I am currently a doctoral student at Liberty University in Lynchburg, Virginia and am working on my doctoral dissertation. My work is focused on increasing the academic performance of all students and developing programs to enhance student success in mathematics. Understanding mathematical concepts in elementary schools are essential for developmental of mathematical competence; however, all students need access to instruction that leads to such understanding. I am interested in studying this subject in relation to schools with the same reform and teachers in your schools. It is important that educators and educational administrators identify gaps in student learning so that all schools are meeting state requirements. These concerns prompted this proposed study, which will explore relationships among elementary school teachers’ perceived levels of efficacy in teaching mathematics and student mathematics achievement.

I have previously contacted the system administration and they have graciously agreed to allow me to contact you to request your help. I would like to examine the relationship between elementary school teachers’ teaching styles, their perceptions of self-efficacy, and student mathematics achievement. This research, may help quantify the teaching styles most effective in helping our different types of students to learn.

I am hopeful that you will be willing to work with me and allow teachers in the third, fourth, and fifth grade to complete voluntarily the online survey. Teachers who voluntarily consent to participate in the study are being asked to complete the online informed consent hosted via the online survey prior to completing the survey. The records of this study will be kept private and all subjects will remain unidentified.

Additionally, a $10 Wal-Mart eGift card will arrive via email within 72 hours to all participants who complete the survey.

The online survey will be posted on ______ to ________. I welcome the opportunity to discuss in further detail as requested. Feel free to contact me via e-mail or by phone if you have any additional questions or concerns. I look forward to your response.

Sincerely,
Christi Davis-Langston
Mathematics and Science Instructional Facilitator
404-788-8831
cdavislangston@liberty.edu
APPENDIX D: INFORMED CONSENT FORM
EXPLORING RELATIONSHIPS AMONG TEACHING STYLES, TEACHERS’ PERCEPTIONS OF SELF-EFFICACY, AND STUDENTS’ MATHEMATICS ACHIEVEMENT

Christi Davis-Langston
Liberty University
School of Education

You are invited to participate in a research study that will explore relationships among teachers’ teaching styles, their perceptions of self-efficacy to teach mathematics, and students’ mathematics achievement. All elementary schools in the state of Georgia must meet certain requirements to achieve AYP based on the mathematics standards that have been created by NCLB. Because of this law, teachers must modify their instructional practices so that all students become proficient in the basic state mathematics curricula by 2014. Elementary school teachers must be accountable for their personal professional development and administrators must encourage the best available research for what constitutes effective mathematical instruction and for providing students with engaging hands on lessons that are relevant to real life. Additionally, with the accountability pressures from NCLB, elementary school teachers have been given the charge to increase the academic performance of all students. Higher academic performance expectations are being required for teachers and students in elementary schools.

You were selected as a possible participant because the population identified for this study consists of third- through fifth-grade elementary mathematics teachers in 16 elementary schools in an urban public school system. You work for one of the 16 elementary schools within the same school system that uses the same reform efforts to promote student success in mathematics, setting the foundation for lifelong learners in mathematics.

Principal Investigator: Christi Davis-Langston, School of Education, Liberty University.

Background Information: The need to meet and exceed these new expectations requires teachers to change their principles and values pertaining to student mastery. If teachers’ teaching styles and perceptions of self-efficacy are tracked to their students’ scores on mandated standardized tests, it may help quantify the teaching styles most effective in helping the different types of students to learn. Hence, in an effort to meet teacher effectiveness, educational demands and state policies should be aimed toward enhancing teaching and learning aspects such as teachers’ self-efficacy and instructional delivery.

Procedures: Participants are asked to complete an online instrument consisting of questions about their perceived levels of efficacy in teaching mathematics, teaching styles, and their class percentage in mathematics on the Georgia Criterion-Referenced Competency Test. The online assessment is estimated to take approximately 15 to 20 minutes. Participants are allowed to complete the survey in one sitting or several sittings over a 3-weeks period. Survey Monkey will be the host for the surveys and will collect the submitted responses. The records of study will also remain private and all subjects will remain unidentified. If any part of this study is released, no participants in the study, schools, or the school district will be identified.
Voluntary Nature of the Study: Your participation would be greatly appreciated but this study is strictly voluntary. All potential teachers are encouraged to participate but may decline if choose.

Risks and Benefits of Study: This research study presents minimal risk, which is no greater than everyday activities. To ensure effective teaching and learning outcomes teachers are required to develop full awareness of their students’ way of life of learning which includes their needs, potentials and learning style preferences. In order to meet their learners’ expectations and foster their style teachers must be aware of their own teaching styles and self-efficacy to teach mathematics.

Compensation: A $10 Wal-Mart eGift card will be emailed within 72 hours of receipt of a completed questionnaire. If participants are Sam’s Club members, they can also use the eGift card at Samsclub.com. All Wal-Mart e Gift Cards have no expiration date and are exempt from sales tax online.

Confidentiality: The researcher will strive to ensure that all research data is secure and all participants and schools remain unidentified. In an effort to secure the data, the researcher will first secure the account created by Survey Monkey by using a complex username and password. The researcher will use a key system (coded) rather than listing school names and teacher names on records. After imputing data, the keys will be destroyed. The information that is provided will be stored on a password and firewall protected computer. School names will never appear in any data collected for the study. Lastly, the school district’s name will not be identified by name in research reports, but rather referred to only as “a large urban school system.” All files collected throughout the research study will be kept for three years in a locked fireproof file cabinet located in researcher’s home office. After 3 years, the researcher will purge all related documentation through shredding.

Contacts: If you have concerns or questions, you may contact researcher Christi Davis-Langston @ cdavislangston@liberty.edu. Or you may contact the researcher’s faculty advisor Dr. Gary Khune @ gwkuhne@liberty.edu. Additionally, if you like to talk to someone other than the researcher and advisor, you may contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502, or email at irb@liberty.edu

Statement of Consent:

Please click.

☐ I read and fully understand all the above information regarding this research study. I voluntarily consent to participate at this time.
Thank you for agreeing to participate in the following survey. This informed consent outlines the facts, implications, and consequences of the research study. Upon reading, understanding, and signing this documentation, you are giving consent to participate in the research study.

Voluntary Nature of the Study. Your participation in this study is strictly voluntary. Your decision whether or not to participate will not affect your current or future relations with the researcher or the participating schools. If you initially decide to participate, you are still free to withdraw later without affecting those relationships.

Risks and Benefits of Being in the Study. No study is without risk. The risks are minimal, no more than the participant would encounter in everyday life. There are no risks associated with participating in this study and there are no short or long-term benefits. In the event you experience stress or anxiety during your participation in the study, you may terminate your participation at any time. You may refuse to answer any questions you consider invasive or stressful.

Compensation. A $10 WalMart eGift card will be emailed within 72 hours of receipt to participants who complete the questionnaire. If participants are Sam’s Club members they can also use the eGift card at Samsclub.com. All WalMart eGift cards have no expiration date and are exempt from sales tax online. The eGift card will be sent to an email address of your choice when you complete the entire questionnaire.

Confidentiality. The records of this study will be kept private and all subjects will remain unidentified and anonymous. I will take every precaution to protect participant identity by not linking survey information to participant identity. In any part of this study is published, the researcher will not include any information that will make it possible to identify schools and participants. The survey will be located on SurveyMonkey.com. Data stored by Survey Monkey is in a secure location protected by pass card and biometric recognition; it is conceivable that engineering staff at the web hosting company may need to access the database for maintenance reasons. The researcher will also store all research documentation on a protected computer database on her personal computer used for educational and university purposes that requires a secure password to access.

Contacts and Questions. I understand that should I have any questions about this research and its conduct, I should contact any of the following:

The researcher conducting this study is Christi Davis-Langston at cdavislangston@liberty.edu. You may ask any questions you have any via email. If you have additional questions later regarding the form and content of study, you are encouraged to contact the researcher’s faculty advisor Dr. Gary Kuhne at gwkuhne@liberty.edu. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher and advisor, you are encouraged to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502, or email at irb@liberty.edu.

I have read and understand the purpose of this research. By checking Yes, I agree to participate in the survey. I provide my consent to participate in this research, according to the terms and conditions outlined above.

________Yes
**Please indicate the extent to which you agree with the following statements.**

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>moderately disagree</th>
<th>undecided</th>
<th>moderately agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Facts, concepts, and principles are the most important things that students should acquire.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>I set high standards for students in this class.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>What I say and do models appropriate ways for students to think about issues in the content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>My teaching goals and methods address a variety of student learning styles.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Students typically work on course projects alone with little supervision from me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Sharing my knowledge and expertise with students is very important to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>I give students negative feedback when their performance is unsatisfactory.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Students are encouraged to emulate the example I provide.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>I spend time consulting with students on how to improve their work on individual and/or group projects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Activities in this class encourage students to develop their own ideas about content issues.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>What I have to say about a topic is important for students to acquire a broader perspective on the issues in that area.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Students would describe my standards and expectations as somewhat strict and rigid.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>I typically show students how and what to do in order to master course content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>Small group discussions are employed to help students develop their ability to think critically.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>Students design one of more self-directed learning experiences.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>I want students to leave this course well prepared for further work in this area.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>It is my responsibility to define what students must learn and how they should learn it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>Examples from my personal experiences often are used to illustrate points about the material.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>I guide students’ work on course projects by asking questions, exploring options, and suggesting alternative ways to do things.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>Developing the ability of students to think and work independently is an important goal.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>Lecturing is a significant part of how I teach each of the class sessions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>22</td>
<td>I provide very clear guidelines for how I want tasks completed in this course.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>23</td>
<td>I often show students how they can use various principles and concepts.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>24</td>
<td>Course activities encourage students to take initiative and responsibility for their learning.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>25</td>
<td>Students take responsibility for teaching part of the class sessions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>26</td>
<td>My expertise is typically used to resolve disagreements about content issues.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>27</td>
<td>This course has very specific goals and objectives that I want to accomplish.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>28</td>
<td>Students receive frequent verbal and/or written comments on their performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>29</td>
<td>I solicit student advice about how and what to teach in this course.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>30</td>
<td>Students set their own pace for completing independent and/or group projects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>31</td>
<td>Students might describe me as a “storehouse of knowledge” who dispenses the facts, principles, and concepts they need.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>32</td>
<td>My expectations for what I want students to do in this class are clearly defined in the syllabus.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>33</td>
<td>Eventually, many students begin to think like me about course content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>34</td>
<td>Students can make choices among activities in order to complete course requirements.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
35. My approach to teaching is similar to a manager of a work group who delegates tasks and responsibilities to subordinates.  
   1 2 3 4 5

36. There is more material in this course than I have time available to cover it.  
   1 2 3 4 5

37. My standards and expectations help students develop the discipline they need to learn.  
   1 2 3 4 5

38. Students might describe me as a “coach” who works closely with someone to correct problems in how they think and behave.  
   1 2 3 4 5

39. I give students a lot of personal support and encouragement to do well in this course.  
   1 2 3 4 5

40. I assume the role of a resource person who is available to students whenever they need help.  
   1 2 3 4 5

Please indicate the extent to which you agree with the following statements.

<table>
<thead>
<tr>
<th></th>
<th>1 strongly disagree</th>
<th>2 moderately disagree</th>
<th>3 undecided</th>
<th>4 moderately agree</th>
<th>5 strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When a student does better than usual in mathematics it is often because the teacher exerted a little extra effort.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>I continually find better ways to teach mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Even if I try very hard, I do not teach mathematics as well as I do most subjects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>I know how to teach mathematics concepts effectively.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>I am not very effective in monitoring mathematics activities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>I generally teach mathematics ineffectively.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>The inadequacy of a student’s mathematics background can be overcome by good teaching.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>I understand mathematics concepts well enough to be effective in teaching elementary mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>The teacher is generally responsible for the achievement of students in mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>Students’ achievement in mathematics is directly related to their teachers’ effectiveness in mathematics teaching.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>If parents comment that their child is showing more interest in mathematics at school, it is probably due to the performance of the child’s teacher.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>I find it difficult to use manipulatives to explain to students why mathematics works.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>I typically am able to answer students’ questions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>I wonder if I have the necessary skills to teach mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>Given a choice, I do not invite the principal to evaluate my mathematics teaching.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>When a student has difficulty understanding a mathematics concept, I am usually at a loss as to how to help the student understand it better.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>When teaching mathematics, I usually welcome student questions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>I do not know what to do to turn students on to mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Please provide a response to each question.

<table>
<thead>
<tr>
<th></th>
<th>How many years have you been a teacher?</th>
<th>How many years have you been in your current position?</th>
<th>What is your highest earned degree?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BA/BS</td>
<td>MA/MS</td>
<td>Specialist</td>
</tr>
<tr>
<td></td>
<td>EdD/PhD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What grade did you teach last year (2010-2011)?

Please complete only one of the sections below.

### Third Grade

What was your 2010-2011 third-grade **Class Mean Number Correct** in each of the following domains?

<table>
<thead>
<tr>
<th>Domain</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and Operations</td>
<td>(out of 30 possible)</td>
</tr>
<tr>
<td>Measurement</td>
<td>(out of 11 possible)</td>
</tr>
<tr>
<td>Geometry</td>
<td>(out of 7 possible)</td>
</tr>
<tr>
<td>Algebra</td>
<td>(out of 6 possible)</td>
</tr>
<tr>
<td>Data Analysis and Probability</td>
<td>(out of 6 possible)</td>
</tr>
</tbody>
</table>

Please record the **overall class percent** of students performing at each of these levels.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Level 1 (Does not meet standards, scores below 800)</td>
</tr>
<tr>
<td>2</td>
<td>Level 2 (Meets standards, scoring at or above 800 but below 850)</td>
</tr>
<tr>
<td>3</td>
<td>Level 3 (Exceeds standards, scoring at or above 850)</td>
</tr>
</tbody>
</table>

### Fourth Grade

What was your 2010-2011 fourth-grade **Class Mean Number Correct** in each of the following domains?

<table>
<thead>
<tr>
<th>Domain</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and Operations</td>
<td>(out of 26 possible)</td>
</tr>
<tr>
<td>Measurement</td>
<td>(out of 10 possible)</td>
</tr>
<tr>
<td>Geometry</td>
<td>(out of 12 possible)</td>
</tr>
<tr>
<td>Algebra</td>
<td>(out of 6 possible)</td>
</tr>
<tr>
<td>Data Analysis and Probability</td>
<td>(out of 6 possible)</td>
</tr>
</tbody>
</table>

Please record the **overall class percent** of students performing at each of these levels.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Level 1 (Does not meet standards, scores below 800)</td>
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</tr>
<tr>
<td>3</td>
<td>Level 3 (Exceeds standards, scoring at or above 850)</td>
</tr>
</tbody>
</table>

### Fifth Grade

What was your 2010-2011 fifth-grade **Class Mean Number Correct** in each of the following domains?

<table>
<thead>
<tr>
<th>Domain</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and Operations</td>
<td>(out of 23 possible)</td>
</tr>
<tr>
<td>Measurement</td>
<td>(out of 19 possible)</td>
</tr>
<tr>
<td>Geometry</td>
<td>(out of 6 possible)</td>
</tr>
<tr>
<td>Algebra</td>
<td>(out of 6 possible)</td>
</tr>
<tr>
<td>Data Analysis and Probability</td>
<td>(out of 6 possible)</td>
</tr>
</tbody>
</table>

Please record the **overall class percent** of students performing at each of these levels.

<table>
<thead>
<tr>
<th>Level</th>
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<tbody>
<tr>
<td>1</td>
<td>Level 1 (Does not meet standards, scores below 800)</td>
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<td>2</td>
<td>Level 2 (Meets standards, scoring at or above 800 but below 850)</td>
</tr>
<tr>
<td>3</td>
<td>Level 3 (Exceeds standards, scoring at or above 850)</td>
</tr>
</tbody>
</table>

Thank you for your responses! Please indicate the email address at which you wish the $10 WalMart eGift card to be sent to you.