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A QUANTITATIVE STUDY OF MATHEMATICS TEACHING SELF- EFFICACY
AND PRINCIPAL INSTRUCTIONAL LEADERSHIP
IN ALABAMA ELEMENTARY SCHOOLS

by

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A DISSERTATION

Submitted to the graduate faculty of the University of Alabama at Birmingham
in partial fulfillment of the requirements for the degree of
Doctor of Education

BIRMINGHAM, ALABAMA

2013

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Dilhani Uswatte
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DILHANI USWATTE
EDUCATIONAL LEADERSHIP

ABSTRACT

Given the current pressure on educational leaders to successfully implement the Mathematics Common Core Standards, which is currently in its infancy stages in Alabama, the possible relationship between mathematics teaching self-efficacy of Alabama elementary teachers and principal instructional leadership was evaluated. The relationship between mathematics teaching self-efficacy and grade level taught, years of teaching experience, gender, and school location were also evaluated individually and as part of a multiple regression model. A representative sample of 144 Alabama elementary teachers completed an on-line survey which contained demographic questions, and questions from two previously validated instruments to measure mathematics teaching self-efficacy (the Mathematics Teaching Efficacy Belief Instrument) and perceived levels of principal instructional leadership (the Instructional Leadership Inventory). No significant relationships were found between mathematics teaching self-efficacy and any of the predictor variables tested. Implications of these finding for education leaders are discussed, including the need for future research on how principals may differentiate their instructional leadership for novice (less than 3 years of experience) and career teachers.

Keywords: mathematics teaching self-efficacy, teaching self-efficacy, principal instructional leadership, Alabama elementary in-service teachers

DEDICATION

This dissertation is dedicated to my three boys—my beloved husband, Gitendra, and two precious sons, Suman and Asel. Gitendra, thank you for being such a magnificent partner and father. You enabled me and our children to cheerfully accomplish our daily challenges, even when life was hectic. Also, I cannot thank you enough for your statistics expertise and numerous thought-provoking discussions on my research. Suman and Asel, I owe you many trips to the park and bike rides. Thank you for being so loving and understanding as I worked on attaining this degree. I hope this journey will remind you that with love, support, dedication, and hard work, anything is possible!

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CHAPTER 1

This chapter provides the rationale for conducting a study in elementary schools across Alabama to assess the relationship between mathematics teaching self-efficacy, a teacher's belief in his or her ability to teach mathematics, and the effectiveness of the principal's instructional leadership as perceived by the teacher. First, the need to improve mathematics education by focusing on mathematics teaching self-efficacy is investigated. Next, the paucity of research on increasing mathematics teaching self-efficacy by providing effective principal instructional leadership is explored. The purpose of the study, research questions, the significance, limitations, and assumptions of the study, and definitions of key terms used in this study is then be presented.

Rationale for Study

Improving mathematics education continues to be of national concern, given the poor performance of US students compared to other nations and the growing need for creating a workforce skilled in science, technology, and mathematics (Ball, 2008; Education, 2011; Lips & McNeill, 2009). According to Johnson (2011), mathematics is a critical subject that directly impacts job readiness and national economic competitiveness. In his State of the Union Address, President Obama (2013) highlighted the importance of mathematics education, pledging the creation of new initiatives that will better equip our graduates for current and future jobs that focus on science, technology, engineering, and mathematics.

In addition to federal initiatives to improve mathematics education, a state-led effort initiated by the National Governors Association Center for Best Practices and the Council of Chief State School Officers has resulted in the development of a new curriculum, called the Common Core Standards, that has been adopted by 46 states (Initiative, 2012). In describing the increased rigor and challenges of implementing the Common Core Standards to improve mathematics education, Co-Founder and Chairman of the Common Core Institute, Kevin Baird, stated:

The biggest challenge coming from the Common Core Standards is not in the content itself, it's the notion of a learning target, or level of cognitive demand and critical thinking, attached to a content standard. These are overlays that demand changes in instructional practice. And, frankly, this change is revolutionary. It will cause a big change in how you do your job as a teacher. (Achieve3000, 2012, p. 1)

As Baird inferred, the successful implementation of the Common Core Standards and expected improvement in mathematics education will depend on the classroom teacher. One element that has been closely studied for its impact on teacher effectiveness and student learning is teacher self-efficacy (Guskey & Passaro, 1994). Teacher self-efficacy has been defined as teachers' belief in their ability to organize and implement a set of tasks to produce desired results and is based on Bandura's theory of self-efficacy (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). According to Hart, Smith, Smith, and Swars (2007), "The relationship between teachers' beliefs and teaching is well-established. Beliefs influence teacher behavior and decision-making and change in beliefs is a crucial precursor to real change in teaching" (p.239). Teacher self-efficacy is

known to impact teacher behavior and student growth according to Tschannen-Moran and Woolfolk Hoy (2001) who stated, “Teacher efficacy has proved to be powerfully related to many meaningful educational outcomes such as teachers’ persistence, enthusiasm, commitment and instructional behavior, as well as student outcomes such as achievement, motivation, and self-efficacy beliefs” (p.783).

Specific teacher behaviors that have been found in teachers with high self-efficacy include a greater willingness to embrace new ideas, use of varying instructional strategies (De Mesquita & Drake, 1994; Turner, Cruz, & Papakonstantinou, 2004), and increased likelihood of using inquiry and student-centered teaching strategies instead of lecture or other traditional instructional methods (Swars, 2005). Given the increased rigor of the Common Core Standards that demand these specific teacher behaviors (Initiative, 2012), understanding teaching self-efficacy, specifically mathematics teaching self-efficacy, is essential.

Distinguishing mathematics teaching self-efficacy, the belief in one’s ability to teach mathematics, from teaching self-efficacy is important, as teacher self-efficacy has been found to be context and subject-matter specific. As Tschannen-Moran et al. (1998) explained, teachers may feel very competent teaching one particular subject or one specific kind of student, but less able to teach a different subject or population of students. Unfortunately, little research exists that specifically explores mathematics teaching self-efficacy among teachers. Furthermore, those researchers who explored mathematics teaching self-efficacy focused on pre-service teachers, not in-service teachers.

Studies on the mathematics teaching self-efficacy of pre-service teachers have revealed that teachers with low mathematics teaching self-efficacy are more likely to have negative attitudes toward teaching mathematics and are more likely to use traditional teacher-directed instructional methods instead of innovative or exploratory practices (Swars, 2005). Hart et al. (2007) found that pre-service teachers who demonstrated high levels of mathematics teaching self-efficacy were more likely to use manipulatives with their students in order to increase student mathematics understanding. Gresham (2009), who found a negative correlation between mathematics teaching anxiety and mathematics teaching self-efficacy, stated that "...efficaciousness towards mathematics teaching practices is associated with mathematics anxiety and is the basis for [teachers'] mathematics teaching efficacy beliefs" (p.22).

Compared to the number of studies on mathematics teaching efficacy of pre-service teachers, there is an extreme paucity of studies on mathematics teaching self-efficacy pertaining to in-service teachers; a review of the literature has revealed only two studies. In the most recent study, Rimpola (2011) compared the mathematics teaching self-efficacy and general teaching efficacy of high-school mathematics teachers and their special education co-teacher. Although both groups had similar high levels of general teaching efficacy, the special education co-teachers had significantly lower measures of mathematics teaching self-efficacy. Rimpola's study is important because it establishes that general teaching efficacy is not necessarily indicative of mathematics teaching self-efficacy. The second study, by Turner et al. (2004), revealed that levels of mathematics teaching self-efficacy can be increased for in-service teachers by providing effective mathematics professional development during a summer university program.

The four week professional development program was designed to support the reform-based approaches to instruction and teaching as outlined in the National Council of Teachers of Mathematics (NCTM) Standards that form the basis for the Mathematics Common Core. Teachers were given opportunities to observe master teachers, practice their teaching with fellow participants, and collaborate with other teachers, all of which are sources to increase self-efficacy according to Bandura (1997).

Although Turner et al. (2004) identified a method to increase mathematics teaching self-efficacy, it was not done in the school setting. Given that principals are expected to be instructional leaders, one would expect a plethora of studies on teaching efficacy and principal instructional leadership. However, only a few studies have been conducted on the relationship between principal instructional leadership and teacher self-efficacy (Blase & Blase, 2000; Çalik, Sezgin, Kavgaci, & Kilinc, 2012; Walker & Slear, 2011), but none specifically to address mathematics teaching self-efficacy. Blase and Blase (2000) identified two instructional leadership behaviors that increase teaching efficacy, namely promoting professional growth and conversing with teachers to promote reflection. Similarly, Walker and Slear (2011) found that principal instructional leadership behaviors have an influence on teacher efficacy but vary depending on the teacher's years of experience. The most recent study of instructional leadership and teaching efficacy has not only shown a positive correlation between the two variables, but also a mediating effect of teaching efficacy on the relationship between instructional leadership and collective teacher efficacy (Çalik et al., 2012).

Given the positive relationship found between principal instructional leadership and teaching self-efficacy, one might assume a similar relationship between principal

instructional leadership and mathematics teaching self-efficacy. However, as previous research has indicated, teaching self-efficacy is context- and subject-specific (Tschannen-Moran et al., 1998) and general teaching self-efficacy is not a predictor of mathematics teaching self-efficacy (Rimpola, 2011). Therefore, investigating the relationship between principal instructional leadership and mathematics teaching self-efficacy of in-service teachers was warranted, especially at this time in Alabama where the implementation of the Mathematics Common Core Standards was in its infancy stage.

Purpose of Study

The purpose of this quantitative study was to determine if a relationship exists between mathematics teaching self-efficacy and principal instructional leadership, and other demographic characteristics, among elementary school teachers (grades K-5) across Alabama.

Research Questions

The following research questions guided the study:

- 1) Is there a relationship between mathematics teaching self-efficacy, as measured by the Mathematics Teaching Efficacy Belief Instrument (MTEBI), and grade level among Alabama elementary teachers?
- 2) Is there a relationship between mathematics teaching self-efficacy and years of teaching experience among elementary teachers in Alabama?

- 3) Is there a relationship between mathematics teaching self-efficacy and gender among Alabama elementary teachers?
- 4) Is there a relationship between mathematics teaching self-efficacy and school location (urban, suburban, or rural) among Alabama elementary teachers?
- 5) Is there a relationship between mathematics teaching self-efficacy and perceived principal instructional leadership, as measured by the Instructional Leadership Inventory (ILI), among elementary teachers in Alabama?
- 6) Is there a relationship between mathematics teaching efficacy and the linear combination of grade level, years of teaching experience, gender, school location, and principal instructional leadership among Alabama elementary teachers?

Significance of Study

This study on mathematics teaching self-efficacy and the perceived principal instructional leadership by Alabama elementary teachers is significant for several reasons. Issues pertaining to the timing of this study, implementation of the Mathematics Common Core Standards, and paucity of research on mathematics teaching self-efficacy and principal instructional leadership are addressed here.

Opportune assessment period. The timing of this study was essential. The researcher collected data at the commencement of the 2013-2014 school year and required teachers to assess their mathematics teaching self-efficacy and their perceived principal instructional leadership based on the 2012-2013 school year. The 2012-2013 school year was a critical period for mathematics education in Alabama, as it was the first year of implementation for the Mathematics Common Core Standards. This was an

opportune period to assess mathematics teaching self-efficacy and principal instructional leadership for two reasons. First, as teaching efficacy is content- and context-specific (Tschannen-Moran et al., 1998), it was possible that changes in mathematics teaching self-efficacy may have occurred due to the augmented rigor in curriculum and instruction of the Mathematics Common Core Standards. Furthermore, as principals are responsible for ensuring the proper implementation of the Mathematics Common Core Standards, there was an increased likelihood that principals acted as instructional leaders pertaining to mathematics specifically during the time of this study.

Implementation of the Mathematics Common Core Standards. Proper implementation of the Mathematics Common Core Standards will require years of effort by many educational entities. It will require continuous efforts by the Alabama State Department of Education and school district leaders to provide training and support to teachers and principals. Knowledge of specific principal instructional leadership strategies that may lead to increased mathematics teaching self-efficacy can be used by the State Department of Education and school boards to provide training for principals to implement the Mathematics Common Core Standards. Furthermore, this information may be used by school district leaders, such as the Superintendent, to assess principal effectiveness in the implementation of the Mathematics Common Core Standards. Lastly, given the time constraints and budget limitations faced by many Alabama principals, knowledge of specific instructional leadership strategies that may increase mathematics teaching efficacy and subsequently student achievement will be invaluable.

Paucity of research. Since no studies have examined the relationship between instructional leadership and mathematics teaching self-efficacy, and only one study has been conducted on mathematics teaching efficacy of in-service elementary teachers (Turner et al., 2004) based on the current literature review, this study addressed a major gap in the literature on mathematics teaching efficacy and principal instructional leadership at the elementary school level.

Limitations

Despite the significance of the study, there were a few limitations. These limitations are addressed by the researcher below.

Type of sampling. Because the researcher used convenience sampling to gather data, the results generated from this study are not generalizable to the population of elementary school teachers.

Sampling bias. Given the full disclosure of the survey's focus on mathematics, it is possible that the sample under-represented teachers who do not enjoy teaching mathematics and therefore did not participate in the study.

Perceived versus actual levels of instructional leadership. Principal instructional leadership was measured based on teacher perception and may not be reflective of actual principal instructional leadership.

Web-based issues. Other issues possibly occurred due to the web-based dissemination of the survey. First, because the researcher sent information about the study and the link to the electronic survey via email to the appropriate gatekeeper in each school system, there was a chance the email terminated in the gatekeeper's junk mail and

therefore was not read. Second, teachers who did not have access to a computer with an internet connection would not have been able to complete the survey.

Survey completion by unintended participants. The researcher relied on each school district gatekeeper to forward the study information and survey link to only elementary school teachers within grades kindergarten to grade five, not other teachers or principals. Furthermore, it was expected that only elementary teachers who had worked with their current principal for a minimum of one full school year completed the survey. It was possible that the survey was completed by unintended participants who did not fit the prescribed criteria.

Delay of assessment. Because the survey was administered at the beginning of the 2013-2014 school year, evaluation of mathematics teaching self-efficacy and principal instructional leadership was based on the participant's recollection from the 2012-2013 school year which may not have been at its strongest level after the two month vacation period between school years.

Variances in the number of years of principal-teacher interactions. It is plausible that teachers who worked with their current administrator for a longer period of time may have responded differently than those teachers who had less time with their current administrator.

Variance in the number of years of principal experience. Total number of years of principal experience and number of years as the principal of the current school may have also affected the evaluation of principal instructional leadership by the teacher.

Modification of mathematics teaching assessment instrument. Slight modification of the wording found in the MTEBI was necessary because it was designed to assess the mathematics teaching self-efficacy of pre-service, not in-service elementary teachers. Each question required a tense change from future to present tense. For example, the original statement, “I will continually find better ways to teach mathematics” was changed to “I continually find better ways to teach mathematics.” Although previous studies have modified the MTEBI similarly and reported the validity of the original MTEBI, it was theoretically possible that the validity and reliability of this modified instrument slightly differed.

Assumptions of the Study

Due to an Alabama State Department of Education mandate, the researcher assumed that all participants began implementing the Mathematics Common Core Standards at the beginning of the 2012-2013 school year by following the Alabama State Department 2010 Alabama Mathematics Course of Study document which incorporates the Mathematics Common Core Standards. The researcher also assumed that principals met state department and school board expectations of ensuring that teachers were provided with the appropriate support to implement the Mathematics Common Core Standards. Finally, due to Alabama State Department of Education teaching requirements, the researcher assumed that all participants held a valid teaching license with certification in elementary education.

Definition of Key Terms

A description of terms pertinent to this study is provided here.

1. 2010 Alabama Mathematics Course of Study- this document, created by the Alabama State Department of Education, follows the Mathematics Common Core Standards. For grades K-5, the standards are identical to those found in the Mathematics Common Core Standards. No additional Alabama standards were added to the Mathematics Common Core Standards for grades K-5. For this reason, the term Mathematics Common Core Standards will be used in this document.
2. Mathematics Common Core Standards - the new curriculum initiated by the National Governors Association Center for Best Practices and the Council of Chief State School Officers that has been adopted by Alabama and will be in its second year of implementation during this study.
3. Collective Teacher Efficacy- teachers' perceptions that their effort, as a group of teachers, will have a positive impact on students (Goddard, 2001).
4. Efficacy, self-efficacy, and sense of efficacy- used interchangeably to describe "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performance" (Bandura, 1986, p. 391).
5. General teaching efficacy- a term used to describe a teacher's belief in his or her general ability to teach, not a specific subject or context.
6. Mathematics beliefs- an individual's beliefs concerning the nature of mathematics knowledge and knowing (Briley, 2012).

7. Mathematics efficacy- the belief in oneself to perform mathematical tasks or problems (Briley, 2012).
8. Mathematics teaching self-efficacy- the belief in oneself to teach mathematics effectively to increase student mathematics performance.
9. Principal instructional leadership- a type of leadership shown by the principal that emphasizes improving the teaching and learning in a school (W. K. Hoy & Miskel, 2008).
10. Teaching efficacy or teacher efficacy or personal teaching efficacy or teaching self-efficacy- The teacher's belief in his or her ability to organize and implement a set of tasks to produce desired results. It is based on Bandura's theory of self-efficacy (Tschannen-Moran et al., 1998).

CHAPTER 2

Review of the Literature

The purpose of this chapter is to examine the theoretical background and existing literature related to mathematics teaching self-efficacy and principal instructional leadership. This chapter begins by describing the theoretical framework for mathematics teaching self-efficacy, namely Bandura's Model of Social Cognitive Learning Theory (1977), followed by a review of existing literature on teacher self-efficacy and mathematics teaching self-efficacy. Next, a description of principal instructional leadership theory and models is presented. Studies on principal leadership and its impact on teacher efficacy are then evaluated by the researcher. Finally, the lack of research on the relationship between principal instructional leadership and specifically mathematics teaching self-efficacy is presented to establish the basis for the current study.

Theoretical Framework for Teaching Efficacy

Mathematics teaching self-efficacy is based on the work of Bandura (1977) who laid the foundation for self-efficacy. Prior to 1977, existing learning theories did not address the effect of self-beliefs on the capacity to learn (Pajares, 2002). To distance his work on prevalent social learning theories that emphasized environmental factors and biological influences in the development of human behavior, and to accentuate his belief in the role of self-belief, or cognition, Bandura (1986) changed the name of his existing learning theory called 'social learning theory' to 'social cognitive learning theory.'

Bandura emphasized the role that self-beliefs play in enabling a person to control his or her thoughts, actions, and feelings. He stated, “What people think, believe, and feel affects how they behave” (Bandura, 1986, p.25).

Bandura (1986) defined self-efficacy as, “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performance” (p.391). Self-efficacy provides the foundation for motivation, well-being, and personal accomplishment because unless an individual believes his or her actions can produce a desired outcome, there is no motivation to initiate or complete the task (Pajares, 2002). Bandura’s (1997) statement, “People’s level of motivation, affective states, and actions are based more on what they believe than on what is objectively true” (p.2), provides a rationale for trying to understand a person’s beliefs about his or her capabilities instead of assessing what he or she is actually capable of accomplishing based on previous attainments, skills, or knowledge.

Bandura (1997) stated that self-efficacy can be formed from four sources. The most influential source is a result of an individual’s past performance, called mastery experience. Outcomes that are considered successful increase self-efficacy. The second source originates from observing others perform a task, also known as vicarious experience. Although weaker than mastery experience in raising self-efficacy, if there is limited prior personal experience, individuals become more sensitive to it. Social persuasion, which involves the verbal judgments of others, is the third source. Finally, somatic and emotional states such as anxiety, stress or arousal can impact self-efficacy. When an individual experiences negative thoughts about his or her capabilities, those affective reactions can themselves lower self-efficacy.

Teacher Efficacy

Experts from various disciplines have tested and found support for the tenets of self-efficacy in social cognitive theory (Bandura, 1997). Since the 1990s, researchers have paid increased attention to efficacy in educational research (Pajares, 2002). One such area has been on teacher efficacy. Teacher efficacy has been described as, “the extent to which a teacher believes that he or she can affect student performance” (Hipp, 1995, p. 5). According to Tschannen-Moran and Woolfolk Hoy (2001), the concept of teacher efficacy was investigated over thirty years ago in 1976 by researchers at the Rand Corp who asked teachers to indicate their level of agreement to two questions that were summed and identified as the teacher’s level of efficacy:

- “When it comes right down to it, a teacher really can’t do much because most of a student’s motivation and performance depends on his or her home environment.”
- “If I try really hard, I can get through to even the most difficult or unmotivated students.” (p.784)

This early work was considered powerful as it suggested that a teacher’s belief in his or her ability to affect student learning was critical to actual success or failure in a teacher’s behavior (Henson, 2001). It is important to note that studies on teaching efficacy actually began with two separate stands of research, one strand relying on Rotter’s work on locus of control, such as the Rand Studies, and the other strand based on Bandura’s social cognitive theory (Fives, 2003).

Much research on teaching efficacy has been conducted since the Rand study that has assisted educators to better understand the concept of teaching efficacy (Protheroe, 2008). Although research on teaching efficacy began with two strands of research, current conceptualization of teacher efficacy is based on Bandura's self-efficacy theory (Fives, 2003). Therefore, this literature review will focus only on teaching efficacy studies based on Bandura's work.

Gibson and Dembo (1984) were among the first researchers to build on the Rand study and employ Bandura's theory of self-efficacy to develop a new instrument to evaluate teacher efficacy. These authors designed an instrument to measure what they perceived to be two separate aspects of teaching efficacy, namely: (a) outcome expectations, which they called general teaching efficacy; and (b) efficacy expectations, termed personal teaching efficacy. Subsequent research on teaching efficacy built on this distinction between general teaching efficacy and personal teaching efficacy (Tschannen-Moran et al., 1998). Researchers have found that these constructs are independent. As a result, it is possible for a teacher to have a general belief in the ability of teachers to reach challenging students and yet have low confidence in his or her personal teaching ability (Woolfolk Hoy, 2000).

General teaching efficacy has been defined as "a teacher's general feeling that the education system is capable of satisfactorily fostering student academic achievement despite negative influences external to the teacher" (Rich, Lev, & Fischer, 1996, p. 1016). General teaching efficacy is more an assessment of locus of control than self-efficacy (Tschannen-Moran et al., 1998). Unlike general teaching efficacy, personal teaching efficacy focuses specifically on a teacher's belief in his or her ability to positively impact

student learning than on the distant notion of what teachers can do in general. Therefore, it has been argued that personal teaching self-efficacy is a more accurate description of teacher efficacy than general teaching efficacy or a composite of these two belief systems (Guskey & Passaro, 1994; Tschannen-Moran et al., 1998).

The Tschannen-Moran et al. (1998) model of teacher efficacy is firmly grounded in Bandura's self-efficacy construct and consists of a cyclical process in which efficacy beliefs are created, assessed, utilized, and then lead to new beliefs. Teacher efficacy beliefs are created through the four sources of efficacy proposed by Bandura (1977) which are mastery experiences, vicarious experiences, verbal persuasion, and physiological cues. These experiences are then processed by the teacher and believed to impact a teacher's ability to assess the task to be completed and assess his or her personal competence. By evaluating existing personal skills, knowledge, strategies, and personality traits against perceived limitations in teaching the new task, judgments about teacher self-efficacy are developed. This teaching efficacy is then translated into goals, effort, persistence, and ultimately performance. The cycle begins again as the resulting performance acts as a source of mastery experience and can influence future efficacy.

Tschannen-Moran and Woolfolk Hoy (2001) expanded on the model developed by Tschannen-Moran et al. (1998) and focused on three specific critical teaching tasks: engagement, classroom management, and instructional practices. According to Fives (2003), focusing on these three specific teaching tasks have permitted researchers to better understand the relationship between the domains of teaching tasks, teacher performance outcomes, and student achievement.

Teaching efficacy and teacher motivation. The relationship between teacher efficacy and motivation to teach has also been examined by researchers (Ashton & Webb, 1986; Tschannen-Moran et al., 1998). For example, teachers with high levels of efficacy demonstrate a passion for teaching (Dembo & Gibson, 1985) and a greater commitment to the teaching profession (Trentham, Silvern, & Brogdon, 1985). Furthermore, teacher efficacy has been found to affect how a teacher treats his or her students (Ashton, Doda, & Webb, 1983; Ashton & Webb, 1986). Ashton et al. (1983) discovered that teachers with low teaching efficacy tend to ignore lower functioning groups and focus more on higher ability groups. Response to innovation and change, and teaching efficacy has also been examined. For example, Stein and Wang (1988) detected that teacher efficacy beliefs are related to the perceived level of successful implementation of a new program or practice. Similarly, Guskey (1988) found that teachers with greater levels of teacher efficacy had less difficulty implementing new practices, and rated new practices as more aligned with their current practices and more important for student learning.

Teaching efficacy and student outcomes. Researchers have noted a positive relationship between student achievement and levels of teacher efficacy (Allinder, 1995; Ashton & Webb, 1986; Ross, 1992). Teachers with high levels of teacher efficacy have higher expectations for their students. Allinder (1995) found that special education teachers with higher teaching efficacy set more ambitious goals for their students. Strong positive correlations have been found between teacher efficacy and student self-efficacy and perception of ability (Ashton, 1984).

Attributes of the individual and teaching efficacy. In a study of 179 practicing teachers, W. K. Hoy and Woolfolk (1993) investigated the relationship between personal

and demographic characteristics such as age, gender, years of teaching experience, and educational level with personal and general teaching efficacy. Of all these personal variables, the only factor found to predict teacher efficacy was educational level.

Similarly, J. Campbell (1996) who studied both pre-service and in-service teachers in the United States and Scotland, found differences in efficacy based on education level. Education levels were broken down into the three categories of pre-Bachelor's degree, Bachelor's degree, and post-graduate degrees. Teachers with post-graduate degrees in both countries reported the highest level of teaching efficacy.

Although one might assume that people with higher levels of education might gain more knowledge of teaching and thereby increase their teaching efficacy, educators must be cautious of this interpretation. In a review of these two studies that assessed educational level, Fives (2003) argued that neither study addressed two specific concerns. First, neither study assessed the personal characteristics that influence a person to pursue higher studies. Fives (2003) postulated that it is possible that such individuals had a higher efficacy prior to engaging in post-graduate work and that prompted them to extend their learning. Second, both studies assumed a link between education and knowledge. Actual knowledge base was not assessed, so it cannot be assumed that furthering one's study leads to an increase in knowledge and eventually higher teaching efficacy.

Years of teaching experience and changing levels of teaching efficacy.

Efficacy is known to fluctuate often and rapidly for new teachers. There is evidence that initial feelings of confidence in new teachers can change even after just 10 weeks of the first year of teaching (Tschannen-Moran & Woolfolk Hoy, 2001). Earlier researchers

also indicated that efficacy tends to stabilize around the third year of teaching and is more difficult to change as the number of years of teaching experience increases (Wolters & Daugherty, 2007; Woolfolk Hoy, 2000). This is not to imply that teaching efficacy cannot be altered for experienced teachers. Interactions with other teachers and the principal, observation of colleagues, and other teaching and learning experiences have resulted in increased teaching confidence and teacher self-efficacy for experienced teachers (Walker & Slear, 2011; Wolters & Daugherty, 2007).

Mathematics Teaching Self-Efficacy

Although there are many studies that have focused on teaching efficacy, there is limited research on mathematics teaching self-efficacy. Knowing that teacher efficacy is dependent on the specific teaching situation and that overall levels of teaching efficacy may not reflect the beliefs of a teacher's ability to teach a specific subject like mathematics, Enochs, Smith, and Huinker (2000) were the first researchers to develop an instrument that would specifically assess mathematics teaching self-efficacy, as opposed to measuring teaching efficacy in general. The mathematics teaching efficacy belief instrument (MTEBI) is the most widely used survey that has been developed to specifically ask efficacy questions about teaching mathematics (Enochs et al., 2000), and has primarily been used with pre-service elementary teachers. In a study of mathematics teaching self-efficacy of in-service teachers, Turner et al. (2004) developed their own mathematics teaching self-efficacy survey by manipulating a self-efficacy survey by Quiñones (1995). In the next two sections, the researcher will describe and compare

studies that have focused on the mathematics teaching self-efficacy of pre-service versus in-service teachers.

Mathematics teaching self-efficacy of in-service teachers. Using their own mathematics teaching self-efficacy questionnaire based on a self-efficacy instrument by Quiñones (1995), Turner et al. (2004) found that mathematics teaching self-efficacy could be increased by providing mathematics professional development that focused on National Council of Teaching Mathematics (NCTM) Practices (which serves as a basis for the Mathematics Common Core Standards), permitting teachers to practice their new teaching skills within the class (i.e., mastery and vicarious experiences from Bandura's theory), and ensuring teachers had time to share ideas and give each other effective feedback (i.e., verbal and social persuasion).

The only other study to assess mathematics teaching self-efficacy for practicing teachers was conducted by Rimpola (2011) who looked at teacher efficacy of high-school mathematics co-teachers. The MTEBI and the Teachers' Sense of Efficacy Scale (TSES) developed by Tschannen-Moran and Woolfolk Hoy (2001) were both used to assess teacher efficacy between the 77 secondary mathematics teachers and the 15 special education co-teachers. While there was no significant difference in teacher efficacy as measured by the TSES between the co-teachers, the mathematics teachers had a significantly higher personal mathematics teaching efficacy than their special education co-teachers. Furthermore, the amount of collaboration time between co-teachers did not significantly affect teacher efficacy or mathematics teacher self-efficacy. Rimpola (2011) argued that more opportunities to gain conceptual understanding of mathematics concepts needs to be given to special education teachers who must co-teach at the high-

school level. Rimpola's study (2011) is important because it establishes that general teaching efficacy is not necessarily indicative of mathematics teaching self-efficacy.

Mathematics teaching self-efficacy of pre-service teachers. With the exception of two studies (Rimpola, 2011; Turner et al., 2004), all other studies on mathematics teaching self-efficacy have focused on pre-service teachers. Similar to Turner et al. (2004), Rethlefsen and Park (2011) sought to evaluate the effect of a particular mathematics course that focused on NCTM practices on increasing mathematics teaching self-efficacy, but focused on pre-service teachers instead of in-service teachers. Results showed that their BAR model (Build knowledge; Act on knowledge through discussion and/or assignments and feedback; and Reflect on the action and knowledge) facilitated an increase in mathematics teaching self-efficacy, as measured by the MTEBI.

The relationship between mathematics teaching self-efficacy and teaching effectiveness has also been examined. Swars (2005) assessed the mathematics teaching self-efficacy of four female pre-service elementary teachers who had recently completed a mathematics methods course and compared each teacher's efficacy results to her perceived level of general teaching effectiveness after completing a subsequent clinical experience. Mathematics teaching self-efficacy was assessed using the MTEBI at the end of the course, while general teaching effectiveness was measured via follow-up interviews. Swars affirmed that all four teachers expressed confidence in their ability to teach mathematics effectively. However, the two teachers with the lowest mathematics teaching self-efficacy stated it would take more time, work, and effort to increase their effectiveness. The two teachers with the lowest mathematics teaching self-efficacy also reported poor, personal mathematics experiences, but so did one of the teachers

considered to have high teaching efficacy. All four teachers stated that the most important teaching strategy to motivate students was to provide authentic mathematics activities. Although Swars concluded that there is a relationship between mathematics teaching self-efficacy and teaching effectiveness, these results are not conclusive given the small sample size and the mixed results.

An assessment of the literature on mathematics teaching self-efficacy revealed that the majority of studies to date have focused on a relationship between mathematics teaching self-efficacy and mathematics anxiety. One study found a moderate negative relationship between mathematics teaching self-efficacy and mathematics anxiety ($r = -.440, p < .05$) among 28 pre-service elementary teachers (Swars, Daane, & Giesen, 2006). Similarly, Bursal and Paznokas (2006) found a negative relationship between mathematics anxiety of 65 pre-service teachers and their mathematics teaching self-efficacy ($r = -.638, p < .05$) and their science teaching self-efficacy ($r = -.417, p < .05$). Furthermore, personal mathematics and science teaching self-efficacy were found to be correlated ($r = .549, p < .01$) suggesting that mathematics teaching self-efficacy may affect not only mathematics teaching but science teaching as well.

Gresham's (2009) study has shown the strongest support for a negative relationship between mathematics teaching self-efficacy and mathematics anxiety compared to other studies that have examined this relationship, as it involved the largest sample size of pre-service teachers ($n = 156$) and found an effect size of $r = -.475, p < .05$. Additionally, interviews with the 10 students who had the highest mathematics anxiety and the 10 students who had the lowest mathematics anxiety revealed that efficaciousness

towards mathematics teaching practices is associated with mathematics anxiety and is the basis for their mathematics teaching self-efficacy beliefs.

Other factors that have been found to have a relationship with mathematics teaching self-efficacy are mathematics self-efficacy, defined as the belief in oneself to perform mathematical tasks or problems, and mathematical beliefs, which can be described as an individual's beliefs concerning the nature of mathematics knowledge and knowing (Briley, 2012). Briley (2012) was the first to assess all three of these measures in one study of 95 pre-service teachers. In this study, Briley used the MTEBI to assess mathematics teaching self-efficacy. Mathematics self-efficacy was measured using the Mathematics Self-Efficacy Scale-Revised (MSES-R). The Conceptions of Mathematics Inventory-Revised (CMI-R) was used to obtain a measure of mathematical beliefs. Briley reported a statistically significant positive relationship between mathematics teaching self-efficacy and mathematics self-efficacy, mathematics teaching self-efficacy and mathematical beliefs, and mathematics self-efficacy and mathematical beliefs. Both mathematics beliefs and mathematics self-efficacy were found to be statistically significant positive predictors of mathematics teaching self-efficacy and explained 51% of the variance in mathematics teaching self-efficacy.

Similarly, Bates et al. (2011) found a positive correlation between teachers' mathematics self-efficacy and mathematics teaching self-efficacy but also compared these two factors to actual mathematics performance measured by the Illinois Certification Testing System Basic Skills Test. The results showed that mathematics performance of the teacher is related to both mathematics self-efficacy and mathematics teaching self-efficacy.

A recent study by Brown (2012) examined other characteristics of 141 non-traditional pre-service teachers compared to their mathematics teaching self-efficacy as measured by the MTEBI. Brown noted that factors such as age, the level and grade of mathematics courses previously taken, and the grade earned in the mathematics methods course which they just completed were all positively correlated with their mathematics teaching efficacy. The variables described by the author as ‘failed attempts on the mathematics sub-tests of the teacher certification exam’ and ‘time elapsed between previous mathematics courses and the current mathematics methods course’ did not have a significant correlation with mathematics teaching self-efficacy.

The majority of studies on mathematics teaching self-efficacy have been conducted with pre-service teachers. Furthermore, the studies that involved in-service teachers did not question what could be done at the school- level by the principal to increase mathematics teaching self-efficacy. The next section specifically examines the role of principal instructional leadership on mathematics teaching self-efficacy, beginning with a review of principal instructional leadership theory and models.

Principal Instructional Leadership Theory and Models

Instructional leadership emphasizes improving teaching and learning in a school (W. K. Hoy & Miskel, 2008). The concept of instructional leadership was born out of the effective schools movement in the late 1970s and early 1980s (Klump & Barton, 2007). While it has become an important aspect of improving school performance and reform, there is no clear definition of the term, and multiple models of instructional leadership exist (Alig-Mielcarek & Hoy, 2004; Hallinger, 2005). In the following sections, the

researcher describes the evolution of instructional leadership by focusing on three predominant models from the literature on instructional leadership that led to the development of the model used in this study (Alig-Mielcarek, 2003).

The Hallinger and Murphy (1985) model. Hallinger and Murphy (1985) created their model by examining the leadership behaviors of principals and reviewing existing literature on school effectiveness. This led the researchers to create a model focusing on three dimensions and 11 job descriptors. The first dimension, *defining the school's mission*, is based on the principal's ability to communicate school goals such that they are widely known and incorporated into daily practices. The second dimension, *managing the instructional program*, encompasses the principal's ability to coordinate and control the school's curriculum and instruction by supervising and evaluating curriculum, as well as monitoring student progress. The last dimension, *promoting a positive school learning climate*, is based on the principal's ability to protect instructional time, provide effective professional development, maintain high visibility, provide teacher and student incentives, and enforce high academic standards. This model led to the formation of the Principal Instructional Management Rating Scale (PIMRS) which has been used in over 130 studies (Hallinger, 2005).

The Murphy (1990) model. Murphy (1990) continued to refine the model by reviewing the literature on school effectiveness and school improvement, staff development and organizational change. Murphy developed a four-dimension model with 16 different principal roles or behaviors. Similar to the Hallinger and Murphy Model (1985), the first dimension was *developing mission and goals*. The second dimension, *managing the educational production function*, included promoting quality instruction,

supervising and evaluating instruction, allocating and protecting instructional time, coordinating the curriculum and monitoring student progress. The third dimension, *promoting academic learning climate*, involved establishing positive expectations and standards, maintaining high visibility, providing incentives for teachers and students, and promoting professional development. The final dimension, *developing a supportive work environment*, consisted of creating a safe and orderly learning environment, providing opportunities for student involvement in the school, developing staff collaboration and cohesion, obtaining resources to support school goals, and creating links between home and school.

The Weber (1996) model. Weber (1996) developed five domains based on his review of the literature. The first, *defining the school's mission*, is similar to the other two models described above. The second domain, *managing curriculum and instruction*, includes monitoring classroom practice and ensuring such practice is aligned to the school's mission, providing resources and support, and modeling and providing support in the use of data to drive instruction. The third domain, *promoting a positive learning climate*, requires the leader to communicate and establish goals and expectations, and establish an orderly learning environment. The fourth domain, *observing and improving instruction*, is a measure of the principal's ability to improve instruction specifically by conducting classroom observations and providing professional development opportunities. *Assessing the instructional program* is the last domain and is associated with the leader's ability to plan, design, administer, and analyze assessments that evaluate curriculum effectiveness.

The Alig-Mielcarek (2003) model. Alig-Mielcarek (2003) developed a simplified model of instructional leadership that built on all three models described above. This model focuses on three domains. The first, *defines and communicates shared goals*, focuses on the leader's ability to collaboratively work with others to define, communicate, and use shared goals to make organizational decisions, align instructional practices, purchase appropriate curriculum materials, and set learning targets. The second dimension, *monitors and provides feedback on the teaching and learning process*, includes activities such as being visible throughout the school, talking with students and teachers, providing teacher and student feedback and praise, and ensuring uninterrupted instructional time. The last domain, *promotes school-wide professional development*, targets the leader's ability to encourage teachers to use data analysis to learn more about student achievement, provide professional development opportunities that align to school goals, and provide appropriate professional literature and teacher resources. This model led to the development of the Instructional Leadership Inventory (ILI) that was used in this study. The ILI was selected due to its conciseness (23 items) and reported high reliability (Cronbach alpha= .92) as compared to the commonly used PIMRS that consists of 50 items and has a lower reliability (Cronbach alpha= .75) (Hallinger & Murphy, 1985). Although this model has been referenced in more than twenty studies, no studies on teacher efficacy and principal instructional leadership have been conducted using the ILI. In the following section, the researcher presents the existing literature describing the relationship between principal instructional leadership and teacher efficacy.

Principal Instructional Leadership and Teacher Efficacy

In the absence of a concrete, widely-acknowledged model of instructional leadership, each of the studies reviewed described instructional leadership and its associated principal behavior and skills in different ways. Many of the studies encompassed elements from the instructional leadership theories described above, however. Using an open-ended questionnaire, Blase and Blase (2000) asked over 800 teachers in the United States to describe principal behaviors that enhanced their classroom instruction and impacted their teaching efficacy. Two themes and 11 strategies emerged. The first theme, *promoting reflection*, included strategies of (a) making suggestions, (b) giving feedback, (c) modeling, (d) using inquiry to solicit advice/opinions, and (e) giving praise. The second theme, *promoting professional growth*, included the six strategies of (a) emphasizing the study of teaching and learning, (b) supporting collaboration efforts among educators, (c) developing coaching relationship among educators, (d) encouraging and supporting redesign of programs, (e) applying the principles of adult learning, growth, and development to all phases of staff development, and (f) using action research to guide instructional decision making.

Walker and Slear (2011) assessed how principal behaviors impacted the efficacy of 366 new and experienced middle school teachers. These authors found that out of 11 principal leadership behaviors tested, only three instructional leadership traits significantly affect the teacher efficacy of all participants. Emphasizing the importance of instruction by modeling instructional expectations and establishing strong communication with and among students and teachers were both found to correlate positively with teacher efficacy. Providing contingent rewards in the form of formal and

informal recognition for outstanding work inside and outside of the classroom was negatively correlated to teacher efficacy, indicating it was more important for teachers with lower efficacy. Furthermore, Walker and Slear detected differences in the relationship between principal instructional leadership and years of experience. For new teachers (0-3 years), only modeling instructional expectations predicted teacher efficacy. Teachers with more experience (4-14 years) seemed to be more interested in school culture, as modeling instructional expectations and communications were correlated with teaching efficacy. The only factor shown to predict teaching efficacy for seasoned teachers (15+ years) was inspiring group purpose in which the principal creates a collaborative environment where everyone works toward shared goals to increase student and teacher success. Based on these results, Walker and Slear suggested that principals must approach teachers with varying experience differently in their efforts to build teacher efficacy.

In the most recent study on teaching efficacy, Çalik et al. (2012) scrutinized the relationship between teaching efficacy, collective teaching efficacy, and principal instructional leadership. The study, conducted in Turkey, involved 328 primary school teachers. Results showed that instructional leadership has a positive and significant direct effect on teaching self-efficacy and a positive, significant indirect effect on collective efficacy through self-efficacy. In other words, teachers' self-efficacy acts as a mediator between instructional leadership and collective teaching efficacy. Caution must be taken, however, in comparing these results to other studies, as Çalik et al. did not discuss the components of the instructional leadership scale used to assess instructional leadership.

Principal Instructional Leadership and Mathematics Teaching Efficacy

While research has been conducted showing a positive relationship between principal instructional leadership and teaching efficacy (Blase & Blase, 2000; Çalik et al., 2012; Walker & Slear, 2011) no studies have been conducted on the impact of principal instructional leadership and the teaching efficacy of any specific subject, including mathematics. Given that teaching efficacy is subject matter and context specific (Tschannen-Moran et al., 1998) and that principals today are under enormous pressure to act as instructional leaders to implement the new, rigorous Mathematics Common Core Standards, further inquiry into the relationship between principal instructional leadership and mathematics teaching self-efficacy is warranted.

In the subsequent chapter, the researcher describes the methodology used to investigate the relationship between principal instructional leadership and mathematics teaching self-efficacy. Details of the survey instruments used, data collection, data analysis, and ethical considerations are presented.

CHAPTER 3

Methodology

The goal of this study was to determine if a relationship exists between an elementary teacher's mathematics teaching self-efficacy and the instructional leadership of his or her principal as perceived by the teacher. Quantitative analysis was used to measure the relationship between mathematics teaching self-efficacy and perceived principal instructional leadership by elementary teachers in Alabama, and also to evaluate the relationship between mathematics teaching self-efficacy and grade level, years of teaching experience, school location, and gender. The methodology required to conduct this study is outlined in this chapter.

A description of the methodology is presented here in four sections. In the first section, the researcher describes each of the instruments used, including its history, reliability, and validity information. In the second section, the researcher outlines the data collection, including information on the study population, sampling frame, sampling plan, and survey procedures. A description of the data analysis techniques is provided in the third section. In the last section, ethical considerations are examined.

Instrument Descriptions

In order to assess if there is a relationship between mathematics teaching self-efficacy and principal instructional leadership, the researcher used the Mathematics Teaching Efficacy Belief Instrument (MTEBI) by Enochs et al. (2000) and the

Instructional Leadership Inventory (ILI) developed by Alig-Mielcarek (2003). Based on the review of literature, the MTEBI is the only formally evaluated tool available to measure mathematics teaching self-efficacy. The ILI was chosen for its brevity in permitting teachers to evaluate their principal's instructional leadership, and the high validity and reliability of the instrument, as described below.

Description of the MTEBI. The MTEBI was designed to assess the mathematics teaching self-efficacy beliefs of pre-service teachers and resulted from the modification of the Science Teaching Belief Instrument for pre-service teachers (STEBI-B). Both the MTEBI and the STEBI-B were based on the original Science Teaching Efficacy Belief Instrument for in-service teachers (STEBI-A) developed by Riggs and Enochs (1990). The MTEBI is comprised of two independent subscales, personal mathematics teaching efficacy (PMTE) and mathematics teaching outcome expectancy (MTOE). The MTOE probes for information related to teacher's beliefs about student performance based on collective teacher actions; this is significantly different from the PMTE subscale which focuses on the teacher's belief in his or her ability to teach. The original MTEBI consisted of 23 questions, but after item analysis, two questions were dropped resulting in 13 items on the PMTE subscale and 8 items on the MTOE subscale (Enochs et al., 2000). Possible scores on the PMTE scale may range from 13-65, while the MTOE score may range from 8-40 since both scales use a five-point Likert-type response system.

The factorial validity study of the MTEBI by Enochs et al. (2000) in which 324 pre-service elementary teachers completed the instrument, revealed an internal consistency reliability score (Cronbach alpha) of 0.88 for the PMTE and 0.77 for MTOE. Construct validity was calculated using confirmatory factor analysis, which the authors

noted as a more flexible, theoretically-guided technique to assess validity compared to the commonly used exploratory factor analysis. Based on the chi-square statistic of 346.70 (df =184), an Akaike Information Criteria (AIC) of 2.23, and Comparative Fit Index (CFI) value of .919, the authors stated, “ These statistics show a reasonably good model fit with respect to all the criteria of [the proposed model]...this confirmatory factor analysis indicated that the two scales (PMTE and MTOE) are independent, adding to the construct validity of the MTEBI” (Enochs et al., 2000, p. 197).

Modification of the instrument for this study. With the aim of specifically measuring the personal mathematics teaching self-efficacy of elementary teachers, only the PMTE subscale was used. Furthermore, since the MTEBI was developed for use by pre-service teachers to reflect future mathematics teaching beliefs, a tense change from future to present was made so that it was similar to the tense structure found in the STEBI-A for in-service teachers. For example, the original MTEBI statement “I will continually find better ways to teach mathematics” was changed to “I continually find better ways to teach mathematics.” This tense change was not expected to cause a significant difference in reliability, as the reported reliability scores between the same item on each of the STEBI-A and STEBI-B were not statistically different (Enochs et al., 2000). The following are the tense-revised items from the PMTE subscale that was used and assessed using a Likert-type scale with values of 5= strongly agree, 4= agree, 3= uncertain, 2= disagree, and 1= strongly disagree:

- I continually find better ways to teach mathematics.
- Even if I try very hard, I don’t teach mathematics as well as I do most subjects.

(reverse score)

- I know how to teach mathematics concepts effectively.
- I am not very effective in monitoring mathematics activities. (reverse score)
- I generally teach mathematics ineffectively. (reverse score)
- I understand mathematics concepts well enough to be effective in teaching elementary mathematics.
- I find it difficult to use manipulatives to explain to students why mathematics works. (reverse score)
- I am typically able to answer students' questions.
- I wonder if I have the necessary skills to teach mathematics. (reverse score)
- Given a choice, I would not invite the principal to evaluate my mathematics teaching. (reverse score)
- 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. (reverse score)
- When teaching mathematics, I usually welcome student questions.
- I do not know what to do to turn students on to mathematics. (reverse score)

Description of the ILI. Based on the review of several pre-existing models of instructional leadership, including models by Hallinger and Murphy (1995), Murphy (1990), and Weber (1996), Alig-Mielcarek (2003) synthesized a concise, comprehensive tool to assess principal instructional leadership based on three main functional categories: (a) *defining and communicating school goals*, (b) *monitoring and assessing the curriculum and instructional program*, and (c) *promoting school-wide professional development*. The initial 50 items were eventually reduced to 27 items such that there

were nine items per function. However, after being field-tested by 143 teachers enrolled in graduate level studies at Ohio State University, only 23 of the items were found to load on the three proposed functions. The instrument was further revised to produce 10 items per dimension for a total of 30 items. This new instrument was then tested by just over 4,000 teachers from 146 Ohio elementary schools, with each school having on average 24 teachers with 13.14 years of teaching experience. Since the unit of analysis was the school, the principal instructional leadership was an average of the teacher responses in a school. Initial factor analysis resulted in the number of items being reduced to 23 items either due to low factor loading, loading on more than one factor, or an absence of conceptual fit. Principal axis factoring with varimax rotation was conducted again on the 23 items and showed that the three factors explained 72.63% of the variance.

The resulting 23 items of the ILC is considered to have good construct validity due to the strong loadings and conceptual fit of the items per factor and high reliability based on the reported Cronbach's alpha coefficient. The first factor, *promotes school-wide professional development*, is comprised of seven items, has a loading range from .59-.77, and a reliability score of .94. The second factor, *defining and communicating shared goals*, has eight items, a loading range from .57-.83, and a reliability score of .97. The last factor, *monitoring and providing feedback*, consists of eight items, with a loading range from .55-.87, and a reliability score of .93. Due to theoretical overlap between the three dimensions, a second-order factor analysis was performed and showed that all three dimensions load on one factor (factor loading of .884, .965, and .867 for factor 1, 2, and 3 respectively). As a result of this analysis, the instructional leadership construct was defined as a composite of the three factors with an overall reliability score

of .92 (Cronbach's alpha coefficient). Each of the 23 items is assessed on a five-point Likert-type scale. The following are the items organized by the three factors of (a) *promotes school-wide professional development*, (b) *defines and communicates shared goals*, and (c) *monitors and provides feedback on the teaching and learning process*:

Promotes School-Wide Professional Development

- Encourages teachers to attend professional development activities that are aligned to school goals
- Provides for in-house professional development opportunities around instructional best practices
- Plans professional development around teacher needs and wants
- Supports individualized professional development plan
- Plans professional development in-service with teachers
- Furnishes useful professional materials and resources to teachers
- Schedules time on in-service for collaboration among teachers

Defines and Communicates Shared Goals

- Uses data on student achievement to guide faculty discussions on the instructional program
- Encourages teachers to use data analysis of student academic progress
- Develops data-driven academic goals in collaboration with teachers
- Communicates the school's academic goals to faculty
- Works with teachers to interpret assessment data for instructional implications
- Uses school goals when making academic decisions

- Develops school goals that promote high standards and expectations for all students
- Sets high but achievable standards for all students

Monitors and Provides Feedback on the Teaching and Learning Process

- Visits the classroom to ensure classroom instruction aligns with school goals
- Monitors classroom practices for alignment to district curriculum
- Works with students on academic tasks
- Stays in the office all day (reverse score)
- Observes teachers for professional development instead of evaluation
- Evaluates teachers to improve instructional practice
- Provides private feedback of teacher effort
- Provides private feedback of student effort

Data Collection

To assess whether a relationship exists between mathematics teaching self-efficacy and principal instructional leadership based on the MTEBI and ILI scores of each participant, the researcher used a secure web-based, cross-sectional survey via the UAB-approved Qualtrics survey tool. In addition to the items from the two instruments, the survey also included demographic questions such as gender, number of years of teaching experience, number of years working with current principal, location of school (urban, suburban, or rural) and grade level taught in 2012-13 school year; this information was essential to address all research questions. Mathematics teaching

efficacy, as measured by the PMTE score of the MTEBI, was set as the dependent variable. Principal instructional leadership, as measured by the ILI, gender, number of years of teaching experience, grade level taught in 2012-2013 school year, and location of school (urban, suburban, or rural) were set as the independent variables.

Once the survey questions were inputted into Qualtrics, the researcher assessed the survey to ensure that it was free of grammatical errors, double or triple barreled responses, and professional jargon that was out of the range for participants (Czaja & Blair, 2005). Furthermore, five colleagues were asked to take the survey to ensure that the survey link was functional, determine whether the survey could be completed within the 5-8 minute timeframe anticipated by the researcher, and assess the clarity of the survey questions and format; positive responses to these items were received from all five colleagues. The surveys completed by these colleagues were not included in the data set.

According to Creswell (2012), this cross-sectional, web-based survey design has the advantage of measuring current attitudes and practices quickly. However, possible disadvantages of low response rates from email, non-random sampling, technological problems such as security issues causing the email to be identified as junk mail, and a bias towards certain demographic groups that tend to use computers remain.

Study population, sampling frame, and sampling plan. To address the potential web-based issues of low response rate and surveys being identified as junk mail, the researcher first sent an email in early August to the school district leader in charge of research studies in the 67 county and 65 city Alabama school systems via a gatekeeper who has established ties with Alabama schools through a nationally recognized

mathematics and science initiative. The email contained the study details and survey link so that the school system's research gatekeeper could send out the information to their elementary teachers in grades K-5 via their internal email system by mid-August. Although the researcher used convenience, non-probability sampling, results were expected to be strengthened by a large sample size given that over 1093 elementary schools were targeted for this study. A minimum sample size of 100 participants was determined based on the recommendation of Tabachnick and Fidell (1989) who suggested having twenty times more cases than the total number of independent variables. The researcher was prepared to send a second email to each district gatekeeper asking for more participants if at least 80 surveys were not completed by the last week of August; however, this was not necessary as the minimum sample size was reached by this time.

Data Analysis Techniques

Data gathered via Qualtrics was imported into the Statistical Package for the Social Sciences (SPSS) software program. Gravetter and Wallnau (2009) recommended that data sets need to be "cleaned" to remove participants that provide incomplete data or do not meet the participant criteria set by the researcher. Incomplete data was not expected to be an issue, unless participants chose not to complete the survey, as the Qualtrics survey was designed such that participants could not leave a response blank. After ensuring the data set was complete, SPSS was used to compute the MTEBI and ILI scores for each participant. In the case where teachers identified teaching multiple grades, a new variable, "highest grade taught" was created and used in the analysis.

Furthermore, both non-metric variables, namely gender and school location, were translated into metric variables, called dummy variables, which are required for multiple regression. As recommended by Hair, Anderson, Tatham, and Black (1998), indicator coding was used for gender (Female=0, Male=1) and effects coding was used for school location, in which suburban, the largest category, acted as the comparison group.

Before multivariate analysis was executed, several diagnostic tests were performed. First, the reliability of each instrument was measured by the researcher and compared to the reported values. Then, a descriptive analysis of each variable was performed. To generalize the results to the Alabama teaching population, the Chi-Square Goodness of Fit was performed using the observed data and compared to the Alabama State Department of Education (ALSDE) reported values for gender, grade level, and years of experience (location breakdown was not available from the ALSDE). This was followed by an inspection of the data for outliers. Hair et al. (1998) discussed the importance of identifying outliers for each distribution of observations and only removing outliers if there is “demonstrable proof that they are truly aberrant and not representative of any observations in the population” (p.66). To identify outliers, the recommended guideline of detecting cases which fall three or more standard deviations beyond the mean was used (Hair et al., 1998). Furthermore, bivariate and multivariate detection of outliers was determined by examining boxplots and Mahalanobis D^2 measures (Mertler & Vannatta, 2005).

After investigating outliers, the assumptions underlying multivariate analysis, which include normality, homoscedasticity, and linearity, were tested for each variable

separately and for the multivariate model variate. Normality, which requires that the data is normally distributed, was first assessed by examining histogram plots for kurtosis, defined as the “peakness” or “flatness of a distribution compared to a normal distribution, and for skewness (Tabachnick & Fidell, 1989). Secondly, the kurtosis and skewness measures provided by SPSS descriptive analysis were assessed to ensure they were within the recommended ± 1.0 range (George & Mallery, 2007). Lastly, the Kolmogorov-Smirnov test, which calculates the level of significance for the differences from a normal distribution was also utilized. Homoscedasticity, described as the desired equal spread of variance across independent variables to allow for a “fair test” of the relationship across all values, was assessed by running the Levene test and by examining scatterplots of the MTEBI score (the dependent variable) against each independent variable and a plot of residuals to assess the regression variate. Scatterplots were also used to assess linearity. Assessing linearity is important because nonlinear effects can result in an underestimation of the actual strength between variables (Hair et al., 1998). Where assumptions were violated, data transformations to modify the variable(s) in question were performed using the guidelines suggested by Hair et al. (1998) and Mickey, Dunn, and Clark (2004).

Once assumptions were tested, multivariate analysis was performed to answer each research question. Furthermore, prior to performing the multiple linear regression analysis to assess the relationship between mathematics teaching self-efficacy and all other independent variables combined, multicollinearity was assessed to ensure independent variables were not correlated with each other. Collinearity was assessed by

examining the tolerance and variance inflation factors (VIF). A low tolerance value near zero indicates extreme collinearity, indicating that the variables are likely increasing the standard errors and weakening the power of the analysis (George & Mallery, 2007). A tolerance value greater than 0.1 (Norusis, 1998) and a VIF less than 10 (Stevens, 1992) are desirable.

Ethical Considerations

It is imperative that researchers follow ethical practices when conducting any study to ensure the safety of participants and confidence in the study procedure (Creswell, 2012). For example, it is the researcher's duty to ensure all participants have accurate information about the research (Fowler, 2009) and clear directions accompanying the survey (Czaja & Blair, 2005). Furthermore, confidentiality is an essential element; intentional measures must be taken to protect the identity and responses of each participant (Creswell, 2012). To ensure these ethical considerations were examined closely, the researcher obtained university Instructional Review Board (IRB) approval prior to the dissemination of all materials. Once IRB approval was obtained, a consent letter including information about the study, voluntary nature, confidentiality, and web-security of data was sent to potential participants via the research survey gatekeeper of each Alabama school district.

CHAPTER FOUR

Results

This chapter presents the findings of the current study based on the statistical analysis of the data gathered from the online survey. First, a descriptive analysis of the sample is provided. Next, the summary statistics, including measures of instrument reliability, are provided for the mathematics teaching self-efficacy and instructional leadership scores. The preliminary analysis of the data set to test the assumptions associated with multivariate analysis follows. Finally, results of the statistical analysis performed to test each research question are presented.

Descriptive Analysis of the Sample

The online survey was accessed by 165 Alabama elementary teachers. However, only 155 teachers completed the survey in its entirety. No missing data was found in any of the cases. After examination of the data set for outliers, one case was removed because her score was more than three standard deviations from the mean of the MTEBI score. Table 1 provides a description of the frequency and percent distribution of the various categories within each demographic variable including gender, highest grade taught, number of full school years of teaching experience, number of full school years working with the current principal, and school location. The mean school years of

teaching experience was 14 (SD = 8) years. The mean school years of time spent working with the current principal was 4 (SD = 3) years.

Table 1

Characteristics of the Sample

Variable		Frequency	Percent
Gender	Male	8	5.2
	Female	146	94.8
Highest grade taught	K	21	13.6
	1	23	14.9
	2	24	15.6
	3	26	16.9
	4	27	17.5
	5	33	21.4
Years teaching	1-3	14	9.1
	4-10	39	25.3
	>10	101	65.6
Years with principal	1	25	16.2
	2-5	83	53.9
	6-10	33	21.4
	>10	13	8.4
School location	urban	18	11.7
	suburban	71	46.1
	rural	65	42.2

To generalize the results to the Alabama teaching population, a Chi-Square Test for the Goodness of Fit was performed for gender, grade level(s) taught, and years of experience using data provided by the ALSDE (T. Thacker, personal communication, September 16, 2013). Location could not be compared since such data was not available from the ALSDE. As Table 2 illustrates, the observed frequencies were very similar to the expected values reported by the ALSDE. Despite the low response rate of 1%, Chi-square analysis indicated that this sample is representative of the Alabama teaching population, as no statistically significant differences were found for gender, $\chi^2(1) = .65$, $p > .05$, grade level(s) taught, $\chi^2(5) = .63$, $p > .05$, and years of experience $\chi^2(2) = 5.70$, $p > .05$.

Table 2

Comparison of Observed Values to State Department Values for Demographic Variables

Variable		Observed	Expected
Gender	Male	5.2	7.3
	Female	94.8	92.7
Grade(s) Taught	K	15.5	16.3
	1	16.5	17.2
	2	17.0	17.0
	3	16.0	17.1
	4	18.9	16.1
	5	16.0	16.2
Years Teaching	1-3	9.1	14.4
	4-10	25.3	31.6
	>10	65.6	54.0

Note. Grade(s) taught includes teachers who taught multiple grades. Observed and expected frequencies are reported in percentages.

Summary Statistics for MTEBI and ILI

Table 3 shows the summary statistics for each instrument, including the mean, standard deviation, range and Cronbach's Alpha. Mathematics teaching self-efficacy, as measured by the MTEBI, could have resulted in a score between 13-65 points. Teachers rated their mathematics teaching self-efficacy moderately high, with the lowest reported value being 39 points and a mean of 54.5 points. The possible range of scores for the ILI, which measured the instructional leadership of each participant's principal, was 23-115 points. Unlike the MTEBI, the ILI total and subscale scores represented the full range of possible scores. Despite the wide range of reported scores, the mean ILI score was moderately high with a value of 89 points. The ILI subscale means were very similar to each other and the total ILI mean score. Internal consistency of reliability for each instrument was assessed by examining the Cronbach's Alpha values for this data set. The Cronbach's Alpha scores were high (.88-.97) and exactly matched the reported values (Alig-Mielcarek, 2003; Enochs et al., 2000), signifying strong internal consistency for each measure.

Table 3

Summary Statistics of Instruments

Scale	Subscale	Mean (SD)	Range	Cronbach's Alpha
MTEBI		54.5 (5.35)	39-65	.88
ILI		89.7 (21.75)	24-115	.92
	Promotes PD	28.1 (6.71)	7-35	.94
	Communicates goals	33.2 (7.65)	8-40	.97
	Provides feedback	28.4 (8.34)	8-40	.93

Analysis of Assumptions

The assumptions underlying multivariate analysis, which include normality, homoscedasticity, and linearity, were assessed for each variable and the multivariate model variate.

Univariate analysis. Table 4 shows the statistical results of the tests used to assess normality of each variable. Years of teaching experience and MTEBI scores were considered statistically normal based on the Kolmogorov-Smirnov test and measures of skewness and kurtosis, both of which were within the acceptable ± 1.0 value (George & Mallery, 2007). Gender, school location, grade, and ILI were not found to be normally distributed. Gender was not normally distributed due to the low sample size ($n = 8$) of males. As a result, it was determined that gender should not be included in the final multiple regression model. Although school location and grade were not normally distributed, these variables were not transformed, as they are reflective of the Alabama teaching population. Furthermore, for studies with moderate to large samples sizes, most types of non-normal data tend to have little impact on the accuracy of multiple regression results (Yockey, 2008). Since the ILI scores were not normally distributed as expected, a squared transformation was applied, resulting in normally distributed data (Kolmogorov-Smirnov $p = 0.58$).

Table 4

Test of Normality

Variable	P value	Skewness	Kurtosis
Gender	.000*	-4.08	14.82
Location	.000*	-.45	-.76
Years Teaching	.120	.59	-.12
Grade	.001*	-.17	-1.26
MTEBI	.196	-.09	-.03
ILI	.002*	-1.10	.389
ILI squared	.058	-.60	-.61

Note. N=154. Normality was assessed using the Kolmogorov-Smirnov statistic for all variables except gender and location. Gender was assessed using a One-Sample Binomial Test. Location was tested with a One-Sample Chi-Square Test. Standard error (SE) for skewness =.196. Kurtosis SE =.389. *p < .05.

Multivariate analysis. Outliers were assessed again at the bivariate and multivariate level. While some extreme cases were noted, no observations were extreme on a sufficient number of variables and were therefore not excluded (Hair et al., 1998). Figure 1 displays a scatterplot of the standardized residuals to the predicted values of the MTEBI. The independent variables included in this analysis were years of teaching experience, school location, grade level taught, and the transformed ILI (ILI squared). Assumptions of linearity, normality, and homoscedasticity are met when residuals create

an approximate rectangular distribution and scores are concentrated along the center (Mertler & Vannatta, 2005), as is displayed in Figure 1.

Figure 1

Regression Standardized Residual Scatterplot

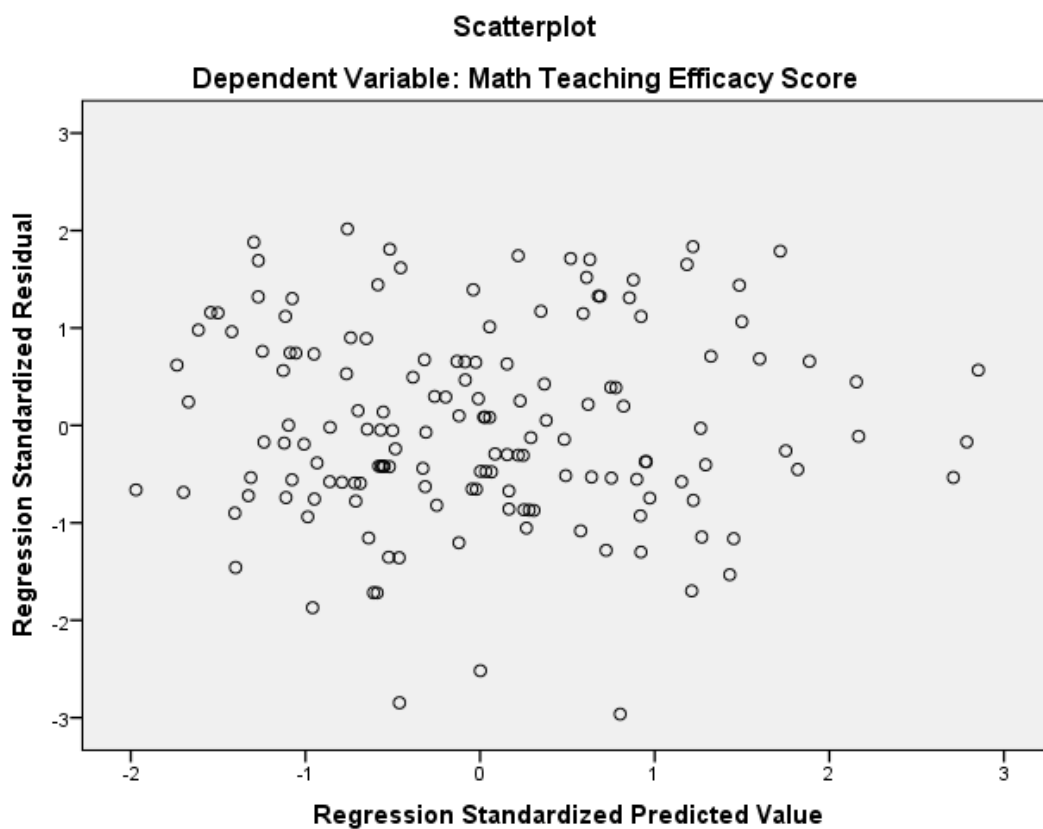


Figure 1. A scatterplot comparing the standardized residuals to the predicted values of the MTEBI scores.

Finally, collinearity diagnostics were performed to test for multicollinearity of predictors. As Table 5 reveals, tolerance and VIF values were within acceptable ranges indicating no multicollinearity issues.

Table 5

Collinearity Statistics

Model	Tolerance	VIF
Constant		
Years teaching	.986	1.014
Grade	.926	1.079
Urban vs. Suburban	.505	1.982
Rural vs. Suburban	.480	2.082
ILI squared	.945	1.058

Research Questions Analysis

Research questions from the study were aimed at identifying possible relationships of Alabama elementary teacher demographic variables (gender, years of teaching experience, grade level taught and school location) and their perceived level of principal instructional leadership with their mathematics teaching efficacy. Results of the statistical analysis performed to address each question are presented below.

Research question one. Research question one sought to answer if there was a relationship between mathematics teaching self-efficacy and grade level taught for Alabama elementary teachers. A simple linear regression between the MTEBI as the criterion variable and grade level taught as the predictor variable did not reveal a

significant relationship ($F(1, 152) = .014, p > .05$) with R^2 of .000. Grade level is not a significant predictor of mathematics teaching self-efficacy (Tables 6 and 7).

Table 6

Model Summary for MTEBI and Grade Linear Regression

Model	R	R^2	Adjusted R^2	SE of Estimate
1	.009	.000	-.006	5.363

Note. Predictors: (Constant), Grade. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Table 7

ANOVA for MTEBI and Grade Linear Regression

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.390	1	.390	.014	.907
Residual	4371.948	152	28.763		
Total	4372.338	153			

Note. Predictors: (Constant), Grade. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Research question two. The second research question focused on determining if a relationship exists between mathematics teaching self-efficacy and years of teaching experience for Alabama elementary teachers. A simple linear regression between mathematics teaching self-efficacy as the criterion variable and years of teaching

experience as the predictor variable did not reveal a significant relationship ($F(1, 152) = .816, p > .05$) with $R^2 = .005$. Years of teaching experience is not a significant predictor of mathematics teaching self-efficacy (Tables 8 and 9).

Table 8

Model Summary for MTEBI and Years of Teaching Experience Linear Regression

Model	R	R ²	Adjusted R ²	SE of Estimate
1	.073	.005	-.001	5.34899

Note. SE= Standard Error. Predictors: (Constant), Years teaching. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Table 9

ANOVA for MTEBI and Years of Teaching Experience Linear Regression

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	23.356	1	23.356	.816	.368
Residual	4348.981	152	28.612		
Total	4372.338	153			

Note. Predictors: (Constant), Years teaching. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Research question three. Research question three examined whether there was a relationship between mathematics teaching self-efficacy and gender among Alabama

elementary teachers. Due to the small sample of male subjects ($n = 8$), extreme caution must be taken in generalizing these results to the Alabama teaching population.

Nonetheless, the results of the Independent-Samples t-Test are presented for the reader's examination. Since the Levene's Test for Equality of Variances were not significant ($F = .055, p > .05$), equal population variance for males and females was assumed.

Mathematics teaching self-efficacy does not appear to be significantly different for males ($M = 58.00, SD = 4.87$) as compared to females ($M = 54.34, SD = 5.32$), $t(152) = 1.90, p > .05, d = .69$.

Research question four. The fourth research question focused on an exploration of the relationship between mathematics teaching self-efficacy and school location (urban, sub-urban, and rural). The Levene Statistic of .471, $p > .05$ indicated the assumption of equal variance had not been violated for these school location categories. Based on the one-way ANOVA test, mathematics teaching self-efficacy did not vary significantly between urban ($M = 52.94, SD = 4.48$), sub-urban ($M = 54.86, SD = 5.57$), and rural ($M = 54.62, SD = 5.31$), $F(2, 151), p > .05, \eta^2 = 0.0$.

Research question five. The fifth research question was aimed at determining if a relationship exists between mathematics teaching self-efficacy and the perceived instructional leadership of the principal by the teacher for Alabama elementary teachers. A simple linear regression model with mathematics teaching self-efficacy as the criterion variable and the transformed instructional leadership (ILI squared) as the predictor variable revealed that there was no significant relationship ($F(1, 152) = .372, p > .05$) with

$R^2=.002$. Principal instructional leadership is not a predictor of mathematics teaching self-efficacy (Tables 10 and 11).

Table 10

Model Summary for MTEBI and ILI Squared Linear Regression

Model	R	R^2	Adjusted R^2	SE of Estimate
1	.049	.002	-.004	5.35678

Note. SE= Standard Error. Predictors: (Constant), ILI squared. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Table 11

ANOVA for MTEBI and ILI Squared Linear Regression

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	10.688	1	10.688	.372	.543
Residual	4361.649	152	28.695		
Total	4372.338	153			

Note. Predictors: (Constant), ILI squared. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Research question six. The final research question posed by the investigator sought to answer whether there was a relationship between mathematics teaching self-efficacy and the linear combination of grade level taught, years of teaching experience,

gender, school location, and instructional leadership of the principal. A standard multiple regression analysis was performed using mathematics teaching self-efficacy as the criterion variable. Grade, years teaching, the dummy variables for school location (urban vs. suburban, rural vs. suburban), and the transformed ILI (ILI squared) were inputted as the predictor variables. Due to the small sample size of male participants ($n = 8$), gender was excluded from the multiple regression analysis. The linear combination of independent variables was not a significant predictor of mathematics teaching efficacy, $F(5,148) = .658$, $p > .05$, $R^2 = .022$ (Tables 12, 13, and 14).

Table 12

Model Summary for MTEBI and Linear Combination of Grade, Years Teaching, School Location, and ILI Squared Multiple Linear Regression

Model	R	R ²	Adjusted R ²	SE of Estimate
1	.147	.022	-.011	5.37589

Note. SE= Standard Error. Predictors: (Constant), Grade, Years Teaching, School Location (urban vs. suburban, rural vs. suburban), and ILI squared. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Table 13

ANOVA for MTEBI and Linear Combination of Grade, Years Teaching, School Location, and ILI Squared Multiple Linear Regression

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	95.102	5	19.020	.658	.656
Residual	4277.236	148	28.900		
Total	4372.338	153			

Note. Predictors: (Constant), ILI squared. Predictors: (Constant), Grade, Years Teaching, School Location (urban vs. suburban, rural vs. suburban), and ILI squared. Dependent variable: Mathematics teaching self-efficacy (MTEBI).

Table 14

Coefficients Model for Multiple Linear Regression

Model	Unstandardized		Standardized	t	Sig.
	Coefficients		Coefficients		
	B	Std. Error	Beta		
(Constant)	52.433	1.704		30.780	.000
Grade	.041	.262	.013	.155	.877
Years teaching	.050	.053	.078	.951	.343
Urban vs. Suburban	-1.200	.900	-.153	-1.333	.184
Rural vs. Suburban	.381	.666	.067	.572	.568
ILI squared	.000	.000	.066	.793	.429

Note. Dependent variable = Mathematics teaching self-efficacy (MTEBI).

Summary of Findings

The statistical analysis of data revealed that none of the independent variables tested, including grade level taught, years of teaching, gender, school location, and ILI (specifically the transformed squared ILI), had a significant relationship with mathematics teaching self-efficacy independently or in a combined multiple regression model. These results suggested that mathematics teaching self-efficacy of Alabama elementary teachers cannot be predicted based on the independent variables tested in this study. A discussion of these results, including a comparison to previous research,

implications for instructional leaders, and suggestion for future research, is subsequently presented.

CHAPTER FIVE

Discussion

This chapter is focused on a discussion of the results and its implications for educational leaders. The chapter begins with a brief overview of the study including the rationale for the study, research goals, methodology, and sample description. Next, the results of each research question are explained and compared to previous studies, including implications of the findings for educational leaders. This is followed by suggestions for future research. The chapter concludes with a discussion of the overall findings on mathematics teaching self-efficacy and principal instructional leadership.

Overview of Study

Rationale for study. As education leaders, principals are under enormous pressure to assist their teachers in the implementation of the new, rigorous, Mathematics Common Core Standards. This pressure stems from national-, state- and local- level concerns of poor mathematics performance (Ball, 2008; Education, 2011; Lips & McNeill, 2009) and the fact that the new Mathematics Common Core Standards requires revolutionary changes in mathematics instructional practices (Achieve3000, 2012).

One factor found to improve student achievement and teacher performance, even during periods of educational reform, is teaching efficacy (De Mesquita & Drake, 1994; Guskey, 1988; Guskey & Passaro, 1994; Tschannen-Moran & Woolfolk Hoy, 2001).

Furthermore, there is evidence that the instructional leadership of principals can influence teaching efficacy (Blase & Blase, 2000; Çalik et al., 2012; Walker & Slear, 2011). No prior research, however, has been conducted to examine the influence of principal instructional leadership on any specific subject- level efficacy.

Research goals. Based on the findings that (a) teaching efficacy is subject- and context- specific (Tschannen-Moran et al., 1998), (b) general teaching self-efficacy is not a predictor of mathematics teaching self-efficacy (Rimpola, 2011), and (c) only two studies exist on the mathematics teaching self-efficacy of in-service teachers (Rimpola, 2011; Turner et al., 2004), an examination of principal instructional leadership and its impact specifically on the mathematics teaching self-efficacy was warranted. As such, this study was designed to quantitatively evaluate possible relationships between the instructional leadership of principals and the mathematics teaching self-efficacy of in-service, elementary teachers across Alabama. Furthermore, relationships between mathematics teaching self-efficacy and demographic variables such as gender, years of teaching experience, grade level taught, and school location were examined in an effort to find predictors of mathematics teaching self-efficacy that could assist principals in identifying and supporting teachers with potentially lower levels of mathematics teaching self-efficacy.

Methodology. To collect data for this study, an on-line survey was sent to all Alabama school district research gatekeepers for dissemination to their grades K-5 elementary teachers with at least one year of experience with their current principal. In addition to demographic questions on gender, years of teaching experience, years

working with current principal, grade(s) taught, and school location, a measure of each teacher's mathematics teaching self-efficacy was obtained using the personal mathematics teaching efficacy subscale of the Mathematics Teaching Efficacy Belief Instrument (MTEBI) developed and validated by Enochs et al. (2000). The perceived level of instructional leadership of his or her principal was measured using the Instructional Leadership Inventory (ILI) developed and validated by Alig-Mielcarek (2003). Data gathered via this on-line survey were statically evaluated using SPSS software. Statistical analysis included a descriptive analysis of all variables, t-tests, ANOVA, linear regression, and multiple linear regression.

Sample description. After the removal of incomplete surveys and one outlier, a sample size of 154 participants was used to answer each research question. The sample consisted of 8 male teachers and 146 female teachers, representing all grade K-5 levels fairly equally, and with a wide range (1-35) of years of teaching experience (mean=14 years teaching experience). Participants were from a variety of Alabama schools and school districts based on the distribution of school locations (urban= 18 participants, sub-urban= 71 participants, rural=65 participants). The distribution of teachers in this sample were statistically similar to the general Alabama teaching population (see Table 2). A discussion of the findings for each research question follows.

Discussion of Research Question One

No significant relationship was found between mathematics teaching self-efficacy and grade level among Alabama elementary teachers. With the knowledge that teaching

efficacy is context-specific (Bandura, 1997; Tschannen-Moran et al., 1998) and not uniform against different types of teaching tasks known to exist across different grade levels (A. W. Hoy, 2000), it was important to assess whether a relationship between grade level and mathematics teaching efficacy exists.

One might argue that as grade level increases, so does the complexity of mathematics concepts, resulting in potentially lower mathematics teaching self-efficacy. This is logical knowing that (a) one's own mathematics efficacy, described as a person's belief that he or she can perform the mathematics task at hand, decreases when the mathematics task is perceived to be difficult; and (b) decreased mathematics self-efficacy correlates with a decreased mathematics teaching self-efficacy. (Bates et al., 2011; Briley, 2012). Unfortunately, a teacher's own mathematics efficacy was not assessed in this study, nor is there prior research to validate a relationship between mathematics self-efficacy of the teacher and grade level taught.

The researcher also postulated that since the participants in this study were mainly experienced teachers (mean of teaching experience = 14 years) and mathematics teaching self-efficacy is known to increase with mastery experience (Turner et al., 2004), perhaps years of experience needed to be controlled for in assessing the relationship between mathematics teaching self-efficacy and grade level taught. When Tschannen-Moran and Woolfolk Hoy (2007) compared novice teachers (0-3 years of experience) with career teachers (4+ years of experience), they noted school level (elementary, middle, and high school) impacted the teaching efficacy of only career teachers. Despite controlling for years of experience, a relationship between mathematics teaching self-efficacy and grade

was not found in this study. It is important to note, however, that this study asked participants to report their total years of experience, not the years of experience teaching their current grade. Therefore, it cannot be assumed that the total years of experience was spent teaching the same material and that an increase in the mastery experiences of teaching that particular grade occurred. Furthermore, although Tschannen-Moran and Woolfolk Hoy (2007) found teaching efficacy was higher at the elementary level compared to middle school and high school for career teachers, a direct comparison of our studies cannot be made because they did not break down each school level by grade.

Implications for educational leaders. The results suggest that mathematics teaching self-efficacy cannot be predicted by grade. As such, if elementary principals wish to increase the mathematics teaching self-efficacy of their teachers, they should not focus on any particular grade. Principals might, however, focus their attention on teachers who are switching grades. There is evidence to suggest that when teachers are faced with teaching new material or required to implement new teaching strategies, an increase in mathematics teaching anxiety and a decrease in mathematics teaching self-efficacy can ensue (Gresham, 2009).

Discussion of Research Question Two

The goal of the second research question was to evaluate the relationship, if any, between mathematics teaching self-efficacy and years of teaching experience. The current study did not reveal any significant relationship between the two variables, indicating that years of teaching experience is not a predictor of mathematics teaching

self-efficacy in Alabama elementary teachers. Based on the researcher's extensive review of the literature on teaching efficacy, this finding is valuable, as other researchers have not examined the impact of years of teaching experience on specifically mathematics teaching self-efficacy. Instead, researchers in this field have investigated the relationship between teaching experience and teaching efficacy in general.

In their assessment of the literature on teacher experience as an antecedent of teaching efficacy, Wolters and Daugherty (2007) noted mixed results. For example, W. K. Hoy and Woolfolk (1993), in their study involving 179 elementary in-service teachers, did not find a significant relationship between teaching efficacy and years of experience. In contrast, Ross, Cousins, and Gadalla (1996) discovered that increased teaching efficacy was associated with greater teaching experience in the 92 high-school teachers they studied. Wolters and Daugherty (2007) argued that both studies should be interpreted with caution due to their relatively small sample sizes and restricted range of teaching experience. By including 1,024 teachers from across all grades (preK-12) from a large suburban school district in Texas, Wolters and Daugherty (2007) found stronger evidence that a moderate relationship between teaching efficacy and teaching experience exists, $F(3, 1012) = 13.04, p < .001$. A post-hoc analysis of these results revealed that first year teachers reported significantly lower levels of efficacy than teachers with more than one year of experience. Teachers with 1-5 full years of teaching had significantly lower teaching efficacy scores compared to teachers with more experience. Finally, no difference in teaching efficacy was found between teachers with 6-10 years versus 11 or more years.

While this study does not support the findings of Wolters and Daugherty (2007), there may be two significant reasons. First, this sample included very few first year teachers ($n=4$), and it appears that teaching efficacy is often significantly different in the first year (Tschannen-Moran & Woolfolk Hoy, 2001; Wolters & Daugherty, 2007). Furthermore, participants in this sample reported high levels of experience (mean= 14 years), and based on Wolters' and Daugherty's (2007) findings, teaching efficacy does not vary significantly past 6 years. If the current study included more new teachers, a relationship between mathematics teaching self-efficacy and years of experience may have been noted.

The second possible reason why this study did not support the finding of Wolters and Daugherty (2007) is that we used two different constructs of teaching efficacy. Wolters and Daugherty were focused on measuring teaching efficacy using the Teachers Sense of Efficacy Scale (TSES). This study, however, was focused on specifically measuring mathematics teaching self-efficacy. Evidence exists that demonstrates that these two constructs are independent of each other and that teaching efficacy is not a predictor of mathematics teaching efficacy (Rimpola, 2011; Tschannen-Moran et al., 1998).

Implications for educational leaders. The results of this study imply that principals should not use years of experience as a predictor for mathematics teaching efficacy in their school. However, these results need to be interpreted conservatively due to the low number of new teachers and high average of teaching experience for this sample. Based on previous research findings (Tschannen-Moran & Woolfolk Hoy, 2007;

Wolters & Daugherty, 2007; Woolfolk Hoy, 2000) which indicated that (a) mathematics teaching efficacy fluctuates dramatically in the first years and does not stabilize until after 3 years; and (b) teaching efficacy is significantly lower for first year teachers compared to teachers with more experience, educational leaders should focus their attention on increasing the mathematics teaching self-efficacy of new teachers.

Discussion of Research Question Three

The third research question focused on evaluating a possible relationship between mathematics teaching self-efficacy and gender. No significant relationship was found between the two variables. However, these results are inconclusive due to the small sample of male teachers (n=8).

Assessing a relationship between gender and mathematics teaching self-efficacy was important, as no previous studies have examined the effect of gender on specifically mathematics teaching efficacy. Two other studies by W.K Hoy and Woolfolk (1993) and Tschannen-Moran and Woolfolk Hoy (2007) have examined the role of gender on teaching efficacy. Their investigations, similar to this study, did not reveal a significant gender effect.

Implications for educational leaders. The results of this study and previous research suggest that gender is not a significant predictor of mathematics teaching efficacy and therefore should not be used as a factor in identifying teachers with possibly low levels of mathematics teaching self-efficacy.

One may argue that identifying gender differences in the elementary teaching population is not valuable given that over 90% of teachers are female at both the state and national level (Beilock, Gunderson, Ramirez, & Levine, 2010). However, the researcher argues that when such a large population of females are teaching at the elementary level, educational leaders must be especially aware of any female-biased educational issues. One such issue related to mathematics teaching self-efficacy is mathematics teaching anxiety. Beilock et al. (2010) found that by the end of the school year, the higher a female teacher's mathematics anxiety, the more likely that the girls in the classroom, but not the boys, were to endorse the stereotype that "boys are good at mathematics, and girls are good at reading." Furthermore, girls who endorsed this stereotype had significantly lower mathematics achievement than the boys. These results suggest that if a female teacher's anxiety about mathematics is not reduced, it can dramatically influence the beliefs and mathematics performance of female students. This creates a cyclical problem in which female students, who may later become teachers themselves, may develop mathematics anxiety that is known to reduce mathematics teaching self-efficacy (Gresham, 2009). To end this vicious cycle and subsequently increase mathematics achievement, principals should monitor the levels of mathematics teaching self-efficacy and possibly mathematics anxiety of female teachers and students.

Discussion of Research Question Four

No significant differences in mathematics teaching self-efficacy was found between urban, sub-urban, and rural school locations, implying that school location should not be used as a predictor for mathematics teaching self-efficacy.

Comparing this finding to previous research is difficult because no one has studied the effects of school location on mathematics teaching self-efficacy. Only one study could be found that evaluated the impact of school location on teaching efficacy (Tschannen-Moran & Woolfolk Hoy, 2007); similar to this study, no relationship was found. Compared to teaching efficacy, there are more studies that have investigated the relationship between school location and student achievement. With the knowledge that teaching efficacy is known to influence student achievement (Allinder, 1995; Ashton & Webb, 1986; Ross, 1992), the relationship between student achievement and school location is examined here.

Multiple studies have explored the effect of school location on student performance and have revealed mixed results (Fan & Chen, 1999; Grissmer, Flanagan, Kawartha, & Williamson, 2000; Isreal, Beaulieu, & Hartless, 2001; Reeves & Bylund, 2005; Roscigno & Crowley, 2001). In an assessment of the literature on school location and student performance, Reeves and Bylund (2005) asserted that it is logical that divergent results occurred due to differences in problem orientation, research designers, and definitions of variables. For example, Fan and Chen (1999) used the categories of rural, suburban, and urban schools, noting that rural students performed as well as, and in some subject areas better than, their peers in the other locations. Grissmer et al. (2000),

however, in their state-to-state comparison of performance using NAEP test scores and the location indicators of urban, suburban, and rural, did not find a significant relationship between the two variables. To increase sensitiveness to differences among non-metro areas, Reeves and Bylund (2005) used the categories of Metro County (similar to urban in this study), Adjacent-nonmetro, Large town-nonmetro (>10,000), Small town-nonmetro (2,500-9,999), and Rural-nonmetro (<2,500). Instead of measuring final performance, Reeves and Bylund (2005) studied mean annual gains in performance and found that rural schools performance was equal to or better the urban schools.

Comparison of this study to the studies which used rural, suburban, and urban categories (Fan & Chen, 1999; Grissmer et al., 2000) is not directly possible due to the difference in operationalization of categories; these researchers used the Beal code definition of rural (a local that is outside a Metropolitan Statistical Area), while the current researcher defined categories by population size limits (Ex. Rural= 5,000 residents or less). Nonetheless, the results of this study are most similar to Grissmer et al. (2000) finding, in the sense that variance in our measured dependent variable cannot be explained by location.

Implications for educational leaders. In this study, identification of school location enabled the researcher to ensure the data was representative of multiple schools and/or school districts, permitting greater generalization to Alabama schools. The finding that school location does not seem to be related to mathematics teaching self-efficacy is especially helpful for school district and state level leaders, as it implies such leaders should not concentrate their efforts on increasing mathematics teaching self-

efficacy based on location. If state and local leaders wish to assist Alabama elementary teachers in increasing mathematics teaching self-efficacy, especially during this period of Mathematics Common Core Standards implementation, they need to extend their assistance to all elementary teachers. Considering that the highest mathematics teaching self-efficacy score possible on the MTEBI is 65 points and the mean score for this sample was 54 points, there is an opportunity to increase mathematics teaching self-efficacy in Alabama elementary teachers.

Discussion of Research Question Five

Given state and local pressures on principals to assist teachers in implementing the new Mathematics Common Core Standards, it was important to assess the relationship, if any, between the instructional leadership of principals and mathematics teaching self-efficacy. Results of this study indicate that a significant relationship between teacher perception of principal instructional leadership and mathematics teaching self-efficacy does not exist. This finding is somewhat surprising, given that only a positive relationship has been found in all known published studies conducted thus far on principal instructional leadership and teaching efficacy in general (Blase & Blase, 2000; Çalik et al., 2012; Walker & Slear, 2011) . There are several possible reasons why this study did not support previous research findings, as will be subsequently addressed.

As mentioned in this study's literature review, multiple models and interpretations of instructional leadership exist, although similarities can be found between these models. To explain why this study did not support previous research, differences in the

instructional leadership model of each study were compared to the ILI used in this study. A comparison of leadership models could not be performed with the study by Çalik et al. (2012) as they did not disclose the components used to assess instructional leadership.

One aspect of instructional leadership lacking in the ILI model but found to impact teaching efficacy in both the studies by Blase and Blase (2000) and Walker and Slear (2011) was modeling of effective instructional practices and instructional expectations by the principal. Even when years of experience was factored in with teaching efficacy, Walker and Slear (2011) revealed that modeling accounted for the largest difference between the various groups organized by years of experience. The only group in which modeling was not found to impact teaching efficacy were teachers with 15 or more years of experience. Furthermore, the only factor found to correlate with teaching efficacy in the 0-3 years of teaching experience was modeling. These results suggest that modeling is an essential component of instructional leadership, especially for new teachers (defined as having 0-3 years of experience) and teachers with less than 15 years of experience. Therefore, the lack of a strong modeling component in the ILI may explain why a relationship between mathematics teaching self-efficacy and principal instructional leadership was not found, especially with teachers with less than 15 years of experience.

Considering that over 65% of the participants in this study had greater than 10 years of experience, which is representative of the Alabama elementary teaching population, there was a need to understand whether principals can impact the teaching efficacy of these seasoned teachers who represent the majority of teachers in Alabama.

Walker and Slear (2011) postulated that teachers with more than 15 years of experience had an abundance of mastery experiences such that modeling by the principal was not needed and therefore did not influence teacher efficacy. What they did find, however, is that teaching efficacy for this group with 15 or more years experiences was influenced by the principal defining the group purpose and creating an environment in which they could collaborate to accomplish shared goals. While the ILI has components addressing shared goals and one item pertaining to the scheduling of teacher collaboration during in-services, it does not heavily emphasize creating collaboration opportunities between teachers on an on-going basis. This lack of a collaboration emphasis in the ILI may explain the non-correlation between mathematics teaching self-efficacy and instructional leadership in this study, especially since the majority of participants were seasoned teachers.

Another instructional leadership component found to increase teaching efficacy, but deficient in the ILI is that of coaching. Blase and Blase (2000) discovered that developing and promoting coaching relationships as part of promoting professional growth was important in increasing teaching efficacy. Bearing in mind the challenges faced by principals in acting as a mathematics coach to faculty due to restrictions such as time and/or knowledge of effective mathematics teaching strategies, it seems logical that promoting coaching by teachers with expertise in mathematics has the potential to increase mathematics teaching efficacy. This notion is supported by (Hallinger, 2003) who argued that when the principal acts as the sole instructional leader, organizational and instructional improvement is not sustainable. Hallinger (2003), suggested using an

integrated model of leadership that contains elements of both instructional and transformational leadership in which there is shared instructional leadership.

Implications for educational leaders. The successful implementation of the Mathematics Common Core Standards will fall on the shoulders of educational leaders, in particular principals. While a direct, significant correlation was not found between mathematics teaching self-efficacy and principal instructional leadership, it may be due to the ILI's lack of modeling, on-going collaboration, and coaching elements found to be significant factors in other studies on instructional leadership and teacher efficacy (Blase & Blase, 2000; Walker & Slear, 2011).

Principals should not and cannot afford to believe that impacting mathematics teaching self-efficacy is beyond their control. One must understand that as a cross-sectional study, this investigation measured current levels of mathematics teaching self-efficacy, not changes in mathematics teaching self-efficacy. Evidence from other studies indicate that increasing mathematics teaching self-efficacy is possible with the right professional development (Rethlefsen & Park, 2011; Turner et al., 2004). Although the ILI included a detailed professional development subscale, it did not specifically measure the quality of mathematics instructional professional development. Instead, it queried teachers to evaluate the professional development in general provided by principals.

In their assessment of mathematics and science professional development for teachers during reform periods, Stein and Mundry (1999) asserted that school leaders must play an active role in the design of professional development and continually assess its effectiveness as policy mandates change, and teachers grow and learn. The question

instructional leaders must ask themselves as we implement the Mathematics Common Core Standards is, “What constitutes effective professional development that will result in increased mathematics teaching self-efficacy and lead to implementation of the new teaching task(s) or method(s) deemed necessary by the new standards?”

The study by Turner et al. (2004) provides some answers to this question. The mathematics teaching self-efficacy of in-service teachers was significantly increased by providing extensive, multiple-day training in which NCTM best practices were modeled by teacher experts, collaboratively discussed, and practiced by participants in a supportive environment during the training. In other words, teachers were exposed to multiple sources of self-efficacy (mastery experience, vicarious experience, and verbal persuasion). The importance of including multiple sources of self-efficacy in professional development to increase teaching self-efficacy is supported by multiple researchers (Henson, 2001; Stein & Wang, 1988; Tschannen-Moran & McMaster, 2009).

Of the studies done to evaluate professional development best practices to increase teaching efficacy, the recent work by Tschannen-Moran and McMaster (2009) is of great importance to this study as it provides additional evidence that principals must provide opportunities for modeling, collaboration, and especially coaching to increase teaching efficacy. Tschannen-Moran and McMaster (2009) tested four professional development models to learn a new literacy technique using different and varying sources of self-efficacy. Treatment group one received information only, experiencing only verbal persuasion. Treatment group two received information and an opportunity to see the instructor model the new technique, thereby adding vicarious experience. In addition

to what treatment group two received, treatment group three was afforded an additional 1.5 hour practice session, thereby adding mastery experience. The final treatment group received all the treatments mentioned thus far and follow-up coaching, in which the expert trainer provided one-on-one assistance in the classroom. This coaching element provided stronger mastery experience, personalized verbal persuasion, and additional vicarious experience. Of all the models tested, treatment four with the coaching showed the greatest increasing in teaching efficacy. Those individuals in treatment three who did not receive follow-up coaching actually experienced a decrease in their teaching efficacy. These results emphasize the need for principals to include coaching as part of professional development. Furthermore, if principals cannot provide the on-going coaching themselves, there is a need for collaborative, shared instructional leadership in which teacher experts must be identified and given the time to coach their colleagues.

District leaders who are contemplating the provision of mathematics coaches should examine the extensive three-year, randomized, control study by P. F. Campbell and Malkus (2011). These researchers found that when mathematics coaches were extensively trained, they had a significant positive impact on grades 3-5 student achievement. However, the effect on student achievement did not emerge until after the completion of the first year. The researchers postulated that the coaches needed this time to gain experience and learn how to work together with administration. Furthermore, coaches who were highly engaged with a teacher were able to significantly impact his or her beliefs about mathematics teaching.

Discussion of Research Question Six

The final research question was aimed at evaluating a possible relationship between mathematics teaching self-efficacy and the linear combination of grade level, years of teaching experience, gender, school location, and principal instructional leadership among Alabama elementary teachers. As mentioned previously, gender was excluded from the final regression analysis due to the small sample of male participants ($n = 8$). Although a relationship between mathematics teaching self-efficacy and each of the independent variables was not found, it was valuable to test whether there was a combined effect of the variables. Data analysis, however, did not reveal a significant combined effect of the independent variables. Consequently, a model to predict mathematics teaching self-efficacy of Alabama elementary teachers did not emerge in this study.

Comparison of this finding to previous research is difficult, as no other study has examined the combined effect of these variables specifically with mathematics teaching self-efficacy. This study does, however, support the finding of Tschannen-Moran and Woolfolk Hoy (2007) who measured the combined effect of gender, school location, years of teaching experience and interpersonal support on the teaching efficacy of 255 elementary, middle, and high school teachers and found no relationship. However, when they separated the teachers by years of experience into either the novice (0-3 years of teaching experience) or the career teaching group (4+ years of experience), the teaching efficacy of novice teachers only was significantly and positively influenced by

interpersonal support from colleagues, and the community. Interpersonal support from administration was not found to influence teaching efficacy for either group.

Implications for educational leaders. Unfortunately, a model to predict mathematics teaching self-efficacy for in-service, Alabama elementary teachers was not found. Given the immediate need to successfully implement the Mathematics Common Core Standards, and the paucity of research on mathematics teaching self-efficacy of in-service teachers, additional research on how instructional leaders can influence mathematics teaching self-efficacy is needed. In the meantime, educational leaders need to consider the implications presented thus far for each variable. Suggestions for future research to investigate the relationship between principal instructional support and mathematics teaching self-efficacy are presented next.

Suggestions for Future Research

Prior to this study, research had not been conducted to evaluate the relationship between mathematics teaching self-efficacy of in-service teachers and principal instructional leadership. Hence, these results are groundbreaking and further research is required to refute or substantiate the findings.

Although previous studies (Tschannen-Moran & Woolfolk Hoy, 2007; Woolfolk Hoy, 2000) were able to show that teaching efficacy is lower for novice teachers and rely more on interpersonal support, this study could not corroborate these findings due to the extremely small sample size of novice participants. As such, further research is needed to

understand how educational leaders may increase novice teacher mathematics teaching self-efficacy. Focusing future research on principal support of novice teachers is substantiated by Tschannen-Moran and Woolfolk Hoy (2007) who imply that the reason why so many novice teachers leave the teaching field is due to their reported lower levels of teaching efficacy compared to career teachers.

Although a focus on novice teachers is necessary, there is much to be understood about the mathematics teaching self-efficacy of career teachers that constitute the majority of the Alabama teaching population. As a cross-sectional study, this research was the first to provide a snapshot of mathematics teaching self-efficacy levels for Alabama elementary teachers. A mixed-method longitudinal study to measure changes in mathematics teaching self-efficacy as teachers continue to implement the Mathematics Common Core Standards is needed, using qualitative analysis to identify instructional leadership components that may increase mathematics teaching self-efficacy. Factors such as the principal's own mathematics efficacy, levels of mathematics modeling, quality of mathematics coaching provided, opportunities for ongoing collaboration to work toward school-wide mathematics goals, and quality of extensive mathematics professional development need to be examined.

Finally, since general instructional leadership is correlated with general teaching efficacy, perhaps there is a stronger relationship between specifically mathematics instructional leadership and mathematics teaching self-efficacy. Testing this theory would first require the development of a valid and reliable mathematics instructional leadership tool. Development of such an instrument would be of immediate value across

the nation, as educational leaders from numerous states attempt to successfully implement the Mathematics Common Core Standards.

Conclusion

The paucity of research on mathematics teaching self-efficacy, especially among in-service teachers inspired the researcher to question what might Alabama educational leaders do to increase mathematics teaching self-efficacy of elementary teachers, knowing that teaching efficacy leads to increased student achievement and impacts reform efforts (Allinder, 1995; Ashton & Webb, 1986; Guskey, 1988; Ross, 1992; Stein & Wang, 1988). Although significant relationships were not found between mathematics teaching self-efficacy, principal instructional leadership, and demographic variables including grade level taught, years of teaching experience, gender, and school location, the results of this study are groundbreaking and provide a baseline of data for future research on this topic. Furthermore, analysis of the data and comparison to previous literature revealed several implications for education leaders. For example, educational leaders cannot rely on the demographic variables tested to predict mathematics teaching self-efficacy. As Walker and Slear (2011) realized, principals must be ready to approach teachers differently to build teaching efficacy due to differences in the quality and quantity of teaching experiences. Bearing in mind the sources of efficacy (mastery experiences, vicarious experiences, verbal persuasion, and physiological cues), mathematics teaching self-efficacy may be increased with greater efforts by the principal to model mathematics instructional practices and provide more extensive mathematics

professional development that includes opportunities for collaboration and coaching.

Given the impending release of new science standards in Alabama and the positive correlation between mathematics and science teaching self-efficacy (Bursal & Paznokas, 2006), educational leaders must continue the research to understand how they can positively impact mathematics teaching self-efficacy of in-service teachers.

References

- Achieve3000. (2012). 10 steps for migrating your curriculum to the common core.
Retrieved from www.eschoolnews.com/files/2012/03/ACH11c9-CommonCore-W1.pdf
- Alig-Mielcarek, J. M. (2003). *A model of school success: Instructional leadership, academic press, and student achievement*. (Doctor of Philosophy Dissertation), Ohio State University, UMI- Dissertations Publishing.
- Alig-Mielcarek, J. M., & Hoy, W. K. (2004). Instructional leadership: Its nature, meaning, and influence. In W. K. Hoy & C. G. Miskel (Eds.), *Educational Leadership and Reform* (pp. 29-51): Informational Age Publishing, Inc.
- Allinder, R. M. (1995). An examination of the relationship between teaching efficacy and curriculum-based measurement and student achievement. *Remedial and Special Education*, 27, 141-152.
- Ashton, P. T. (1984). Teacher efficacy: A motivational paradigm for effective teacher education. *Journal of Teacher Education*, 35, 28-32.
- Ashton, P. T., Doda, N., & Webb, R. B. (1983). A study of teacher's sense of efficacy. Final report to the National Institute of Education, Executive Summary. Gainesville: University of Florida.
- Ashton, P. T., & Webb, R. B. (1986). *Making a difference: Teachers' sense of efficacy and student achievement*. New York: Longman.
- Ball, D. L. (2008). Improving mathematics learning: Where are we and where do we need to head?, 1-10. Retrieved from www.opportunityequation.org
- Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, N.J.: Prentice Hall.

- Bandura, A. (1986). *Social foundations of thought and action : a social cognitive theory*. Englewood Cliffs, N.J.: Prentice-Hall.
- Bandura, A. (1997). *Self-efficacy : the exercise of control*. New York: W.H. Freeman.
- Bates, A. B., Latham, N., & Kim, J. (2011). Linking preservice teachers' mathematics self efficacy and mathematics teaching efficacy to their mathematical performance. *School Science and Mathematics, 111*(7), 325-333.
- Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2010). Female teachers' math anxiety affects girl's math achievement. *Proceedings of the National Academy of Sciences of the United States of America, 107*(5), 1860-1863.
- Blase, J., & Blase, J. (2000). Effective instructional leadership: Teachers' perspective on how principals promote teaching and learning in school. *Journal of Educational Administration, 38*(2), 130-141.
- Briley, J. S. (2012). The relationships among mathematics teaching efficacy, mathematics self-efficacy, and mathematical beliefs for elementary pre-service teachers. *Issues in the Undergraduate Mathematics Preparation of School Teachers, 5*, 1-13.
- Brown, A. B. (2012). Non-traditional preservice teachers and their mathematics efficacy beliefs. *School Science & Mathematics, 112*(3), 191-198. doi: 10.1111/j.1949-8594.2011.00132.x
- Bursal, M., & Paznokas, L. (2006). Mathematics anxiety and preservice elementary teachers' confidence to teach mathematics and science. *School Science and Mathematics, 106*(4), 173-180. doi: 10.1111/j.1949-8594.2006.tb18073.x
- Çalik, T., Sezgin, F., Kavgaci, H., & Kilinc, A. C. (2012). Examination of relationships between instructional leadership of school principals and self-efficacy of teachers

- and collective teacher efficacy. *Educational Sciences: Theory & Practice*, 12(4), 2498-2504.
- Campbell, J. (1996). A comparison of teacher efficacy for pre- and in-service teachers in Scotland and America. *Education*, 117, 2-12.
- Campbell, P. F., & Malkus, N. N. (2011). The impact of elementary mathematics coaches on student achievement. *Elementary School Journal*, 111(3), 430-454.
- Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th Ed.)*. Boston, MA: Pearson Education, Inc.
- Czaja, R., & Blair, J. (2005). *Designing surveys: A guide to decisions and procedures (2nd ed.)*. Thousand Oaks, CA: Pine Forge Press.
- De Mesquita, P. B., & Drake, J. C. (1994). Educational reform and self-efficacy beliefs of teachers implementing nongraded primary school programs. *Teaching and Teacher Education*, 10(3), 291-302.
- Dembo, M. H., & Gibson, S. (1985). Teachers' sense of efficacy: An important factor in school improvement. *Elementary School Journal*, 86, 173-184.
- Education, U. S. D. o. (2011). Improving science, technology, engineering, and mathematics (STEM) education. Retrieved from www2.ed.gov/.../overview/budget/budget12/crosscuttingissues/stemed.pdf
- Enochs, L. G., Smith, P. L., & Huinker, D. (2000). Establishing factorial validity of the mathematics teaching efficacy beliefs instrument. *School Science & Mathematics*, 100(4), 194-202.

- Fan, X., & Chen, M. J. (1999). Academic achievement of rural school students: A multi-year comparison with their peers in suburban and urban schools. *Journal of Research in Rural Education*, 15, 31-46.
- Fives, H. (2003). *What is teacher efficacy and how does it relate to teachers' knowledge?: A theoretical review*. Paper presented at the American Educational Research Association Annual Conference, Chicago.
- Fowler, F. J. (2009). *Survey research methods (4th ed.)*. Los Angeles, CA: Sage.
- George, D., & Mallery, P. (2007). *SPSS for Windows step by step: A simple guide and reference 14.0 update (7th ed.)*. New York, NY: Pearson Education, Inc.
- Gibson, S., & Dembo, M. H. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology*, 76, 569-582.
- Goddard, R. D. (2001). Collective efficacy: A neglected construct in the study of schools and student achievement. *Journal of Educational Psychology*, 93(3), 467-476.
- Gravetter, F., & Wallnau, L. (2009). *Statistics for the behavioral sciences (8th Ed.)*. Belmont, CA: Wadsworth.
- Gresham, G. (2009). An examination of mathematics teacher efficacy and mathematics anxiety in elementary pre-service teachers. *Journal of Classroom Interaction*, 44(2), 22-38.
- Grissmer, D. A., Flanagan, A., Kawartha, J., & Williamson, S. (2000). Improving student achievement: What state NAEP scores tell us. Santa Monica, CA: RAND.
- Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes towards the implementation of instructional innovation. *Teaching and Teacher Education*, 4, 63-69.

- Guskey, T. R., & Passaro, P. D. (1994). Teacher efficacy: A study of construct dimensions. *American Educational Research Journal*, 31(3), 627-643.
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). Upper Saddle River, NJ: Prentice-Hall, Inc.
- Hallinger, P. (2003). Leading educational change: Reflections on the practice of instructional and transformational leadership. *Cambridge Journal of Education*, 33(3), 329-351.
- Hallinger, P. (2005). Instructional leadership and the school principal: A passing fancy that refuses to fade away. *Leadership and Policy in Schools*, 4(3), 221-239.
- Hallinger, P., & Murphy, J. (1985). Assessing the instructional management behavior of principals. *Elementary School Journal*, 86(2), 217-247.
- Hart, L. C., Smith, M. E., Smith, S. Z., & Swars, S. L. (2007). A longitudinal study of elementary preservice teachers' mathematics pedagogical and teaching efficacy beliefs. *School Science and Mathematics*, 107(8), 325-335.
- Henson, R. K. (2001). *Teacher self-efficacy: Substantive implications and measurement dilemmas*. Paper presented at the Annual Meeting of the Educational Research Exchange, College Station, TX.
- Hipp, K. (1995). *Exploring the relationship between principals' leadership behaviors and teachers' sense of efficacy in Wisconsin middle schools*. Paper presented at the American Educational Research Association, New York.
- Hoy, A. W. (2000). *Changes in teacher efficacy during the early years of teaching*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans.

- Hoy, W. K., & Miskel, C. G. (2008). *Educational administration: Theory, research, and practice (8th ed.)*. New York, N.Y.: McGraw Hill.
- Hoy, W. K., & Woolfolk, A. E. (1993). Teachers' sense of efficacy and the organizational health of schools. *Elementary School Journal*, 93, 355-372.
- Initiative, C. C. S. S. (2012). Implementing the common core state standards. Retrieved from <http://www.corestandards.org/in-the-states>
- Isreal, G. D., Beaulieu, L. J., & Hartless, G. (2001). The influence of family and community social capital on educational achievement. *Rural Sociology*, 66, 43-68.
- Johnson, E. B. (2011). U.S. economic future needs STEM education. *National Math and Science Initiative*. Retrieved from <http://www.nationalmathandscience.org/newsroom/article/us-economic-futureneeds-stem-education>
- Klump, J., & Barton, R. (2007). Building instructional leadership. *Principal's Research Review*, 2(5), 1-6.
- Lips, D., & McNeill, J. B. (2009, April 15, 2009). A new approach to improving science, technology, engineering, and math education. *Backgrounder*, 1-10.
- Mertler, C. A., & Vannatta, R. A. (2005). *Advanced multivariate statistical methods: Practical application and interpretation (3rd ed.)*. Glendale, CA: Pyrczak Publishing.
- Mickey, R. M., Dunn, O. J., & Clark, V. A. (2004). *Applied statistics: Analysis of variance and regression (3rd ed.)*. Hoboken, NJ: John Wiley & Sons, Inc.

- Murphy, J. (1990). Principal instructional leadership. *Advances in Educational Administration, 1 (B: Changing Perspectives on the School)*, 163-200.
- Norusis, M. J. (1998). *SPSS 8.0: Guide to data analysis*. Upper Saddle River, NJ: Prentice Hall.
- Obama, B. (2013). Obama's 2013 state of the union address. Retrieved from http://www.nytimes.com/2013/02/13/us/politics/obamas-2013-state-of-the-union-address.html?pagewanted=all&_r=0
- Pajares, F. (2002). Overview of social cognitive theory and of self-efficacy. Retrieved from <http://www.uky.edu/~eushe2/Pajares/self-efficacy.html#instruments>
- Protheroe, N. (2008). Teacher efficacy: What is it and does it matter? *Principal*, 42-45. Retrieved from www.naesp.org
<http://www.naesp.org/resources/1/Principal/2008/M-Jp42.pdf>
- Quiñones, M. A. (1995). Pre-training context effects: Training assignment as feedback. *Journal of Applied Psychology, 80*, 226-238.
- Reeves, E. B., & Bylund, R. A. (2005). Are rural schools inferior to urban schools? A multilevel analysis of school accountability trends in Kentucky. *Rural Sociology, 70*(3), 360-386. doi: 10.1526/0036011054831215
- Rethlefsen, A. L., & Park, H. (2011). A mixed-method study: Assessing the BAR model's impact on preservice teachers' efficacy beliefs. *School Science and Mathematics, 111*(3), 102-117.
- Rich, Y., Lev, S., & Fischer, S. (1996). Extending the concept and assessment of teaching efficacy. *Educational & Psychological Measurement, 56*, 1015-1025.

- Riggs, I. M., & Enochs, L. G. (1990). Toward the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education*, 74, 625-637.
- Rimpola, R. C. (2011). *Teacher efficacy of high school mathematics co-teachers*. Paper presented at the Georgia Educational Research Association Conference, Georgia.
<http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED525282&site=ehost-live>
- Roscigno, V. J., & Crowley, M. L. (2001). Rurality, institutional disadvantage, and achievement/attainment. *Rural Sociology*, 66, 268-292.
- Ross, J. A. (1992). Teacher efficacy and the effects of coaching on student achievement. *Canadian Journal of Education*, 17, 51-65.
- Ross, J. A., Cousins, J. B., & Gadalla, T. (1996). Within-teacher predictors of teacher efficacy. *Teaching and Teacher Education*, 12, 385-400.
- Stein, M. K., & Mundry, S. (1999). Professional development for science & mathematics teachers: dilemmas of design. *High School Magazine*, 7(2), 14-18.
- Stein, M. K., & Wang, M. C. (1988). Teacher development and school improvement: the process of teacher change. *Teaching and Teacher Education*, 4, 171-187.
- Stevens, J. (1992). *Applied multivariate statistics for the social sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Swars, S. L. (2005). Examining perceptions of mathematics teaching effectiveness among elementary preservice teachers with differing levels of mathematics teacher efficacy. *Journal of Instructional Psychology*, 32(2), 139-146.
- Swars, S. L., Daane, C. J., & Giesen, J. (2006). Mathematics anxiety and mathematics teacher efficacy: What is the relationship in elementary preservice teachers?

- School Science and Mathematics*, 106(7), 306-315. doi: 10.1111/j.1949-8594.2006.tb17921.x
- Tabachnick, B., & Fidell, L. S. (1989). *Using multivariate statistics*. New York, NY: Harper & Row Publishing.
- Trentham, L. L., Silvern, S., & Brogdon, R. (1985). Teacher efficacy and teaching competency ratings. *Psychology in the Schools*, 22, 343-352.
- Tschannen-Moran, M., & McMaster, P. (2009). Sources of self-efficacy: Four professional development formats and their relationship to self-efficacy and implementation of a new teaching strategy. *Elementary School Journal*, 110(2), 228-245. doi: 10.1086/605771
- Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education*, 17, 783-805.
- Tschannen-Moran, M., & Woolfolk Hoy, A. (2007). The differential antecedents of self-efficacy beliefs of novice and experienced teachers. *Teaching and Teacher Education*, 23, 944-956.
- Tschannen-Moran, M., Woolfolk Hoy, A., & Hoy, W. K. (1998). Teacher Efficacy: Its meaning and measure. *Review of Educational Research*, 68, 202-248.
- Turner, S. L., Cruz, P., & Papakonstantinou, A. (2004). *The impact of a professional development program on teachers' self-efficacy*. Paper presented at the Annual Meeting of the National Council of Teachers of Mathematics, Philadelphia, PA.
- Walker, J., & Slear, S. (2011). The impact of principal leadership behaviors on the efficacy of new and experienced middle school teachers. *NASSP Bulletin*, 95(1), 46-64.

- Weber, J. (1996). Leading the instructional program. In S. Smith & P. Piele (Eds.), *School Leadership* (pp. 253-278). Eugene, OR: Clearinghouse of Educational Management.
- Wolters, C. A., & Daugherty, S. G. (2007). Goal structures and teachers' sense of efficacy: Their relation and association to teaching experience and academic level. *Journal of Educational Psychology*, 99, 181-193.
- Woolfolk Hoy, A. (2000). *Changes in teacher efficacy during the early years of teaching*. Paper presented at the American Educational Research Association, New Orleans, LA.
- Yockey, R. D. (2008). *SPSS demystified: A step-by-step guide to successful data analysis*. Upper Saddle River, NJ: Pearson Education, Inc.

APPENDIX A
PERMISSION LETTER TO USE ILI

From: Jana Alig [jalig@reyn.org]
Sent: Monday, February 18, 2013 6:44 PM
To: Uswatte, Dil
Subject: Re:

Dear Mrs Uswatte,

I have a few stipulation on using the instrument. First, please make sure you cite the original research. Unfortunately, this has been a problem in the past. Second, I ask that you send me your summary of data after using the instrument. This way I may strengthen the data set.

If you agree to these stipulations, you may use the instrument for your research. I give my permission.

Jana Alig
Jana M. Alig, PhD

Executive Director of Elementary Education

Reynoldsburg City Schools

APPENDIX B

PERMISSION LETTER TO USE MTEBI

MTEBI

 LARRYENOCBS <lgeeval@gmail.com>

Sent: Fri 2/15/2013 12:03 PM

To:  Uswatte, Dil

You may certainly use the MTEBI. Revising it should be done with care. You indicate in your writing that it was revised. If you need more help feel free to contact me.

Larry Enochs
2708 West 105th Street
Leawood, KS. 66206

APPENDIX C

LETTER TO DISTRICT GATEKEEPERS

Dear District and/or School Gatekeeper Responsible for Research:

My name is Mrs. Dilhani Uswatte, and I am a doctoral candidate at the University of Alabama at Birmingham majoring in Educational Leadership. As a requirement for completion of my EdD degree, I am working on a dissertation entitled, “A Quantitative Study of Mathematics Teaching Self-Efficacy and Principal Instructional Leadership in Alabama Elementary Schools.”

The study will require input from elementary teachers in **grades K-5** across Alabama **with at least one full year completed with his or her current principal** through an online, web-based survey. I would be very grateful if you would encourage elementary teachers in your district who meet these requirements to participate in this anonymous survey. At no time will any teacher, principal, school, or school district be identified in any way.

By participating in this research study, it is not anticipated that teachers, principals or your school district will experience any risks. In fact, your institution could possibly benefit from the results of the study. Your teachers’ valuable input in this study will help us understand the relationship between teachers’ beliefs in their ability to teach mathematics effectively and the instructional leadership provided by principals. Given the increased rigor of the Mathematics College and Career Readiness Standards that has been newly implemented in Alabama, this study may help principals and other district leaders to understand how to best support elementary teachers with their mathematics instruction.

Participation in this research study is voluntary and may be completed online at the teachers’ convenience from any computer with an Internet connection.

The on-line survey will take between 5-8 minutes complete. It will consist of multiple-choice questions about the teacher’s belief in his or her ability to teach mathematics, the instructional leadership of the principal, as well as a few demographic questions. All responses will be anonymous and will be used only for this study.

The findings of this research may be subject to possible publication in the future. Participant identity and the identity of your institution will be protected in the reporting of results. In fact, data provided cannot be linked to individuals or school districts, thereby ensuring confidentiality of participants and their school districts.

Please accept my sincere thank you in advance for your cooperation in this study. There is no reward for your effort other than the knowledge that you have helped a graduate student complete her dissertation and that you have contributed to further research into understanding elementary teachers’ beliefs about their ability to teach mathematics and how instructional leaders can support these teachers.

Please forward the survey link below to your grade K-5 teachers once approved. The link provides details about the study, participation information, and survey questions. **Your leadership in asking teachers to complete this survey by September 5, 2013 is much appreciated.**

Here is a link to the survey:

https://uabhumanstudies.co1.qualtrics.com/SE/?SID=SV_3aBVjE68vu0qj2t

If you have any questions, concerns, or complaints about this study and/or would like a summary of the final report, please contact Dilhani (Dil) Uswatte at 205-296-3925 or duswatte@uab.edu.

If you have questions about research participant rights, or concerns/complaints about the research, you may also contact the Office of the Institutional Review Board for Human Use (OIRB) at the University of Alabama at Birmingham at (205) 934-3789 or toll-free 1-855-860-3789. Regular hours for the Office of the IRB are 8:00 a.m. to 5:00 p.m. CT, Monday through Friday.

Thank you again for your valuable assistance,

Dilhani Uswatte, Principal Investigator

APPENDIX D

SURVEY

Default Block

Protocol name: A QUANTITATIVE STUDY OF MATH TEACHING SELF-EFFICACY AND PRINCIPAL INSTRUCTIONAL LEADERSHIP IN ALABAMA ELEMENTARY SCHOOLS

Protocol# E130515005

I invite you to participate in a study of Alabama elementary teachers' (Grades K-5) beliefs in their ability to teach mathematics and the instructional leadership provided by principals. Given the increased rigor of the Alabama College and Career Readiness Standards in Mathematics (also known as the Math Common Core), it is important for educational leaders, particularly principals, to understand how they can best support you in providing effective math instruction.

If you have been teaching with your current principal for at least one full year, please consider completing the following survey. All the information you provide will be used responsibly and will be protected against release to unauthorized persons. At no time during this survey will you provide your name, school's name or your principal's name. Even if you decide to participate now, you may stop at any time and close your browser. Your data will be discarded if you do not complete the survey.

While participation in this survey would be helpful, there is no requirement that you participate. All participation is voluntary and anonymous. Completion of the survey will provide evidence of your consent to participate in the study. The survey that you will complete has 41 multiple choice questions and should take 5-8 minutes to complete. Your data record is totally anonymous.

If you have any questions, concerns, or complaints about the research or a research-related injury, please contact Dilhani Uswatte. She will be glad to answer any of your questions. Mrs. Uswatte can be reached at 205-296-3925 or by email at duswatte@uab.edu.

If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact Mr. Jonathan E. Miller. Mr. Miller is the Director of the Office of the Institutional Review Board for Human Use (OIRB) at the University of Alabama at Birmingham. Mr. Miller may be reached at (205) 975-3919 or (205) 934-1301. Regular hours for the Office of the IRB are 8:00 a.m. to 5:00 p.m. CT, Monday through Friday.

1. What is your gender?

Male
☐

Female
☐

2. What grade level did you teach during the 2012/13 school year? If you taught more than one grade, please select all grades taught.

Kindergarten
☐

Grade 1
☐

Grade 2
☐

Grade 3
☐

Grade 4
☐

Grade 5
☐

3. How many years of teaching have you completed? (Do not include 2013/14 school year).

0	50
Drag button along bar until the correct number of years of teaching experience appears on the right of the bar	

4. How many years have you worked with your current principal? (Do not include the 2013/14 school year)

0	50
Drag button along bar until the correct number of years you have worked with your current principal appears on the right of	

the bar

5. How would you describe the location of your school (please choose one) ?

Urban- located in a major city with a population well exceeding 100,000 residents

Sub-urban- located in a medium-sized community of 5,000 -100,000 residents

Rural- located in or near a town with a populations of 5,000 residents or less

For questions 6-18, please indicate the degree to which you agree or disagree with each statement by selecting the appropriate level of agreement.

6. I continually find better ways to teach mathematics.

Strongly agree

Agree

Uncertain

Disagree

Strongly Disagree

7. Even if I try very hard, I don't teach mathematics as well as I do most subjects.

Strongly Agree

Agree

Uncertain

Disagree

Strongly Disagree

8. I know how to teach mathematics concepts effectively.

Strongly Agree

Agree

Uncertain

Disagree

Strongly Disagree

9. I am not very effective in monitoring mathematics activities.

Strongly Agree

Agree

Uncertain

Disagree

Strongly Disagree

10. I generally teach mathematics ineffectively.

Strongly Agree

Agree

Uncertain

Disagree

Strongly Disagree

11. I understand mathematics concepts well enough to be effective in teaching elementary mathematics.

Strongly Agree

Agree

Uncertain

Disagree

Strongly Disagree

12. I find it difficult to use manipulatives to explain to students why mathematics works.

Strongly Agree

Agree

Uncertain

Disagree

Strongly Disagree

13. I am typically able to answer students' questions.

Strongly Agree

Agree

Uncertain

Disagree

Strongly Disagree

☐ ☐ ☐ ☐ ☐

14. I wonder if I have the necessary skills to teach mathematics.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

☐ ☐ ☐ ☐ ☐

15. Given a choice, I would not invite the principal to evaluate my mathematics teaching.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

☐ ☐ ☐ ☐ ☐

16. 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.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

☐ ☐ ☐ ☐ ☐

17. When teaching mathematics, I usually welcome student questions.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

☐ ☐ ☐ ☐ ☐

18. I do not know what to do to turn students on to mathematics.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

☐ ☐ ☐ ☐ ☐

Block 1

For questions 19-41, please indicate the extent to which the principal demonstrates the specific behaviors:
1 (Not at all), 2 (Once in a while), 3 (Sometimes), 4 (Fairly often), 5 (Frequently if not always).

19. Encourages teachers to attend professional development activities that are aligned to school goals

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

20. Visits the classroom to ensure classroom instruction aligns with school goals

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

21. Uses data on student achievement to guide faculty discussions on the instructional program

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

22. Provides for in-house professional development opportunities around instructional best practices

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

23. Encourages teachers to use data analysis of student academic progress	1	2	3	4	5
24. Plans professional development around teacher needs and wants	1	2	3	4	5
25. Monitors classroom practices for alignment to district curriculum	1	2	3	4	5
26. Works with students on academic tasks	1	2	3	4	5
27. Develops data-driven academic goals in collaboration with teachers	1	2	3	4	5
28. Communicates the school's academic goals to faculty	1	2	3	4	5
29. Stays in the office all day	1	2	3	4	5
30. Supports individualized professional development plan	1	2	3	4	5
31. Works with teachers to interpret assessment data for instructional implications	1	2	3	4	5
32. Uses school goals when making academic decisions	1	2	3	4	5
33. Plans professional development in-service with teachers	1	2	3	4	5

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. Observes teachers for professional development instead of evaluation				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
35. Evaluates teachers to improve instructional practice				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
36. Develops school goals that promote high standards and expectations for all students				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
37. Sets high but achievable standards for all students				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
38. Provides private feedback of teacher effort				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
39. Provides private feedback of student effort				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
40. Furnishes useful professional materials and resources to teachers				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
41. Schedules time for collaboration among teachers				
1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>

APPENDIX E
IRB APPROVAL

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on January 24, 2017. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator: USWATTE, DILHANI

Co-Investigator(s):

Protocol Number: **E130515005**

Protocol Title: *A Quantitative Study of Math Teaching Self-Efficacy and Principal Instructional Leadership in Alabama Elementary Schools*

The above project was reviewed on 5/15/13. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This project qualifies as an exemption as defined in 45CFR46.101, paragraph 2.

This project received EXEMPT review.

IRB Approval Date: 5/15/13

Date IRB Approval Issued: 5/15/13



Cari Oliver
Assistant Director, Office of the
Institutional Review Board for Human
Use (IRB)

Investigators please note:

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

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