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Teachers' Sense of Efficacy: Examining the Relationship of Teacher Efficacy and Student Achievement

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by

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ABSTRACT

The purpose of this study was to investigate which teachers' characteristics have an impact on teachers' sense of efficacy. In addition, the relationship between mathematics and science fifth grade teachers' sense of efficacy and student achievement was examined. Two characteristics related to teachers were examined: teachers' years of teaching experience and teachers' highest degree. Participants included 62 mathematics and science teachers from three school districts in Northwest Arkansas. When comparing fifth grade mathematics and science teachers' efficacy beliefs based on their highest degree, a significant difference in teachers' efficacy beliefs was found based on their degrees. Teachers with a Bachelor degree have higher total efficacy than teachers who hold Master's degrees. Moreover, an investigation to determine if there is a difference in mathematics and science teachers' efficacy beliefs in the three subscale of teachers' efficacy (for classroom management, for student engagement, and for instructional strategies) revealed a significant difference in teachers' efficacy for two of the three constructs. However, when examining teachers' sense of efficacy based on their teaching experience, no differences in teachers' efficacy were found. A correlation was conducted and the results indicated that there was no significant relationship between fifth grade teachers' sense of efficacy and students' achievement in the benchmark test in mathematics and science. The recommendations from this study should be used to inform other scholars and administrators of the importance of teachers' sense of efficacy in order to improve students' achievement gains.

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CHAPTER I

INTRODUCTION

Since the No Child Left Behind Act (NCLB) (2001), assessment and student achievement have become the focus of educational reforms. NCLB requires schools to report the Adequate Yearly Progress (AYP), which is students' improvement in mathematics, reading, and science in the state assessment. The NCLB Act (2001) requires that by 2013, all students be in the proficient or advanced level. Therefore, districts, schools, and teachers are seeking all means to meet these requirements. Research on factors that influence student achievement has shown that teachers are the most influential school factor on student achievement. Educators have attempted to determine the effect of teachers' characteristics, such as teacher experience, teacher education, teacher certification, etc., on student achievement. However, there is an inconsistency among those studies in terms of which of the teachers' characteristics have more or less influence on student achievements (Goldhaber and Brewer, 1997; Hess, Rotherham, and Walsh, 2004; Nye, Konstantopoulos, and Hedges, 2004). According to Boonen, Damme, and Onghena (2014), literature on teachers' characteristics that are linked to student achievement are reported in three categories. These categories are: teachers' qualifications, teachers' practices in the classroom, and teachers' beliefs and attitude. Examining some of these variables, like teachers' years of experience, teachers' education, and teachers' beliefs about their role and their abilities in the classroom, teacher sense of efficacy (Darling-Hammond, 2000; Goldhaber, 2002; Ingersoll, 2004; Sanders & Horn, 1998), and its impact on students' achievement, is the aim of this study.

Teachers' beliefs and perceptions are important and govern teachers' actions and decisions in the classroom. However, these beliefs are not tested like other skills and knowledge when testing for certification. Porter and Freeman (1986), though, suggest that teachers'

educational beliefs should be tested and should be part of the criteria for teacher certification. Moreover, they recommend more research on teachers' beliefs to decide what can be taught at their preparation programs. One important area of teachers' beliefs that has been linked to teachers' behaviors in the classroom is teacher sense of efficacy. Bandura (1986) states that "Among the different aspects of self-knowledge, perhaps none is more influential in people's everyday lives than conceptions of their personal efficacy" (p. 390).

Teachers' self-efficacy is a powerful influence that explains teachers' behaviors and has an impact on students' motivation. Educators and researchers have made many efforts to understand and measure teachers' sense of efficacy. In addition to explaining teachers' behaviors, self-efficacy is one of the topics that researchers use to predict motivation (Klassen, Tze, Betts, & Gordon, 2011). Self-efficacy beliefs also impact teachers' efforts on a given task. Research suggests that efficacy beliefs influence teachers' decisions regarding their practices in the classroom, which influences the classroom environment as well. In addition, it has been demonstrated that the classroom environment influences students' achievement (Brophy, 1986; Hunt 1976; Kagan, 1992; Nussbaum, 1992; Rowan, Chiang, & Miller 1997). In order to create an effective learning environment that improves students' outcomes, teacher quality should be considered.

Problem of the Study

The problem of this study concerns differences on teachers' sense of efficacy by examining their qualification (teachers' years of experience and teachers' education) and its effect on student achievement. Several studies have been conducted to examine the impact of teacher self-efficacy on students' achievement, but research attempts to examine the relationship of what teachers' characteristics influence their sense of efficacy and whether teachers' sense of

efficacy impacts student achievement are sparse. Due to the importance of the constructs of teachers' characteristics, teacher sense of efficacy and their relation to student achievement, examination of this correlation is needed.

There are three aspects that Tschannen-Moran and Hoy (2001) reported as the dimensions of teacher efficacy. Tschannen-Moran and Hoy (2001) developed a scale that has received researchers' attention lately: the Ohio State Teacher Sense of Efficacy Scale (TSES). The TSES scale covers several different aspects of teaching tasks. After the researchers tested the instrument several times, three factors were yielded: efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management. According to Tschannen-Moran and Hoy (2001), these three factors represent the dimensions and the requirements for effective teachers. Klassen, Tze, Betts, and Gordon (2011) reviewed research in teacher's sense of efficacy from 1998-2009. They reviewed 218 empirical studies and proposed some problems and gaps in the literature that needed to be studied. They argue that some aspects of the concepts of teachers' sense of efficacy have not received sufficient attention from scholars. One of these gaps in the literature is the connection between teacher efficacy and student achievement. Examining the influence of teachers' efficacy for instructional strategies, classroom management, and student engagement on student achievement would bridge this gap by highlighting and targeting the needs in each dimension, which in turn will provide policymakers and educators valuable information regarding what type of interventions are needed.

Purpose of the Study

The purpose of this study is to examine what teachers' characteristics (teachers' years of experience and teachers' education) have an impact on their level of efficacy. In addition, the

relationship between mathematics and science teachers' sense of efficacy and fifth grade students' achievement will be investigated.

Theoretical Framework

In the literature, methods of explaining and measuring the concept of self-efficacy are based on either Rotter's social learning theory or Bandura's social cognitive theory. The basic notion of the social learning theory is that behaviors can be predicted through one's expectancy about the outcome of this behavior. Reinforcements empower one's expectancy that a specific behavior or event will be followed by the same reinforcement in the future. One's perception of one's self influences behavior (Rotter, 1966). Rotter (1954) also introduced the concept of internal and external locus of control as part of his social learning theory. If an outcome is interpreted as a result of factors other than one's actions, this belief is called, according to Rotter (1966), external control. On the other hand, if a person relates the outcome to his or her own action or personality, this belief is called internal control.

Another theory that concerns people attributional beliefs is Weiner's attribution theory (1979). Attribution theory is concerned with how people explain their success or failure. According to Weiner (1979), people tend to attribute their success or failure to causes like ability, effort, task difficulty, and luck. Weiner (1979) proposed a causal taxonomy that has three dimensions: locus of control (causes are either internal like ability or effort; or external like luck or difficulty of the task), stability (the endurance of the causes), and controllability (reflects whether causes are under the control of the person or not).

Bandura (1986) defines self-efficacy as "peoples' judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is

concerned not with the skills one has but judgments of what one can do with whatever skills one possesses." (p.391). People have a tendency to choose activities they think they are capable of doing based on their beliefs about their own efficacy (Bandura, 1986). Moreover, Bandura (1997) considered efficacy beliefs as the key factor of human behavior.

This study is grounded in Bandura's social cognitive theories. Bandura claims that behaviors can be determined and explained through the interaction among behavior; cognitive, in terms of internal, personal factors; and environmental aspects; this model is called reciprocal determinism (Bandura, 1997). Bandura emphasizes the role of the human factors in behaviors. Moreover, Bandura states, "Among the mechanisms of personal agency, none is more central or pervasive than people's beliefs about their capabilities to exercise control over events that affect their lives" (1997, p. 2). Self-efficacy belief, part of personal agency, influences human thought and motivation which influence behavior. Self-efficacy impacts people's thoughts regarding their abilities. Bandura (1997) further defines self-efficacy as "beliefs in one's capabilities to organize and execute courses of actions required to produce given attainments" (p. 3). Self-efficacy impacts one's desire to perform actions and the amount of effort they expend. Self-efficacy also influences one's persistence in spite of obstacles (Bandura, 1997).

Rotter, Bandura, and Weiner attempted to explain human behaviors and motivation. In Rotter's social learning theory, the concept of locus of control is similar to Weiner's attributional theory in explaining the outcomes and the causes of people's actions. In social cognitive theory, human behaviors result from the interaction among behavior, cognitive and personal factors, and environment. Human behaviors are influenced by what people think, believe, and feel (Bandura, 1997). People's belief regarding their ability to successfully perform is important to produce desired outcomes. On the other hand, Rotter's social learning theory assumes that human

behaviors are learned and can change. Similar to Bandura's views, Rotter stated that behaviors are explained through the interaction of people and their environment (Rotter, 1982). The role of previous experience is another similarity between the two theories. In social learning theory, reinforcements have a great role in human behaviors; while in cognitive learning theory, Bandura emphasizes the role of cognition aspects. Both theories have influenced how researchers form their conceptualization of self-efficacy.

Research Questions

The primary purpose of this study is to examine the relationship between teachers' sense of efficacy and student achievement. The research questions that will guide the investigation are:

1. What teacher characteristics impact teachers' sense of efficacy?
2. Does teacher efficacy impact student achievement in mathematics and science?
3. How does testing impact teacher's feelings of self-efficacy?

Organization of the Study

The study consists of five chapters. The first chapter includes the introduction of the study, the purpose of the study, and the theoretical framework of the study, as well as the research questions that will guide the study.

Chapter two reviews the literature related to teacher sense of efficacy, sources of self-efficacy, and teacher self-efficacy. Measurements of teacher efficacy are reviewed, as well as studies on validations of the measures of teacher self-efficacy and some of the problems associated with those measures. In addition, literature regarding the factors that influence teachers' efficacy will be reviewed. Finally, the researcher will review, in chapter two, the

literature concerning the relation between teacher efficacy and student achievement as well as mathematics and science teachers' sense of efficacy in the elementary school level.

Chapter three presents the methodology used in order to answer the research equations. In this chapter, the participants, as well as data collection procedures, are described. A description of the statistical analysis will also be included. Chapter four presents the results of the data analysis. A descriptive analysis of the data, as well as statistical procedures for each research question along with findings, will be presented. In addition, interpretation of the results will be presented in this chapter. Chapter five presents a summary of the study, a discussion of the findings, and recommendations.

CHAPTER II

LITERATURE REVIEW

Since the No Child Left behind Act (2001), teachers have been held accountable for teaching and reaching the state expectation on the state assessment. Analyzing the Arkansas students' performance in state Benchmark assessments reveals that all students are experiencing a positive growth over time. Moreover, when comparing the Arkansas students' performance to the national performance, the achievement gaps between the subgroups were moderately smaller than the average gaps of the nation on grade 4 (Burks and Ritter, 2014). The notion that teachers make a difference in students' achievement is not new. Numerous studies have attempted to investigate the effect of teachers on student achievement. For example, in 1981, Gusky conducted a study to investigate teachers' contributions to students' achievement. He developed an instrument called Responsibility for Student Achievement (RSA). His study basically focused on teachers' beliefs about the causes of students' success or failure, whether related to the teacher or not. However, this was not the first attempt to link teachers' beliefs to students' achievement. In 1976, Armor et al. evaluated the extent to which teachers believe they have the skills to impact student achievements. Thus, understanding the impact of the teachers on student achievement is important in order to improve students' achievement and narrow the achievement gaps between the subgroups.

The purpose of this study is to examine the relationship between teachers' sense of efficacy and student achievement in mathematics and science as measured by the Augmented Benchmark Examinations of the state of Arkansas. This chapter reviews previous studies on teacher sense of efficacy, sources of self-efficacy, and teacher self-efficacy. Measurements of

teacher efficacy are reviewed, as well as studies on validations of the measures of teacher self-efficacy. Moreover, the literature regarding the relation between teacher efficacy and student achievement will be reviewed.

Teachers' Beliefs

Kagan (1992) defines teachers' beliefs as "implicit assumptions about students, learning, classrooms, and the subject matter to be taught" (Kagan, 1992, p. 66). Pajares (1992) examines the literature to investigate the meaning of beliefs. He indicates that studying teachers' beliefs is important to student teacher effectiveness, as does Fenstermacher (1978). Teachers' beliefs and knowledge influence classroom practices. Hunt (1976) and Harootunian (1980) argue that in order to gain better understanding about practitioners, the practitioners' perceptions about their practice should be known.

Harootunian (1980) argues that when teachers' behaviors are reported, teachers' perceptions about their view of good teaching are often ignored. Harootunian (1980) surveyed 237 teachers asking them to list events in their teaching they believe are effective. He found that teachers' views about effective teaching are different than researchers and policy makers. Therefore, teachers' beliefs should be considered when trying to improve classroom instruction. Understanding the relationship between teachers' effective instruction and their belief in their own teaching efficacy must be underpinned by an appreciation for the importance of teacher behaviors and beliefs.

Teacher Sense of Efficacy

The construct of self-efficacy has developed from the social cognitive theory by Bandura (1997). Tschannen-Moran and Hoy (2001) state that "A teacher's efficacy belief is a judgment

of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (p. 783). Bandura (1986) developed the concept of self-efficacy as part of his social cognitive theory. Unlike Rotter's social learning theory, which is based on reinforcements as the main influence that leads to certain situations, Bandura's social cognitive theory emphasizes the ways human behavior is influenced by cognitive processes.

The concept of teacher sense of efficacy and its impacts on teachers, and on students as well, has been examined by several studies. Teachers with high senses of efficacy are more likely to focus on teaching activities rather than nonacademic activities (Gibson & Dembo, 1984). More efficacious teachers influence student achievements in reading (Armor et.al., 1976) and are less likely to refer students to special education (Meijer & Foster, 1988). In addition, teacher self-efficacy is related to and linked with job satisfaction. Teachers with high levels of efficacy reported higher levels of job satisfaction (Klassen & Chiu 2010). Al-Alwan and Mahasneh (2014) reported a significant relationship between the level of teachers' efficacy and students' attitudes toward school. Several studies of teacher efficacy have examined the meaning of the concept, its sources, and its measure. This study is designed to investigate the relationship between teachers' sense of efficacy and student achievement.

Sources of Sense of Efficacy

Since there is an agreement among researchers that efficacy beliefs influence teachers' behaviors, knowing how these beliefs are shaped is vital. Bandura (1997) proposed four sources of self-efficacy beliefs. Information regarding self-efficacy beliefs come from, according to Bandura (1997), enactive mastery experience, vicarious experience, verbal persuasion, and

physiological and effective states. Researchers assess each source of efficacy differently. The most significant and powerful source of efficacy are enactive mastery experiences or "performance attainments" (Bandura, 1997, p. 399). When one experiences success in a certain situation, he or she will hold high expectations of success in similar situations in the future. However, failures lower these expectations. Task difficulties and efforts influence the development of efficacy beliefs. Obstacles and difficulties inform individuals that successes necessitate persistent effort. "A resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort" (Bandura, 1995, p. 3). To assess this source of efficacy, researchers used self-report items that asked students to rate their performance in terms of their success (Usher and Pajares, 2009).

The second source of efficacy that influences the development of efficacy beliefs is vicarious experience (Bandura, 1997). Through the form of modeling, vicarious experience is people's judgments about their abilities to successfully perform a task based on the performance of similar others (Bandura, 1997). Observing someone performing a certain task successfully informs the observer that he or she is capable of achieving the same results. Likewise, seeing someone fail decreases the observer efficacy. Models influence individuals' efficacy beliefs when they see the model as similar to them (Bandura, 1995). Vicarious experience is measured by asking students to rate the degree of their exposure to models, who are capable of performing the task (Usher & Pajares, 2009).

Verbal persuasion is the third source of beliefs about self-efficacy. Through the verbal feedback from another person about ones' performance, individuals' sense of efficacy increases and they are more likely to put their effort to accomplish the task (Bandura, 1997, 1995).

Verbal persuasion is assessed by asking the students to report if they have received positive feedback from others, whether their peers, parents, or teachers (Usher & Pajares, 2009).

Finally, physiological reactions, such as stress and anxiety, influence people's assessment of their abilities (Bandura, 1997). Stress might be interpreted as "signs of vulnerability to poor performance" (Bandura, 1995, p. 4). A strong reaction to performing a task allows one to predict success or failure (Usher & Pajares, 2009). The way people interpret these physiological reactions and mode states influence their efficacy beliefs. Physiological states have been used in academic setting to assess students' anxiety (Usher & Pajares, 2009).

Factors Influence Teachers' Sense of Efficacy

Several aspects influence teachers' sense of efficacy. These influential factors could have direct influences, like school climate (Hoy and Woolfolk, 1993) and students' achievement (Khan, 2011) or indirect influences, such as home and community (Ashton & Webb, 1986). Dembo and Gibson (1985) suggest that, in order to get a better understanding of teachers' efficacy and to improve teachers' efficacy beliefs, researchers ought to consider variables such as teacher education and socialization, personal teacher variables, school organization, and parent-teacher relations (Dembo & Gibson, 1985). In this section, the construct of teachers' sense of efficacy and its association with several factors will be examined.

Studying environmental processes that influence human development and education helps in discovering what promotes human development. Ashton and Webb (1986) use Bronfenbrenner's (1976) ecological structure as a framework to examine the direct and indirect related factors that influence teachers' sense of efficacy. This framework helps examine influential aspects of teachers' sense of efficacy. Bronfenbrenner's ecological structure of educational environment consists of: the microsystem, the mesosystem, the exosystem, and the

macrosystem. The microsystem represents the teachers' direct influences, such as the classroom, students' characteristics, teachers' characteristics, teacher ideology, role definitions, class size, and activity structure. The second ecological structure is the mesosystem, which includes school size, demographic characteristics, school norms, collegial relations, principal- teacher relations, decision-making structures, and home-school relations. The third structure is the exosystem, which relates to formal and informal social structures that might impact the teachers' direct setting, including the socioeconomic level of the community, the nature of the school district, the mass media, and the state and national legislative agencies. The fourth structure is the macrosystem, which includes conceptions of the learners and conceptions of the role of education (Ashton &Webb, 1986).

Hoy and Woolfolk (1993) examined the relationship between teachers' sense of efficacy and school climate as described by six dimensions: institutional integrities, principal influences, consideration, resource support, moral, and academic emphasis. Specifically, their goal is to examine teachers' perceptions of the dimensions of the school climate and connect these perceptions to the teachers' sense of personal and general teaching efficacy. They hypothesize that general teaching efficacy and personal teaching efficacy are related to the school environment, which includes institutional integrities, academic emphasis, resource support, and principal influences.

To test their hypotheses, Hoy and Woolfolk (1993) use the Teacher Efficacy Scale to assess dimensions of teachers' efficacy and the Organizational Health Inventory to assess teachers' perceptions of their schools. When controlling the influence of other factors in the study, they find that principal influence and academic emphasis are significantly linked to teachers' personal teaching efficacy. Regarding general teaching efficacy, they find that general

teaching efficacy can be predicted only by institutional integrity (institutional level) and moral (technical level). Finally, they emphasize the independence of both dimensions of teachers' sense of efficacy, which are personal and general teaching efficacy. These two dimensions cannot be explained by the same qualities. Moreover, combining the scores of personal teaching efficacy and general teaching efficacy and using the total score as a teachers' efficacy will provide inaccurate results (Hoy and Woolfolk, 1993).

Professional development also influences teachers' sense of efficacy. Tschannen-Moran and McMaster (2009) examined the impact of four professional development formats on teacher self-efficacy and implementing new teaching strategies. They designed the program to include Bandura's sources of efficacy. They found that all four program formats contribute to improve teachers' efficacy, but the particular programs are not related to the likelihood of teachers using the learned strategy. However, the format that includes a mastery experience and follow-up coaching for using the new strategy was found to increase teachers' efficacy levels. Consequently, mastery experience, as suggested by Bandura (1997), is a powerful resource of efficacy and, with the support of coaching, significantly increases teachers' self-efficacy.

The influence of gender, age, and experience were also reported as predictors of the level of teachers' efficacy. Studies indicate that levels of efficacy vary among teachers based on their gender. Female teachers report higher teaching efficacy than male teachers (Edwards, Green, & Lyons, 1996; Riggs, 1991). Additionally, teachers' efficacy levels decreased with experience, and pre-service teachers showed the highest teaching efficacies (Dembo & Gibson, 1958). Klassen and Chiu (2010) reported that teacher self-efficacy beliefs declined when their experiences increased.

Edwards, Green, and Lyons, (1996) examined the relationship between teacher efficacy and several factors assumed to predict teacher efficacy. They found that gender influences teachers' efficacy beliefs, as female teachers consider themselves more efficacious than male teachers. School level also influences teachers efficacy; elementary school teachers score highest when reporting teaching efficacy. Elementary school teachers and kindergarten teachers reported higher levels of efficacy compared with higher grade levels. Moreover, teachers' efficacy levels are varied within the same school. Teachers of younger students have higher efficacy levels than teachers of older students within the elementary school (Klassen & Chiu 2010). Edwards, Green, and Lyons (1996) reported no significant relationship of educational level and teachers' efficacy, but a slightly negative relationship between teachers' efficacy and years of experience.

Walker and Slear (2011) surveyed 366 teachers to examine the influence of principal behavior on teachers' efficacy. They reported that among the eleven characteristics that were found in the literature, only three principal behaviors were found to be significantly related to teachers' efficacy. Modeling instructional expectations and communication were found to be positively related to teachers' efficacy, while providing contingent rewards was negatively related to teachers' efficacy.

Hoover-Dempsey, Bassler and Brissie (1987) report that parent-teacher relations influence teachers' efficacy. They examined the relationship between teachers' sense of efficacy and parent involvement. They found that teachers' efficacy is significantly related to the five criteria of parents involvement, which are: involvement in parent teacher conferences, parent volunteering, parent tutoring, parent home instruction, and parent support.

Tschannen-Moran, Hoy, and Hoy (1998) provide a comprehensive explanation of the construct of teachers' sense of efficacy and its measures. They review data that investigated the concept of teacher efficacy from 1974 to 1997. Moreover, they base their investigation on the two theoretical frameworks in Rotter's social learning theory (1966) and Bandura's social cognitive theory (1977). Their work represents the most important elements of research in teachers' sense of efficacy.

Measures of Teachers' Sense of Efficacy

While some researchers base their investigations about the concept of self-efficacy on Rotter's social learning theory's external and internal locus of control, others ground their work in the concept of self-efficacy that Bandura developed in his social cognitive theory (Tschannen-Moran, Hoy, & Hoy, 1998). As such, instruments developed by researchers often reflect one of these approaches.

Two-item Rand Questions. The two-item Rand questions were developed by Rand researchers to investigate several variables that contribute to improve minority elementary students' reading. Teachers' sense of efficacy and its relation to students' achievements in reading tests was one of the variables studied (Armor et al., 1976). They wanted to assess the extent to which the teachers believe they possess the skills to influence student achievements. Armor et al. (1976) developed a Two-item Teachers' Sense of Efficacy Scale to measure elementary teachers' capacities or sense of efficacy in teaching minority students. These two questions are:

> *"When it comes right down to it, a teacher really cannot do much (because) most of a students' motivation and performance depends on his or her home environment."* and the second item is *"If I really try hard, I get through to even the most difficult or unmotivated students."* (Armor et al., 1976).

Using this tool, the researchers find that the higher the teacher's sense of efficacy, the higher the students' achieved on a reading test (Armor et al., 1976). Rand researchers based these two questions on Rotter's (1977) internal and external locus of control. Each question measures a specific efficacy belief. Question one was labeled General Teaching Efficacy. On the other hand, question two was labeled personal teaching efficacy. Concerns regarding the reliability of the two items encouraged researchers to develop a more reliable, longer, and more comprehensive measure of teacher efficacy (Tschannen-Moran & Hoy, 2001).

Teacher Locus of Control. Rose and Medway (1981) created the Teacher Locus of Control (TLC) based on Rotter's internal and external locus of control. TLC was developed to measure elementary teachers' beliefs regarding control in the classroom (Rose & Medway, 1981). TLC is a 28-item instrument that evaluates teachers' attributions beliefs regarding students' achievements, whether successes or failures (Tschannen-Moran, Hoy, & Hoy, 1998). Fourteen items describe success situations and fourteen items describe failure situations. A sample question is

> *When the grades of your students improve, it is more likely*
> *a. because you found ways to motivate the students, or*
> *b. because the students were trying harder to do well*. (Rose & Medway, 1981, p. 189).

Teachers' responses to each situation are either to attribute their students' success to themselves (internal) or to their students (external). Teachers' options in attributing students' failure are either to hold themselves accountable (internal) or to blame the students (external) (Rose & Medway, 1981; Tschannen-Moran, Hoy, & Hoy, 1998). Using the TLC, Rose and Medway

(1981) found a significant relationship between teachers' locus of control and student achievement.

When testing the validity of the TLC, they found the TLC scale to be a better predictor of teachers' behavior than Rotter's IE scale. They concluded that the TLC scale is a valid measure to assess teachers' belief regarding control in the classroom.

Responsibility of Student Achievement. Another efficacy instrument, developed by Gusky (1981) based on Rotter's internal and external locus of control, is Responsibility for Student Achievement (RSA). RSA was developed to assess teachers' beliefs about their attributions to students' success or failure. RSA is a 30-item scale that asked teachers to divide 100 percentage points between two options. An example item from the scale is:

> *If most students complete a home assignment you make, is it usually*
> *a. because of their personal motivation or*
> *b. because you were very clear in making the assignment?* (Gusky, 1981)

One of the options states that the given situation, whether success or failure, is happening due to the teachers, while the other option states that the given situation is not related to the teachers, but was caused by external factors. RSA was not utilized and tested by other researchers (Tschannen-Moran & Hoy, 200).

Teacher Efficacy Scale. Gibson and Dembo (1984) also attempted to assess teachers' sense of efficacy. 208 elementary teachers completed a Teacher Efficacy Scale (TES) consisting of 30 items on a 6-point Likert scale. A sample question from this scale is: "When a student gets a better grade than he/she usually gets, it is usually because I found better ways of teaching that student" (Gibson & Dembo, 1984, p. 581). Teachers were asked to select from a number

between 1, which indicated a strong disagreement, to 6, which indicated a strong agreement, for each item. Factor analysis was employed and two factors resulted. The first factor indicates teachers' sense of personal teaching efficacy, while the second factor indicates teachers' sense of teaching efficacy. Then, further tests were used for convergent and discriminant validity when compared with two other measures. Results indicate "validation support for the use of the Teacher Efficacy Scale to measure the construct of teacher efficacy" (Gibson & Dembo, 1984, p. 576). Moreover, Gibson and Dembo (1984) investigate the relation between teachers' efficacy and their behaviors in the classroom.

Several studies were conducted to evaluate the validity of this instrument. Some are consistent with previous research in revealing a third aspect of teacher efficacy (Soodak and Podell, 1996). Others suggests that the Teacher Efficacy Scale is not an accurate instrument to assess teachers' sense of efficacy (Brouwers and Tomic, 2003; Further, Denzine, Cooney, and McKenzie, 2005; Hoy and Spero, 2005).

The Teacher Sense of Efficacy Scale. In 2001, Tschannen-Moran and Hoy attempted to develop a more reliable and valid instrument to measure teachers' efficacy. This instrument was developed to address the insufficient perceptions about the construct of teachers' sense of efficacy (Klassen, Bong, Usher, Chong, Huan, Wong, & Georgiou, 2009). The instrument was called the Teacher Sense of Efficacy Scale (TSES). Moreover, this instrument was developed to measure three aspects of teachers' sense of efficacy. The first factor is teacher efficacy for student engagement. This factor measures teachers' beliefs regarding their abilities to motivate students. The second factor that the TSES measures is teacher efficacy in instructional strategies. This factor measures teachers' beliefs about their ability to use different instructional methods in

their teaching. The third factor in TSES measures teacher efficacy for classroom management. This factor measures teachers' beliefs regarding their ability to manage their classrooms.

The Teacher Sense of Efficacy Scale (long form) consists of 24 items on a 9-point Likert scale where one indicates (nothing), three indicates (very little), five indicates (some degree), seven indicates (quite a bit), and nine indicates (a great deal). Some questions from this measure are: "How much can you do to get through to the most difficult students?"; "How much can you use a variety of assessment strategies?" and "How well can you respond to difficult questions from your students?" Tschannen-Moran and Hoy (2001) conducted three studies to test and to improve the instrument. They considered: the factor structure, the reliability, the validity of the measure, and the relevant usage of the scale for pre-service and in-service teachers. In the first and second study, Tschannen-Moran and Hoy (2001) reduced the items from 52 to 18 items. A factor analysis yielded three factors; these factors were labeled: efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management. These three dimensions represent the requirements for effective teachers. When testing the validity of the TSES, they concluded that the 12-item scale or the 24-item scale both are valid scales and cover several and different aspects of teaching tasks. Moreover, according to Tschannen-Moran and Hoy (2001), this scale, in either form, can assess teachers' sense of efficacy adequately for both pre-service and in-service teachers. Finally, they state that the TSES scale needs further testing.

Attempts have been made to test the validity of the TSES in different settings. In 2010, Fives and Buehl administered the short and the long form of the TSES to pre-service and in-service teachers to test the factor structure of the instrument. After statistically analyzing teachers' responses, they concluded that the TSES is an appropriate measure of teachers' sense of efficacy (Fives & Buehl, 2010). Klassen, Bong, Usher, Chong, Huan, Wong, and Georgiou

(2009) made another attempt to test the TSES. They tested the TSES in five countries: in Canada, in Cyprus, in Korea, in Singapore and in the United States. They found that the TSES has a strong internal consistency when they test the cross-national validity of the instrument. In other words, their results reveal that the TSES is not only valid to measure teachers' sense of efficacy in the U.S.A., but also in Canada, Cyprus, Korea, and Singapore. Their findings are consistent with Tschannen-Moran and Hoy (2001) regarding the three dimensions of teachers' sense of efficacy: student engagement, instructional strategies, and classroom management (Klassen, Bong, Usher, Chong, Huan, Wong, & Georgiou, 2009).

Charalambous, Philippou, and Kyriakides, (2008) found that TSES is a valid instrument that measures teachers' sense of efficacy in mathematics, as well as general sense of efficacy. They also found that pre-service teachers were able to differentiate between instructional skills and classroom management when they mentioned their mathematics efficacy beliefs, which contradicts other research (Tschannen-Moran & Hoy 2011). They also concluded that pre-service teachers' efficacy beliefs in mathematics are receptive to change. Another finding that agrees with Bandura (1997) is that experience has a major impact in developing sources of efficacy in teaching mathematics. Finally, the findings indicated that mentors influence pre-service teachers by modeling and by giving feedback either verbally or latently.

As noted above, several instruments appear in the literature, all of which aim to assess teachers' sense of efficacy. However, these measures of teachers' efficacy scales require testing to determine validity (Denzine, Cooney, & McKenzie, 2005). Several researchers have investigated the validity of some of the instruments mentioned above. In sum, the dilemma is not only related to the way the construct has been measured, but also to the ways researchers have interpreted the data. However, the Teacher Sense of Efficacy Scale (TSES) reveals promising

results, as Tschannen-Moran and Hoy (2001) stated. In addition, the TSES scale covers several different aspects of teaching tasks. After Tschannen-Moran and Hoy (2001) tested the instrument several times, yielded three factors: efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management. According to Tschannen-Moran and Hoy (2001), these three factors represent the dimensions and the requirements for effective teachers. Therefore, based on analyzing the literature regarding measuring teachers' sense of efficacy, the Teacher Sense of Efficacy Scale by Tschannen-Moran and Hoy (2001) was used to assess teachers' efficacy level.

The three factors of the TSES. This section reviews the literature regarding the three dimensions that the TSES measures. These three subscales are: teacher efficacy for student engagement, teacher efficacy for instructional strategies, and teacher efficacy for classroom management. In each of these factors, the questions from the TSES that measure each factor were presented as well as a review of the literature regarding each dimension.

Teacher efficacy for student engagement. Several studies have examined the relationship between teachers and student engagement. When reviewing the literature regarding student engagement in the classroom, teachers' practices in the classroom and their beliefs are some aspects that influence student engagement (Skinner & Belmont, 1993). Wiseman (2012) examined teachers' perceptions on what motivates students and students' perceptions on their own motivation. He found that teachers' and students' attributions are different. Students attribute their motivation to either their intrinsic motivation or to their goals they adopt, while teachers link students' motivation to their own characteristics.

Students who engage in their classroom score higher on the standardized tests (Skinner, Wellborn, & Connell, 1990, as cited in Skinner& Belmont, 1993). In a study that examined the relationship between teachers' behavior and student engagement, it was found that teachers' behavior in the classroom predicts students' engagement (Skinner & Belmont, 1993). Uden, Ritzen, and Pieters (2013) examined teachers' efficacy and perceived student engagement. They found that teachers with high levels of efficacy scored themselves as higher on influencing student engagement.

Teachers' efficacy for student engagement is measured by questions 2, 3, 4, and 11 in the Teacher Sense of Efficacy Scale. These questions are:

- How much can you do to motivate students who show low interest in schoolwork?
- How much can you do to get students to believe they can do well in schoolwork?
- How much can you do to help your students value learning?
- How much can you assist families in helping their children do well in school? (Tschannen-Moran & Hoy, 2001)

Teacher efficacy for instructional strategies. Teachers' instructional behaviors are influenced by their sense of efficacy beliefs (Tschannen-Moran, Hoy, & Hoy 1998). Bandura (1997) emphasizes the role of human beliefs on individuals' behaviors. Therefore, teachers' sense of efficacy is assumed to influence teachers' instructional practices in the classroom (Caprara, Barbaranelli, Steca, & Malone, 2006). In the short form of the Teachers' Sense of Efficacy Scale, which will be used in this study, questions 5, 9, 10, and 12 measure teachers' efficacy for instructional strategies. These questions are:

- To what extent can you craft good questions for your students?

- How much can you use a variety of assessment strategies?
- To what extent can you provide an alternative explanation or example when students are confused?
- How well can you implement alternative strategies in your classroom? (Tschannen-Moran & Hoy, 2001)

These questions assess several aspects of instructional strategies, like assessing students, forming questions, explaining difficult concepts, and also lesson planning. Several studies examined instruction in the classroom; however, little research has linked teachers' sense of efficacy with their instruction. Holzberger, Philipp, and Kunter (2013) investigated the role of teachers' efficacy beliefs on their instructional quality. In this study, not only did teachers rate their own performance, but also students rated the quality of their teachers' instructions. After analyzing the data, the researchers found a significant positive correlation between teachers' efficacy beliefs and their instructional quality. That is, the more efficacious the teachers are, the higher the students' perception of the quality of instruction.

A study by Wertheim and Leyser (2002) investigated pre-service teachers' efficacy beliefs and their choices of instructional strategies. 191 pre-service teachers in Israel completed a Hebrew version of Gibson and Dembo's (1984) Teacher Efficacy Scale, the Instructional Strategies Scale, to assess their perception of using differentiated instructional strategies in an inclusive classroom. They found that there was a low but significant positive correlation between the pre-service teachers' personal teaching efficacy and their willingness to use each of the instructional strategies in the instrument, like individualized differentiated instruction, assessment for instruction, behavior management, and communication (with parents, school

professionals, principal, and students). However, they found no significant correlation between pre-service teaching efficacy and teachers' willingness to use differentiated instructional strategies. They concluded: "This result suggested that the degree to which a student teacher believes that teachers can foster student academic achievement, despite negative external factors, was not related to their choices of instructional strategies or perception of their effectiveness" (p. 57).

Teacher efficacy for classroom management. Teachers' ability to control disruptive behavior in the classroom is important. Lack of this ability will lead to wasted instructional time and will contribute to teacher stress and burnout (Brouwers & Tomic, 1999). Doyle (1986) states that managing the classroom is an important teaching task (as cited in Woolfolk, Rosoff, & Hoy, 1990). Self-efficacy for classroom management is defined as "teachers' beliefs in their capabilities to organize and execute the courses of action required to maintain classroom order" (Brouwers & Tomic, 2000, p. 242). Bandura (1997) states that efficacy beliefs impact individuals' actions toward success or failure. Based on Bandura's theory, Dicke, Parker, Marsh, Kunter, Schmeck, and Leutner (2014) assumed that teachers' efficacy beliefs not only influence teachers' behaviors in the classrooms, but also teacher' efficacy beliefs effect the success of the teachers' classroom management.

Teachers' efficacy for classroom management is measured by questions 1, 6, 7, and 8 in the Teacher Sense of Efficacy Scale. These questions are:

- How much can you do to control disruptive behavior in the classroom?
- How much can you do to get children to follow classroom rules?
- How much can you do to calm a student who is disruptive or noisy?

- How well can you establish a classroom management system with each group of students? (Tschannen-Moran & Hoy, 2001)

Dibapile (2012) reviewed the literature on teacher efficacy and classroom management. In general, Dibapile (2012) concluded that classroom management is not an easy task. Efficacious teachers can manage the classroom effectively and can establish organized classrooms that positively influence student learning and behaviors. Teachers with high efficacy levels can manage conflict with their students and are more likely to use different management styles in their classrooms (Morris-Rothschild & Brassard, 2006).A summary of some of the instruments that reported in the literature that measure teachers' efficacy is provided in Table 1.

Table 1
Summary of Some Measures of Teachers' Sense of Efficacy

The Measures	The Purpose	Summary	The Findings
Teacher Locus of Control TLC (Rose & Medway, 1981).	A 28-item instrument that evaluates teachers' attributions beliefs regarding students' achievements, whether successes or failures.	Teachers' responses to each situation are either to attribute their students' success or failure to themselves (internal) or to their students (external).	A significant relationship between teachers' locus of control and student achievement (Rose & Medway, 1981).
Responsibility of Student Achievement RSA (Gusky, 1981).	A 30-item scale to assess teachers' beliefs about their attributions to students' success or failure.	Teachers were given a situation and were asked to decide whether success or failure is happening due to the teachers or to external factors.	Gusky (1981) reported a significant positive correlation between the two-item Rand questions and responsibility for student achievements; RSA was not utilized and tested by other researchers (Tschannen-Moran & Hoy, 200).
Teacher Efficacy Scale TES (Gibson and Dembo, 1984).	A 30-item scale that was developed specifically to measure the construct of teacher efficacy.	Measures two uncorrelated factors of teacher efficacy (teachers' sense of personal teaching efficacy and teachers' sense of teaching efficacy).	There is a relation between teachers' efficacy and their behaviors in the classroom, which improves students' achievement (Gibson and Dembo, 1984).
The Teacher Sense of Efficacy Scale TSES (Tschannen-Moran and Hoy, 2001)	To develop a more reliable and valid instrument to measure teachers' efficacy. They considered: the factor structure, the reliability, the validity, and the relevant usage of the scale for pre-service and in-service teachers.	After the instrument was tested, three factors were yielded: efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management. These three factors represent the dimensions and the requirements for effective teachers (Tschannen-Moran and Hoy, 2001)	The OSTES is a valid and reliable instrument that measures the requirements for teachers' effectiveness. This scale can assess teachers' sense of efficacy adequately for both pre-service and in-service teachers.

Teacher Sense of Efficacy and Student Achievement

Several studies examined the relation between teachers' sense of efficacy and student achievement. The level of teachers' sense of efficacy has been linked and considered a contributing factor to student achievement (Holzberger, Phlipp, & Kunter, 2013). Caprara, Barbaranelli, Steca, and Malone (2006) examined teachers' sense of efficacy and its influence on student achievement and job satisfaction. They found that teachers' efficacy significantly impacts student achievement. Teachers with high levels of efficacy are more likely to have high expectations of learning and success, while teachers with low levels of efficacy are more likely to have high expectations regarding failure (Ashton and Webb, 1986).

Armor et al. (1976) investigated several variables that contribute to improving minority elementary students' reading. Teachers' sense of efficacy and its relation to student achievement in reading tests were some of the variables studied. Specifically, they examined the extent to which the teachers believe they possess the skills to influence student achievement. The development of the Two-item Rand measure of efficacy was part of this study. Armor et al. (1976) reported that the higher the teacher's sense of efficacy, the higher the students achieved on the reading test.

Ashton and Webb (1986) studied the relation of basic skills that teachers have on ninth-eleventh grade student achievement on the Metropolitan Achievement Test (MAT) on the mathematics, language, and reading subtests, specifically. They observed 48 teachers, using several efficacy measures. They found a positive correlation between teacher efficacy and student achievement. Students' mathematics scores were significantly linked to teachers' sense of teaching efficacy. On the other hand, they found no relation between students' scores in reading and teachers' sense of efficacy.

Khan (2011) investigates the correlation between teachers' efficacy and secondary students' achievement. He examines the impact of high/low teacher-efficacy on students' performance and teachers' ability to reach unmotivated and low achieving students. After collecting and analyzing the data, Khan (2011) finds that there is a positive relationship between teachers' sense of efficacy and students' performance. Teachers' sense of efficacy affects their expectations of student achievement, which affects the teachers' effort in the classroom to reach and motivate their students. Teachers with a high sense of efficacy tend to have high expectations of their students to perform, while teachers with a low sense of efficacy create high expectations for failure, which matches earlier findings by Ashton and Webb (1986). In addition, Ross (1992) examines the relationship between teacher efficacy beliefs and student achievement. He finds that teacher efficacy beliefs and student achievement on written history assessments were positively correlated.

Although some researchers have linked teachers' sense of efficacy to student achievement, researchers were neither consistent in the instrument used to measure teachers' efficacy nor in the way student achievement was assessed (Austin, nd). Different aspects related to the construct of teacher efficacy have been the focus of the research, such as measuring this construct and testing its validity. Research on linking teachers' sense of efficacy with student outcome is "modest" according to Klassen, Tze, Betts, and Gordon (2011). Therefore, trying to predict the relation between teachers' sense of efficacy and student achievement will add to the body of knowledge. "Establishing a stronger research base that provides evidence for links between teachers' self-efficacy and student outcomes are needed" (Klassen, Tze, Betts, & Gordon, 2011, p. 40).

Elementary Mathematics and Science Teacher' Self-Efficacy Beliefs

Research has reported that teachers' sense of efficacy influences students' learning and achievement. Teachers with high senses of efficacy focus on teaching activities rather than nonacademic activities (Gibson & Dembo, 1984), influence student achievements (Armor et.al., 1976), and reported higher levels of job satisfaction (Klassen & Chiu 2010). In addition, the level of teachers' efficacy is correlated to students' attitudes toward school. Efficacy beliefs influence teachers' decisions regarding their practices in the classroom, which in turn influences students' achievement (Kagan, 1992; Nussbaum, 1992; Hunt 1976; Rowan, Chiang, & Miller 1997; Brophy, 1986). The research on elementary mathematics teachers' efficacy and science teachers' efficacy is sparse. However, the following review of the literature on teacher efficacy at the elementary level will provide a general understanding of what research has reported up to this point.

Teachers' teaching efficacy beliefs are shaped during the early stages of their student teaching experience (Hoy & Spero, 2005). Scholars have examined teacher self-efficacy in pre-service teachers and how to increase their efficacy beliefs. However, limited studies explore raising in-service teachers' efficacy beliefs (Swackhamer, Koellner, Basile, & Kimbrough, 2009). Moreover, efficacy beliefs, once developed, are resistant to change (Bandura, 1997), which explains the researchers' investment in studying elementary pre-service teacher sense of efficacy (Hoy & Spero, 2005). In addition, self- efficacy influences novice teachers in their learning stage, which has limited the studies of self-efficacy on practicing or in-service teachers. However, reports indicate that Pre-service teachers' general teaching efficacy increases, although it declines during the student teaching experience because pre-service teachers underestimate the complexities of teaching (Hoy & Spero, 2005). Research on self-efficacy beliefs agrees that

teacher sense of efficacy increased during the student teacher period, while efficacy beliefs decreased during the first year of teaching; this is explained by the lack of support in- service teachers received compared to pre-service teachers (Hoy & Spero, 2005).

Elementary teachers teach all subjects. Since efficacy belief is a construct for a specific belief (Bandura, 1981), teachers may experience different efficacy levels among subjects they teach. However, when comparing elementary teachers' efficacy beliefs to middle and secondary schools, elementary teachers reported higher efficacy beliefs in general. Wolters and Daugherty (2007) examined the variation of teachers' self-efficacy levels based on the academic level those teachers teach. Teachers who teach higher grades report lower self-efficacy, while elementary school teachers report higher levels of self-efficacy for student engagement than teachers in middle or high schools. Lee, Cawthon, & Dawson (2013) compare, as a part of a larger study, teachers' sense of efficacy among elementary and secondary teachers. They reported that elementary teachers' sense of efficacy was significantly higher than secondary teachers' sense of efficacy. Pre-service teachers reported that teaching upper grades is more demanding than teaching lower grades especially in mathematics (Charalambous, Philippou, & Kyriakides, 2008).

Several studies have reported that elementary teachers feel uncomfortable teaching mathematics and science (Buss, 2010). Moreover, teaching science is a subject that teachers feel incapable of teaching, specifically at elementary levels (Howitt, 2007). Buss (2010) surveyed 325 pre-service teachers who completed the required coursework and student teaching to be certified to teach all elementary subjects, including mathematics and science. Buss (2010) wanted to assess pre-service elementary teachers' efficacy for teaching math and science when opposed to other subjects such as reading, classroom management, and general instruction. Pre-

service teachers' efficacy beliefs were measured by an instrument that was designed to measure efficacy beliefs for teaching elementary school content in five areas: science, mathematics, reading, classroom management, and general instruction. Findings reveal that teachers' efficacy for teaching reading, classroom management, and general instruction is higher than teachers' efficacy for teaching mathematics and science.

Wenner's (2001) research compares efficacy beliefs between in-service teachers and pre-service teachers. The researcher measures mathematics and science elementary teachers' efficacy beliefs for both groups. 101 in-service teachers and 187 pre-service teachers completed the Science Teaching Efficacy Belief Instrument. Wenner (2001) concluded that experience influences teachers' perceptions regarding their ability to teach. Thus, in this study, in-service teachers reported higher efficacy levels than pre-service teachers. Both groups reported similar beliefs regarding their responsibilities for students' achievement and that their performances increase students' motivation. Wenner (2001) also concluded "science remains an academic area of low confidence especially for pre-service teachers" (p. 185). Finally, Wenner (2001) concluded both in-service and pre-service teachers reported higher efficacy for teaching mathematics than teaching science.

Pas, Bradshaw, and Hershfeldt (2012) conducted a longitudinal study to test factors that influence teachers' efficacy growth over time. 600 elementary teachers completed the Teacher Sense of Efficacy scale by Hoy and Woolfolk (1993). They collected data three times over two academic years. They conclude that teachers' efficacy increased over time. Teachers' demographic data, such as gender and race, were found to be not significantly related to the growth of teachers' efficacy over time. However, the researchers reported that preparedness was significantly related to teachers' efficacy. The better prepared the teachers felt, the higher

efficacy they reported (Pas, Bradshaw, & Hershfeldt, 2012). Consistent with Pas, Bradshaw, and Hershfeldt (2012), Yenice (2009) tested changes of science teacher efficacy beliefs for 139 elementary teachers. Yenice (2009) reported that teachers' demographic factors, such as gender and age, are not associated with changes in teachers' efficacy belief.

Swackhamer, Koellner, Basile, and Kimbrough (2009) examined levels of in-service teachers' personal efficacy and outcome efficacy and if these efficacy beliefs would change as a result of completing courses in mathematics and/or science that linked content acquisition with pedagogy. They found that in-service teachers who took four or more math or science content courses reported higher outcome efficacy, but not higher teaching efficacy. The reason, as the researchers explained, is because participants in this study were experienced teachers who doubt their ability to influence student learning due to their level of content knowledge. Therefore, improving those teachers' content knowledge combined with pedagogical emphasis increased their levels of outcome efficacy.

Teachers' attitudes in the classroom are influenced by their efficacy beliefs (Brophy, 1986; Hunt 1976; Kagan, 1992; Nussbaum, 1992; Rowan, Chiang, & Miller 1997). In-service science elementary teachers with less positive attitudes toward teaching science tend to spend less time in teaching science (Riggs 1991; Shrigley & Johnson 1974). Teachers reported that they choose not to teach science because they are not good in teaching science, according to their own claims (Czerniak &Chiarelott, 2008). Teachers reported being anxious to teach science due to lack of content knowledge, lack of time to prepare their lessons, lack of support, or lack of supplies needed. The increased anxiety level leads teachers to feel inefficacious in their ability to teach science, which impacts teachers' instructional quality (Czerniak &Chiarelott, 2008). On the other hand, elementary science teachers who believe that students can learn science by teaching

science effectively and by their ability to teach science effectively are more likely to teach science frequently and effectively (Riggs, 1991).

Although it is reported that female teachers in general report higher teaching efficacy than male teachers (Edwards, Green, & Lyons, 1996; Riggs, 1991), in-service female science teachers reported lower efficacy beliefs in teaching science than male teachers (Riggs, 1991). Also, elementary science teachers' attitudes toward teaching science were reported to be higher in male teachers than female teachers (Shrigley & Johnson, 1974). Social cognitive theory suggests that this belief is due to gender expectations and beliefs. In addition, science is viewed as a male subject, and this stereotypical beliefs causes females to feel less efficacious when teaching science (Czerniak & Chiarelott, 2008).

In the literature, many studies correlated science teachers' efficacy with several variables. Several studies reported that an important quality of highly efficacious science teachers is a solid science content knowledge (Posnanski, 2002). Bonnstetter, Penick &Yager (1983), in the Search for Excellence in Science Education study, reported that exemplary science teachers had better content knowledge when compared to the national sample. Also, they are more involved in professional development programs (as cited in Czerniak & Chiarelott, 2008, p.54).

Professional development is also reported to be one of the variables that positively influences science teachers' efficacy. In a longitude study, Lakshmanan, Heath, Perlmutter, and Elder (2011) investigated changes in in-service science teacher efficacy over three years of professional development programs. The researchers used the Science Teacher Efficacy Beliefs Instrument (STEBI) to measure teachers' self-efficacy, as well as the Reformed Teaching Observation Protocol (Sawada et al., 2002) to evaluate science teachers' instructional practices.

Lakshmanan, Heath, Perlmutter, and Elder (2011) reported that elementary and middle school teachers' science teaching efficacy in the study increased significantly. They concluded that the standards-based professional development, which is a combination of content knowledge courses and professional learning communities, succeeded to positively influence teachers' efficacy.

Further, method courses in preparation programs are reported to impact science teachers' efficacy. Morrell and Carroll (2003) investigated the influences of several forms of science course-work on the development of self-efficacy of 342 elementary pre-service teachers. They measured pre-service teachers' self-efficacy in the beginning and after completing each science content course. In addition, pre-service teachers' self-efficacy was measured in the beginning and after completing science and math methods courses. The researchers reported that teachers' efficacy did not change before and after enrolling in content courses. However, teachers' self-efficacy did increase significantly after methods courses.

Lee and Houseal (2003) conducted a case study on four fifth grade elementary science teachers to examine internal and external factors that constrain teaching science in elementary school. They identify factors that limit teaching elementary science. These factors are either external factors, such as time, money, classroom management, supplies, etc., or internal factors, like content knowledge, self-confidence, attitude, anxiety, etc. However, both external and internal factors are linked to self-efficacy. Lee and Houseal (2003) focused on how those teachers taught science, why they taught it that way, and teachers' views of the influence of their science teaching. They concluded that the impact of external and internal factors is mediated by teachers' self-efficacy level. The higher self-efficacy is, the lower the influence of difficulties to teach science.

McDonnough and Matkins (2010) examined the impact of field experience on pre-service teachers' level of efficacy and their ability to connect theory to practice. They found that the use of embedded science methods practicum increases pre-service teachers' self-efficacy. Moreover, pre-service teachers, when supported and advised by the science methods instructor, efficacy levels are higher. Also, the embedded science methods practicum allowed teachers to receive feedback from supervisors and to practice instructional methods specific for science teaching. The science methods instructor, with the embedded field experience and real life experience, increases pre-service teachers' self-efficacy levels.

Utley, Bryant, and Moseley (2005) tracked the development of elementary pre-service teachers' efficacy beliefs regarding mathematics and science teaching while enrolling in methods courses and student teaching. Pre-service teachers were surveyed three times: at the beginning of their science and math methods course and at the completion of their student teaching. They concluded that as the teacher completed the science and the mathematics methods courses, their science and mathematics teaching efficacy significantly increased.

Swars, Daane, and Giesen (2006) surveyed 28 elementary pre-service teachers after they completed two sections of mathematics methods courses to examine the relation between mathematics anxiety and mathematics teacher efficacy. They found a negative relationship between the two constructs. When pre-service teachers reported lower mathematics anxiety, they reported higher efficacy levels for teaching mathematics and vice versa. They concluded that if the teachers' belief in his or her ability to teach mathematics is high, their mathematics anxiety level is low. Newton, Leonard, Evans, and Eastburn (2012) reported a similar conclusion. Elementary pre-service teachers who reported high levels of efficacy have high mathematics

content knowledge and are more likely to have low mathematics anxiety, which is consistent with the findings from other studies.

Teachers' efficacy in teaching elementary mathematics and science is the main focus of the previous section. As Bandura (1997) explained, self-efficacy is related to a person's judgments of his or her ability and what can be accomplished. Research on efficacy beliefs reveals that self-efficacy influences behaviors (Bandura, 1997). Efficacy beliefs influence teachers' decisions and their classroom instructions (Brophy, 1986; Hunt 1976; Kagan, 1992; Nussbaum, 1992; Rowan, Chiang, & Miller 1997). In addition, efficacy belief is specific to a situation (Bandura, 1997). That is, teachers may feel efficacious in teaching one specific subject but not another. Research on elementary teachers reported higher efficacy beliefs in general when compared with middle or secondary level teachers. However, elementary teachers feel less efficacious when teaching mathematics and science (Buss, 2010; Howitt, 2007). In addition, research reports that experience influences teachers' perceptions regarding their ability to teach (Wenner, 2001), and teachers' preparedness is significantly related to their efficacy level (Pas, Bradshaw, and Hershfeldt, 2012).

When examining factors that influence elementary teachers' efficacy beliefs, research reported that insufficient mathematics and science content knowledge is the reason for spending less time teaching them (Shrigley & Johnson, 1974; Riggs, 1991). Also, mathematics and science teachers who possess solid background knowledge in their subjects tend to be less anxious (Newton, Leonard, Evans, & Eastburn, 2012; Swars, Daane, and Giesen, 2006). Therefore, content knowledge is one of the characteristics of highly efficacious teachers (Posnanski, 2002; Bonnstetter, Penick & Yager, 1983). Method courses, also, have positively influenced elementary teachers' efficacy (Morrell & Carroll, 2003; Utley, Bryant, and Moseley, 2005).

Another factor that positively influences elemantery teachers' efficacy is professional development (Lakshmanan, Heath, Perlmutter, & Elder, 2011). Student teaching is another variable that influences pre-service teachers' efficacy. When pre-service teachers receive the needed support during field experience and learn how to connect theory to practice, their efficacy levels increase (McDonnough & Matkins, 2010). Finally, targeting pre-service teachers in their preparation phase is the key factor to produce more efficacious teachers.

Summary

This chapter describes literature relevant to the research on teacher sense of efficacy and its relation to students' achievement. The review of the literature begins with discussing the importance of examining teachers' beliefs in order to get better explanation and understanding of their behavior in the classroom. Teachers who have a strong belief about their ability to influence student performance are considered highly efficacious teachers. Research has indicated that teachers' sense of efficacy has a great impact on student achievement. Bandura (1997) proposed a theory on how efficacy beliefs develop and are shaped, also reviewed in the sources of sense of efficacy section. In addition, variables that influence teachers' sense of efficacy, whether direct influences like school climate or indirect influences like home and community, were examined as well as factors that are assumed to predict teachers' sense of efficacy, such as teaching experience, education, certification, gender, age, parent teacher relationship, etc.

In the literature, methods to explain and measure teachers' sense of efficacy are grounded either in Rotter's social learning theory or in Bandura's social cognitive theory. Therefore, several instruments were reviewed, most of which are not tested in terms of validity and reliability, though some have been tested by researchers and concluded to be invalid instruments. However, the Teacher Sense of Efficacy Scale (TSES) by Tschannen-Moran and Hoy (2001) has undergone several attempts by different researchers in different settings to test its validity, and there is a consensus among researchers that the TSES is an appropriate measure to assess teachers' sense of efficacy and covers several aspect of teaching tasks. These aspects are: efficacy for student engagement, efficacy in instructional strategies, and efficacy for classroom management. Literature regarding teachers and the relation with each aspect were presented as well as the questions in the TSES instrument that measure each construct.

The literature on the impact of teachers' sense of efficacy on student achievement were reviewed and there is an agreement that teachers with high levels of efficacy are more likely to have high achieving students and vise versa. Finally, mathematics and science teachers' sense of efficacy beliefs at the elementary level were reviewed. It is reported that elementary teachers in general feel more efficacious than middle or secondary level. Moreover, in elementary level, research reports that teaching experience and education impact teachers' perceptions about their efficacy beliefs.

CHAPTER III

RESEARCH METHODOLOGY

This study examined what teachers' characteristics (teachers' years of experience and teachers education) have an impact on their level of efficacy. In addition, the influence of mathematics and science teachers' sense of efficacy on fifth grade students' achievement as measured by the Arkansas Benchmark test (2013-2014) was investigated. The following section presents research questions, descriptions of participants and instrument, as well as a description of how the data were collected and analyzed.

The research questions that guided the investigation were:

1. What teacher characteristics impact teachers' sense of efficacy?
2. Does teacher efficacy impact student achievement in mathematics and science?
3. How does testing impact teacher's feelings of self-efficacy?

Participants

Participants included 62 fifth grade mathematics and science teachers in Northwest Arkansas. Demographic data like gender; years of teaching experience, and education level were collected. Each teacher received an informed consent form, which had been approved by the University of Arkansas Institutional Review Board. The form indicated the purpose of the study and possible benefits; it also informed teachers that they could withdraw from the study at any time without penalty.

Teachers from three districts "A","B", and"C" in Northwest Arkansas were included in the study. In 2013-2014, there were nine 5^{th} grade science teachers and eleven 5^{th} grade math

teachers in district “A”, 57 math teachers and 57 science teachers in district “B”, while district “C” had 55 teachers who taught 5th grade students. Therefore, the total number of the population is 189 teachers from the three districts. However, some may be special education teachers with multiple grade levels in their classrooms and some were self-contained classroom teachers. All 62 participating teachers who completed the survey met the criteria of teaching in the school year of 2013-2014. In addition, fifth grade students’ class means scores in the Benchmark test from the school year of 2013-2014 were collected.

Students Demographic Information District “A”

District “A” is located in northwest Arkansas. District “A” serves students from prekindergarten through twelfth grade. The total number of schools is 15, and 9,421 students were enrolled in the school year of 2013-2014. Forty-one percent of the students are eligible for free or reduced meals plans. Table 2 and figure 1provide Race and Ethnicity statistics for district “A”. There are nine elementary schools in this district; however, five elementary schools met the criteria of having fifth grade teachers from the school year of 2013-2014. The district has 710 certified teachers. The total number of fifth grade mathematics and science teachers who participated in the study from those schools is 8 teachers.

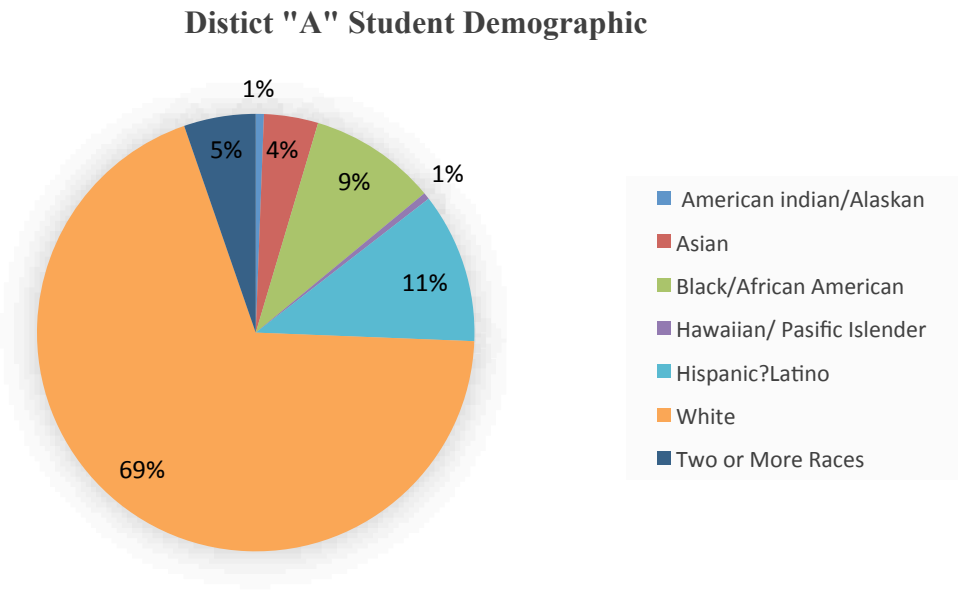

Figure 1 Adapted from the Arkansas Department of Education (2014)

Students Demographic Information District "B"

District "B" is also located in northwest Arkansas. 20,542 students were enrolled in the school year of 2013-2014. Sixty-seven percent of the students are eligible for free or reduced meal plans. Table 2 and figure 2 present race and ethnicity statistics for district "B". The total number of schools in district "B" is twenty-nine schools that serve students from prekindergarten through twelfth grade. Although there are 17 elementary schools in this district, the researcher was permitted to collect data from five elementary schools. 27 fifth grade teachers were agreed to participate in my research.

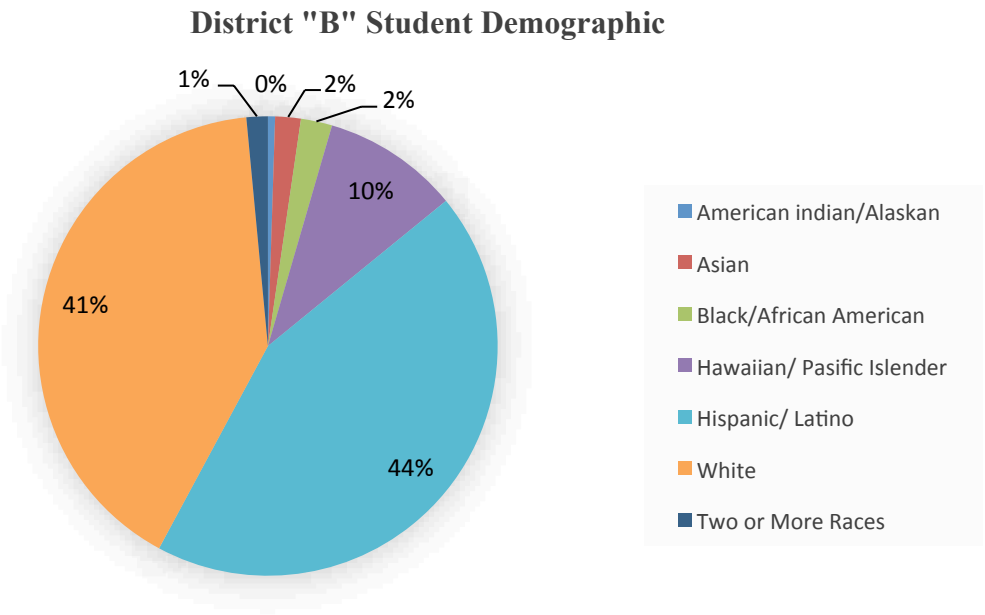

Figure 2 Adapted from the Arkansas Department of Education (2014)

Students Demographic Data District "C"

The third district included in this study is also from NWA. 14,757 students were enrolled in the school year of 2013-2014. Sixty-one percent of the students are eligible for free or reduced meal plans. The total number of schools in district "C" is twenty-nine schools that serve students from prekindergarten through twelfth grade. The total number of elementary schools is fifteen elementary schools. However, four schools chose not to participate in this study. The total number of students from the eleven participating schools is 358 fifth grade students. The total number of fifth grade mathematics and science teachers who participated in the study from those eleven schools is 27 teachers. The Offices of Assessment, Research and Accountability provided

data for the 358 fifth grade students. See Table 2 and figure 3 for race and ethnicity statistics for district “C”.

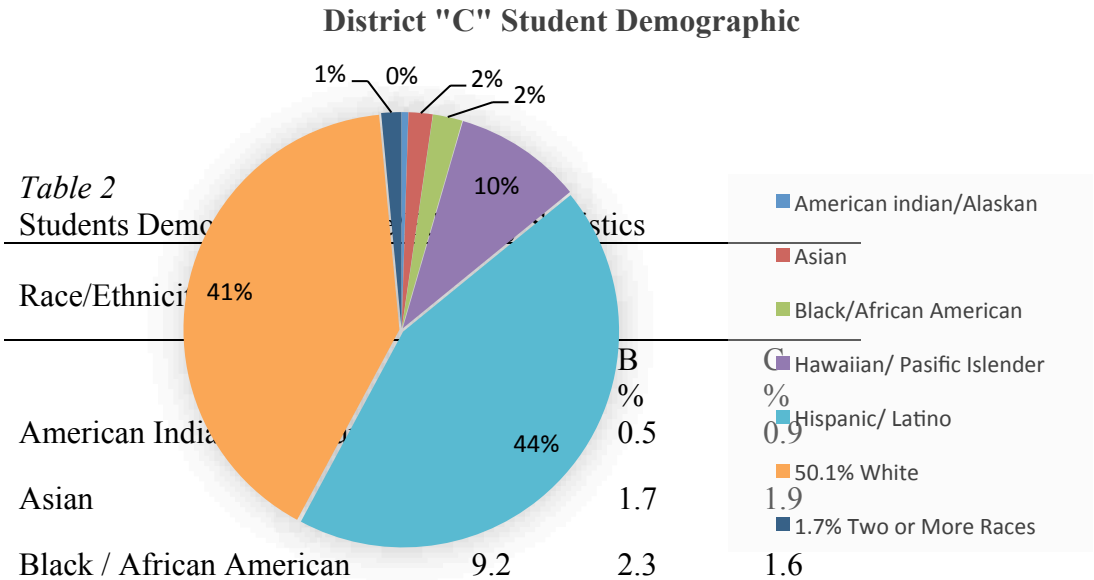

Table 2
Students Demo stics

Race/Ethnici	B	G
	%	%
American Indi	0.5	0.9
Asian	1.7	1.9
Black / African American	2.3	1.6
Hawaiian / Pacific Islander	10.3	0.8
White	39.1	50.1
Two or More Races	1.6	1.7

Note: all information was adapted from the Arkansas Department of Education (2014)

Figure 3 Adapted from the Arkansas Department of Education (2014)

Data Collection

A quantitative approach was utilized to collect data. Permissions were granted from superintendents to collect data (see Appendices J, K, and L), as well as from the University of Arkansas Institutional Review Board for Human Subjects Research. Teachers were contacted through the principal at each school. Students' scores on the Arkansas Benchmark test were collected from the office of Accountability and Research in each district. In the following section, description of the instruments used as well as the procedures to collect and analyze the data are explained. A brief description of the analysis tests that were used to answer the research questions is introduced.

Measures

Teachers' efficacy was measured with The Teacher Sense of Efficacy Scale, or TSES. A copy of the instrument and the permission to use the instrument is available Appendices D & E.

Teacher Sense of Efficacy Scale: TSES. The short form of the Teacher Sense of Efficacy Scale by Tschannen-Moran and Hoy (2001) consists of 12 items. Teachers were asked to express their opinion on the 12 statements on a 9-point Likert scale where one indicates (nothing), three indicates (very little), five indicates (some degree), seven indicates (quite a bit), and nine indicates (a great deal). Some questions from this instrument are: "How much can you do to control disruptive behavior in the classroom?," "How much can you do to get students to believe they can do well on school work?," "To what extent can you craft good questions for your students?," "How much can you do to calm a student who is disruptive or noisy?," and "How much can you use a variety of assessment strategies?"(Tschannen-Moran & Hoy, 2001).

The TSES was created based on Bandura's Teacher Efficacy Scale. Tschannen-Moran and Hoy (2001) recognize a three-factor solution for both the long and the short forms. These factors are labeled: efficacy for instructional strategies, efficacy for classroom management, and efficacy for student engagement. Previous research indicates that the TSES is valid and considered a reliable measure of efficacy. Moreover, the three dimensions of the TSES measure important aspects of teaching tasks.

The overall reliability for the Teacher Efficacy Scale is r = .90. Reliability for the short form of the Teacher Efficacy subscales are: r = .81 for student engagement, r = .86 for instruction and r = .86 for classroom management. The construct validity for the short form of the TSES was tested by the developers by examining the correlation of the TSES subscales with other scales of teacher efficacy (the Rand Items and 10-items adapted from Gibson and Dembo TES by Hoy and Woolfolk, 1993). Positive correlations were found between the short form of the TSES with the first Rand Item ($r = 0.18$, $p < 0.01$); with the second Rand Item ($r = .53$, $p < .01$); with the general teaching efficacy from the Gibson and Dembo's Teacher Efficacy Scale ($r = 0.16$, $p < 0.01$); and with the personal teaching efficacy from the Gibson and Dembo's Teacher Efficacy Scale (r =, 64, p <, 01). The positive correlation with these other scales provides evidence for construct validity.

Teachers' Sense of Efficacy Subscales. A factor analysis of the TSES yielded three factors; these factors are: efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management (Tschannen-Moran & Hoy, 2001). These three dimensions represent the requirements for effective teachers. When testing the validity of the TSES, Tschannen-Moran and Hoy (2001) concluded that the 12-item scale and the 24-item scale are both valid scales. The subscale for teachers' efficacy for student engagement is measured by

questions 2, 3, 4, and 11 in the Teacher Sense of Efficacy Scale. Items 5, 9, 10, and 12 measure teachers' efficacy for instructional strategies. Teachers' efficacy for classroom management is measured by questions 1, 6, 7, and 8 in the Teacher Sense of Efficacy Scale (see Table 3).

Table 3
TSES Questions that Measure Each Construct

Teachers' Efficacy for Student Engagement
How much can you do to motivate students who show low interest in schoolwork?
How much can you do to get students to believe they can do well in schoolwork?
How much can you do to help your students value learning?
How much can you assist families in helping their children do well in school?
Teachers' Efficacy for Instructional Strategies
To what extent can you craft good questions for your students?
How much can you use a variety of assessment strategies?
To what extent can you provide an alternative explanation or example when students are confused?
How well can you implement alternative strategies in your classroom?
Teachers' efficacy for classroom management
How much can you do to control disruptive behavior in the classroom?
How much can you do to get children to follow classroom rules?
How much can you do to calm a student who is disruptive or noisy?
How well can you establish a classroom management system with each group of students?

The Augmented Benchmark Examination. Data from the Arkansas Benchmark Examination was used to measure students' achievement in fifth grade. The Augmented Benchmark Examination is made up of multiple-choice and open-response questions. It tests third to eighth grade students' skills in mathematics, reading and writing, and science. Students' writing is assessed through a writing task, and multiple-choice and open-response questions are used to assess students in science in grades five and seven. The questions in the test were developed based on The Arkansas Mathematics, Science, and English Language Arts Curriculum Frameworks. All students in grades three through eight are required to take the Benchmark

Examination. Therefore, the test is administrated to all Arkansas schools each spring (Arkansas Department of Education, 2014). The Arkansas Department of Education (2011) describes the goal of the Augmented Benchmark Test as follows

> *The goals for the ACTAAP are to*
> *• improve classroom instruction and learning; support public accountability;*
> *• provide program evaluation data;*
> *• assist policy makers in decision-making (p.1).*

Finally, the test provides "performance assessment of the core concepts, thinking skills, and problem-solving skills defined by the Arkansas Curriculum Frameworks; a variety of testing models, including portfolio assessment and performance tasks, which should encourage greater teacher involvement in the assessment process" (Arkansas Department of Education, 2011).

The Arkansas Department of Education releases a report called the Report Interpretation Guide. This report provides explanations on how to read and use the data from the test to assess students' performances as well as to develop plans to improve students' performances. Two copies of the test results are sent to the schools, one for the parents and the other for the school. The results provide students and teachers with students' performances and compare these with the outlined expectations in the Arkansas Curriculum Frameworks. In addition, data from this test helps to identify students with low performances and who need interventions to improve their performances.

In grades three through eight, students and teachers receive a copy of the students' results in each subject: mathematics and literacy, as well as science for fifth and seventh grade students (see Appendix H). Performance levels fall within four categories: advanced, proficient, basic, and below basic. Also, an interpretation of each performance level is given in the report to

explain student performance to the student and parents. Beside the proficiency level for each subject, the report shows where the student falls in the scale, and the student's performance can be compared to the performance of other students in the school, district, and state. In addition, the student's past results on the test are provided. Because science is tested only at grades five and seven, students in fifth and seventh grade receive the same report with the same information, but with an additional science score. To meet the state requirement, students should perform at the advanced and proficient levels, while students who perform at the basic and below basic levels do not meet the state requirements (Arkansas Department of Education, 2011). The Benchmark examination is described by the Arkansas Department of Education in the Consolidated State Application Accountability Plan (2010) as a valid and reliable measure. The Arkansas Department of Education provides the following reason to believe that the results from the Benchmark exam are valid and reliable:

> The assessment system is constructed based on the Content Standards. Independent contractors utilize proven test construction practices in the design, scoring, scaling and reporting. An independent technical advisory committee of experts with documented assessment and psychometric training observe and advise. (The Arkansas Department of Education, 2010, p.32).

Teachers' Demographic Questionnaire. Participants were asked to complete a personal demographic questionnaire. Demographic data were reported as descriptive data. The demographic questionnaire reported teachers' personal characteristics like their age, their gender, whether they taught fifth grade in the 2013-2014 school year, their teaching experience, their highest degree obtained, the subject they taught, and the weekly hours of teaching mathematics and/or science. Responses to all questions were converted to numerical data.

The Open-Ended Question. Teachers were asked about the impact of looking at the benchmark scores on their efficacy levels in teaching mathematics and/or science. Coding was used to analyze participant's responses and themes were developed (Ary,Jacobs, Razavieh,& Sorensen, 2006; Krathwohl, 2009). These themes report teachers' thoughts, feelings, attitudes toward benchmark tests, and most importantly the impact of the results of the Benchmark test on their efficacy beliefs.

Procedures

An approved letter from the superintendent in each district was obtained to conduct the study. After receiving the approval from the University of Arkansas Institutional Review Board for Human Subjects Research, in the fall of 2014, teachers who agreed to participate in the study were asked to complete the Teacher Sense of Efficacy Scale and a demographical questionnaire. The researcher met the principals in each school and asked principals to give the survey packets to fifth grade mathematics and science teachers. Only teachers who taught in the year of 2013-2014 were surveyed in order to match teachers with students' performance in the Benchmark test in the 2013-2014 school year. Each teacher was provided with a packet containing a letter that contained an explanation of the research, demographic questionnaire, and the Teacher Sense of Efficacy Scale. After completing the surveys, teachers were asked to drop the envelops at the main office to be collected by the researcher. Students' performances on the Benchmark test were obtained from each district's Office of Assessment, Research and Accountability without student identifications. For each teacher participating in the study, his or her students' scale score in the benchmark test and the number of tested students in the school year of 2013-2014 were collected in order to link each teacher with his or her students.

Data Analysis

Data from the Teacher Sense of Efficacy Scale for each teacher and the Benchmark test scores for his or her students were analyzed to investigate the relationship between the overall teacher efficacy levels and students' achievement in the Benchmark test 2013-2014.

Analyzing Data from the Teacher Sense of Efficacy Scale

The twelve items in the Teacher Sense of Efficacy Scale (short form) determined participants' beliefs about their ability to influence student achievement. The questions were scored on a 9-point Likert scale. Participants reported their answer to the questions by choosing from 1-9 where one indicates (nothing), three indicates (very little), five indicates (some degree), seven indicates (quite a bit), and nine indicates (a great deal).

As previously mentioned, the TSES includes three subscales that measure three different aspects (teacher efficacy for student engagement, teacher efficacy for instructional strategies, and teacher efficacy for classroom management). To determine the efficacy level for each teacher, three categories were identified from the scale. These categories were: low sense of efficacy for those teachers whose average scores were from 1-3, moderate sense of efficacy for those teachers whose average scores were from 4-6, and high sense of efficacy for those teachers whose mean scores were from 7-9. After categorizing teachers' efficacy, teachers' efficacy for each subscale was calculated. Items in the TSES that measured teacher efficacy for student engagement load on items 2, 3, 4, and 11. Items 5, 9, 10, and 12 assessed teacher efficacy for instructional strategies, while items measuring teacher efficacy for classroom management loaded on items 1, 6, 7, and 8.

Analyzing Data from the Demographic Questionnaire

Participants were asked to complete a personal demographic questionnaire. Demographic data were reported as descriptive data. SPSS was used to analyze the data. Responses to all questions were converted to numerical data in order to answer the research questions.

Analyzing Data the Open-Ended Question

Coding was used to analyze participants' responses and to develop themes. These themes report teachers' thoughts, feelings, attitudes toward benchmark tests, and the impact of the results of the Benchmark test on their efficacy beliefs.

Analyzing Data from the Benchmark Test

The proficient score range in the benchmark test varies for each grade. The proficient score range increases as the student move to the upper grade. Students' scale scores and their proficiency level for mathematics and science were used as the secondary data. The average scale score for all the students were used for each teacher. In fifth grade, mathematics scores range from 543-697, in which 543 is considered a below basic performance level, 544-603 a basic performance, 604-696 a proficient performance level, and 697-and above an advanced level (Table 4). In fifth grade science, the scores range from 153-250, in which 153 means below basic, 145-199 means basic level, 200-249 means proficient level, and 250 and above means advanced level (Table 4).

Table 4
Science and Math Performance Level Description

Performance Level	Science (31)	Math (31)
Advanced	250 and above	697and above
Proficient	200-249	604-696
Basic	154-199	544-603
Below Basic	153 and below	543and below

Procedures to Answer the Research Questions

Specifically, three main research questions guided the research. The first research question concerned the impact of teachers' characteristics in terms of years of teaching experience and highest degree on their sense of efficacy. First, to test if there was any significant difference in teachers' year of teaching experience and their sense of efficacy, a one-way ANOVA was used to examine the relationship between teachers' experience and their sense of efficacy.

The second characteristic that was examined as part of the first question was teachers' highest degree and whether there was any significant difference between teachers' highest degree, teachers' total sense of efficacy, and the three aspects of teachers' sense of efficacy (efficacy in classroom management, efficacy in student engagement, and efficacy in instructional strategies). An independent-sample t test was used to compare participants' (mathematics and science teachers') total efficacy beliefs for those who have a master's degree with teachers who have a bachelor degree. Then, an independent-sample t test was used to examine the differences in mathematics and science teachers' efficacy in each construct based on their highest degree.

The second research question concerned teachers' sense of efficacy and its impact on student achievement in mathematics and science as measured by the benchmark test. To test if there was any significant correlation between teachers' sense of efficacy and students' achievement in mathematics and science, teachers' levels of efficacy, whether high (range from 7-9), moderate (range from 4-6), or low (range from 1-3), were identified by calculating the average scores for participants. Correlation coefficient was used to investigate if there was a relationship between teachers' sense of efficacy in teaching mathematics and science and their students' achievement.

The third research question concerned the impact of benchmark results on teachers' feelings of self-efficacy. Coding was used to analyze participant's responses as themes. These themes report teachers' feelings toward benchmark tests and the impact of the results of the Benchmark test on their efficacy beliefs.

Summary

The purpose of this study was to examine the impact of teachers' years of experience and teachers' education on their levels of efficacy. In addition, the influence of mathematics and science teachers' sense of efficacy on fifth grade students' achievement as measured by the Arkansas Benchmark test (2013-2014) was examined. This chapter presented a descriptive analysis of the participants (teachers and students) and the instruments that were used in the study: Teacher Sense of Efficacy Scale, and the Augmented Benchmark Examination. In addition, procedures used to collect and analyze the data were explained. Finally, a brief description of analysis tests that were used to answer the research questions was included.

CHAPTER IV

RESULTS

In this chapter, a description of findings will be presented to determine the relationship between teachers' sense of efficacy and student achievement on the benchmark test in mathematics and science. Data are analyzed using SPSS to answer the research questions. In addition, response rate and demographic information regarding fifth grade teachers who participated in the study and their students' mean scores in mathematics and science from the Benchmark test 2013-2014 are presented. The following section presents results from the Teachers' Sense of Efficacy Scale, as well as teachers' efficacy in the subscales (efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management). Then, findings that answer the research questions are reported.

Survey Distribution and the Response Rate

The survey packets, which include the Teacher Sense of Efficacy Scale and a demographical questionnaire (see Appendix C), were delivered to all schools by the researcher and handed to each principal. The researcher asked principals to give the survey packets only to fifth grade mathematics and science teachers who taught in the 2013-2014 school year. The total number who met these criteria was 75 teachers. Therefore, 75 survey packets were distributed to all three districts. The completed surveys were collected a week later by the researcher. Table 5 shows the number of distributed surveys and the response rate based on the three districts.

Table 5
Distributed Survey Packets and Response Rate

Districts	Distributed Surveys	Returned Surveys	**%**
A	8	8	100%
B	30	27	90%
C	37	27	72%
Total	75	62	85%

Analysis of the Data

Teachers' Demographic Information

The population involved all fifth grade mathematics and science teacher from districts "A", "B", and "C" from northwest Arkansas. Surveys were sent to all mathematics and science fifth grade teachers who met the criteria of teaching fifth grade in the previous school year, 2013-2014 year school. The demographic questionnaire provides an opportunity to learn about teachers' personal characteristics like their age, their gender, whether they taught fifth grade in the 2013-2014 school year, their teaching experience, their highest degree obtained, the subject they taught, and the weekly hours of teaching mathematics and/or science. In addition, an open-ended question asked teachers about the impact of looking at the benchmark scores on their efficacy level in teaching mathematics and/or science. The total number of teachers participating in this study is 62 from northwest Arkansas, in which 31 teachers were mathematics teachers and 31 teachers were science teachers. All participants are fifth grade teachers and taught mathematics and science in the school year of 2013-2014. Some teachers reported that they taught all subjects (self-contained). In addition, on average, teachers reported 8.6 hours of math instruction and 4.8 hours of science teaching. SPSS was used to analyze the data. Responses to

all questions were converted to a numerical data. Demographic characteristics of fifth grade teachers who completed the survey are shown in Table 6.

Table 6
Teachers Demographic Data (N=62)

	Frequency	Percent (%)
Gender		
Male	8	13
Female	54	87
Age		
25-29	7	11
30-34	13	21
35-39	9	14
40-44	10	16
45+	21	34
Teaching Experience		
1-4 years	9	14
5-9 years	11	18
10-14 years	10	16
15-19 years	12	19
20-24 years	10	16
25-29 years	6	10
30+ years	4	6
Highest Degree		
Bachelor's	28	45
Master's	34	55
Subject		
Math	31	50
Science	31	50

The Open-Ended question. The researcher included one open-ended question asking teachers about their feelings after seeing the results from the benchmark test. To analyze the data from the open-ended question, coding was used to analyze participant's responses and categories or themes (Ary,Jacobs, Razavieh,& Sorensen, 2006; Krathwohl, 2009) were developed. These

themes report teachers' thoughts, feelings, attitude toward benchmark test, and most importantly the impact of the results on the Benchmark test on their efficacy beliefs.

Table 7 shows themes emerging from participants who answered the question. Teachers were asked to answer the following question "How do benchmark scores impact your feelings of efficacy in teaching math or science? Your belief in influencing student's learning." Not all participants provided their answers; only 37 teachers responded. Teachers' responses were analyzed and coded and 4 themes emerged:

1. The impact of the results on teachers' sense of efficacy
2. The accuracy in reflecting students' performance
3. Teachers' attitudes towards standardized testing
4. How they use the scores,
    a) To evaluate students' growth
    b) To improve instruction
    c) To identify students' strengths and weaknesses

Table 7 shows themes emerging from participants who answered the question.

Table 7
Examples of Teachers' Responses to the Open-Ended Question and Themes Emerging from Teachers' Responses

Themes	Teachers' Responses
The impact of the results on teachers' sense of efficacy	▪ " Benchmark test validate my feelings of efficacy in math and science instruction" ▪ "Benchmark scores do not effect my view of my teaching ability…. I know now that benchmark scores do not measure my ability as a teacher."
The accuracy of the benchmark test in reflecting students' performance	▪ "I don't believe all learning can be tested by a state test. These tests don't show the level of understanding a student has accurately." ▪ "… Benchmark exam is a knowledge based exam not a skills based exam." ▪ " Benchmark is not always ideal …"
Teachers' attitudes towards standardized testing	▪ I feel it is a knowledge based exam not a skills based exam." ▪ "Benchmark scores are minimum requirement. Students could get basic skills and pass that test." ▪ "I would like to see all students proficient or advanced."
How teachers use the benchmark scores	a. To improve instruction ▪ "…Indicate areas of strength and weakness that help in driving instruction" ▪ "… I use to create my lesson plan and guide my instruction" b. To evaluate students' growth ▪ "… I worry less about the benchmark scores and more about whether students have made growth in their learning." ▪ "I want to see growth." ▪ "… Help me to analyze growth…" c. To identify students strengths and weakness ▪ "Help me identify common areas that students may lack understanding." ▪ "They indicate areas of strength and weakness…" ▪ "I look for low scoring areas and high scoring areas."

The Teachers' Sense of Efficacy Scale Data

The Teachers' Sense of Efficacy Scale (TSES) was developed by Tschannen-Moran and Hoy (2001). The short form of the Teacher Sense of Efficacy Scale consists of 12 items. Three Factors are recognized: efficacy for instructional strategies, efficacy for classroom management, and efficacy for student engagement. These three dimensions represent the requirements for effective teachers. The subscale for teachers' efficacy for student engagement is measured by questions 2, 3, 4, and 11 in the Teacher Sense of Efficacy Scale. Items 5, 9, 10, and 12 measure teachers' efficacy for instructional strategies. Teachers' efficacy for classroom management is measured by questions 1, 6, 7, and 8 in the Teacher Sense of Efficacy Scale. Teachers' efficacy results will be presented by subjects taught. The mean scores for each of the 12 items will be presented in Table 8. In addition, the overall teachers' efficacy score and teachers' efficacy in the three subscales (efficacy for instructional strategies, efficacy for classroom management, and efficacy for student engagement) were calculated to examine the relationship. Mean scores for the overall math teachers' sense of efficacy and science teachers' sense of efficacy, as well as the three subscales are shown in Table 8 and Table 9.

After analyzing teachers' Sense of Efficacy Scale TSES, data revealed that the average efficacy level for fifth grade mathematics and science teachers in NWA is 7.6, which means in general fifth grade teachers in this study have high sense of efficacy and they believe they have "Quite A Bit" of influence in students' learning. There is no difference in the total scores of efficacy level between math teachers and science teachers. Both groups score the same.

Table 8
Means and Standard Deviation for Each Item in the TSES (N=62)

Item	Mean	SD
1. How much can you do to control disruptive behavior in the classroom?	8.0	1.61
2. How much can you do to motivate students who show low interest in school work?	7.2	1.14
3. How much can you do to calm a student who is disruptive or noisy?	7.7	.974
4. How much can you do to help your students value learning?	7.4	1.22
5. To what extent can you craft good questions for your students?	8.0	1.07
6. How much can you do to get children to follow classroom rules?	8.1	.94
7. How much can you do to get students to believe they can do well in school work?	7.4	1.03
8. How well can you establish a classroom management system with each group of students?	8.0	.87
9. To what extent can you use a variety of assessment strategies?	7.8	.97
10. To what extent can you provide an alternative explanation or example when students are confused?	7.7	1.05
11. How much can you assist families in helping their children do well in school?	6.4	1.44
12. How well can you implement alternative teaching strategies in your classroom?	7.5	1.05
Total mean for all items	7.6	.66

As previously mentioned, the TSES measures three aspects: efficacy for instructional strategies, efficacy for classroom management, and efficacy for student engagement. Fifth grade mathematics teachers' efficacy in the area of instructional strategies is 7.8, efficacy for classroom management is 8, and efficacy for student engagement is 7, while fifth grade science teachers' efficacy for instructional strategies is 7.6, efficacy for classroom management is 8, and

efficacy for student engagement is 7. In both subjects, the lowest mean score among the three subscales is in the area of students' engagement.

Table 9
Science and Math Teachers' Sense of Efficacy Scale: Total Mean Scores and Subscale Mean

	Science (31)		Math (31)	
	Mean	SD	Mean	SD
Total Teachers' Sense of efficacy	7.62	.72	7.65	.60
Efficacy for Student Engagement	7.23	.99	7.08	.88
Efficacy for Instructional Strategy	7.69	.95	7.85	.77
Efficacy for Classroom Management	7.95	.72	8.01	.61

Data from the Benchmark Test

For each teacher who participated in this study, their students' performance in the Benchmark test was provided by the Office of Research and Assessment in each district. For each teacher, the mean class score for the students that each teacher taught was used. Students' performance scores were examined in mathematics and science for the 2013-2014 school year, which represent 2139 students. As previously mentioned, the mathematics scores range from 543-697, in which 544-603 is a basic performance, 604-696 a proficient performance level, and 697-and above an advanced level see Table 4. In fifth grade science, the scores range from 153-250, in which 153 means below basic, 145-199 means basic level, 200-249 means proficient level, and 250 and above means advanced level.

Table 10
The Augmented Benchmark Examinations Mean Scale Scores(N=62)

Subject	N	Mean Scale Score	SD	Min	Max	Scale Score Range
Mathematics	31	669.70	39.16	610	796	543-697 and above
Science	31	212.83	22.70	176	262	153-250 and above

Table 10 presents students' performance in the Benchmark test in mathematics and science for the school year of 2013-2014. In mathematics, the mean scale score for all fifth grade students is 669.70, which indicates that students performed in the proficient level. In science, the mean scale score for all fifth grade students is 212.83, which also indicates that students performed in the proficient level (see appendix G for mathematics and science performance level description).

Inferential Analysis

Research Question 1

The first research question concerned the impact of teachers' characteristics in terms of years of teaching experience and highest degree on their sense of efficacy. To find the answer of this question, several statistical tests were conducted, one for teaching experience and the other for teachers' highest degree.

The impact of teachers' highest degree on total efficacy. The first characteristic that was examined was teachers' highest degree and whether there was any significant difference in teachers' total sense of efficacy when considering teachers' highest degree. This question compares fifth grade teachers' (mathematics and science combined) efficacy beliefs for teachers

with master's degree and teachers who hold a bachelor degree. An independent-sample *t* test was conducted, and results showed a significant difference in teachers who have a bachelor degree *(M=7.84, SD=.49)* and teachers who have a Master's degree *(M=7.47, SD= .74); t (57.8) = 2.29,p=.025.* The effect size is 0.58 and according to Cohen's rule it is medium effect size (Cohen, 1988). These results suggest that teachers who have a Bachelor degree have higher total efficacy than teachers who hold Master's degrees.

Teachers' efficacy for classroom management and teachers' highest degree. This question compared whether there was a difference in fifth grade (mathematics and science combined) teachers' efficacy beliefs in classroom management based on their highest degree. An independent-sample *t* test was conducted, and results showed a significant difference in teachers' efficacy for classroom management between teachers who have a bachelor degree *(M=8.20, SD=.50)* and teachers who have a Master's degree *(M=7.82, SD= .74); t (58.02) = 2.39, p=.020*. The effect size is 0.59 and according to Cohen's rule it is medium effect size (Cohen, 1988). These results suggest that teachers who have Bachelor degrees have higher efficacy for classroom management than teachers who hold Master's degrees.

Teachers' efficacy for student engagement and teachers' highest degree. This question compared whether there was a difference in fifth grade (mathematics and science combined) teachers' efficacy beliefs in student engagement based on teachers' highest degree. An independent-sample *t* test was conducted, and the result showed that there is non-significant difference in teachers' efficacy for student engagement between teachers who have a bachelor degree *(M=7.25, SD=1.17)* and teachers who have a Master's degree *(M=7.17, SD=.82); t (60) = .77, p=.45.* The effect size is 0.081 and according to Cohen's rule it is small effect size

(Cohen, 1988). These results suggest that teachers who have Bachelor degrees do not have higher efficacy for student engagement than teachers who hold Master's degrees.

Teachers' efficacy in instructional strategies and teachers' highest degree. This question compared whether there was a difference in mathematics and science teachers' efficacy in instructional strategies based on the highest degree attained by teachers. An independent-sample *t* test was conducted, and results showed a significant difference in teachers' efficacy for instructional strategies between teachers who have a bachelor degree *(M=8.16, SD=.63)* and teachers who have a Master's degree *(M=7.53, SD=.97); t (57.2) = 2.57, p=.013.* The effect size is 0.75 and according to Cohen's rule it is large effect size (Cohen, 1988). These results suggest that teachers who have Bachelor degrees have higher efficacy for instructional strategies than teachers who hold Master's degrees.

The second characteristic that was examined was teachers' teaching experience. To test if there was any significant difference in teachers' year of teaching experience and their total sense of efficacy, teachers were asked to respond to a question regarding their teaching experience. A one-way ANOVA was used to investigate this relationship. Results revealed that there is non-significant difference in teachers' efficacy based on their teaching experience. *F (2, 59) = .68, p =.51,* partial η^2=.02. Therefore, the level of teachers' efficacy does not differ by teachers' experience.

Research Question 2

The second research question concerned teachers' sense of efficacy and its impact on student achievement in mathematics and science as measured by the benchmark test. To test if there was any significant correlation between teachers' sense of efficacy and students' achievement in

mathematics and science, teachers' levels of efficacy, whether high (range from 7-9), moderate (range from 4-6), or low (range from 1-3), were identified by calculating the average scores for participants. Pearson correlation was used to investigate if there was a relationship between teachers' sense of efficacy in teaching mathematics and science and their students' achievement.

Math teachers' sense of efficacy and student achievement in math. A correlation between elementary math teachers' sense of efficacy and students' math achievement was conducted to measure and describe the relationship between math teachers' sense of efficacy and students' achievement. Students' class mean scale scores for each teacher were reported from each district. Then, a correlation analysis was conducted to determine the relationship between teachers' self-efficacy and student achievement. A Pearson r correlation coefficient was conducted to evaluate the relationship between teachers' sense of efficacy and their students' achievement scores in the benchmark examination in mathematics. A correlation of .329 with a significance value of .071 emerged, which is greater than $\alpha = .05$. Therefore, the analysis revealed that there was non-significant correlation between fifth grade mathematics teachers' sense of efficacy and student performance in the mathematics section in the benchmark examination *(r (29) = .33, p = .071, p>.05).* See table 11

Table 11
Correlation Between Mathematics Teachers' Self-Efficacy and Student Performance

		Math mean score
Mathematics Teachers' Sense of Efficacy	Person Correlation	.329
	Sig. (2-tailed)	.071
	N	31

Science teachers' sense of efficacy and student achievement in science. A correlation analysis was conducted to determine the relationship between science teachers' self-efficacy and

student performance in science. A Pearson r correlation coefficient was conducted to evaluate the relationship. The results showed a correlation of .329 with a significance value of .071, which is greater than $\alpha = .05$. Therefore, the analysis revealed that there was non- significant relationship between fifth grade science teachers' sense of efficacy and student performance in the science section in the benchmark examination *(r (29) = .328, p = .07, p>.05).* See table 12.

Table 12
Correlation Between Science Teachers' Self-Efficacy and Student Performance

		Science Mean Score
Science Teachers' Sense of Efficacy	Person Correlation	.328
	Sig. (2-tailed)	.071
	N	31

Research Question 3

The third research question concerned teachers' feelings after seeing the results from the benchmark test. Data was analyzed from the open-ended question. Participants' responses were coded and themes emerged. These themes present teachers' thoughts, feelings, attitudes toward benchmark tests, and the impact of the results of the Benchmark test on their efficacy beliefs. Table 7 shows themes emerging from participants who answered the question. Teachers were asked to answer the following question "How do benchmark scores impact your feelings of efficacy in teaching math or science? Your belief in influencing student's learning." Not all participants provided their answers; only 37 teachers responded. Teachers' responses were analyzed and coded and 4 themes emerged:

5. The impact of the results on teachers' sense of efficacy

6. The accuracy in reflecting students' performance
7. Teachers' attitudes towards standardized testing
8. How they use the scores,
    a) To evaluate students' growth
    b) To improve instruction
    c) To identify students' strengths and weaknesses

Table 13 shows themes emerging from participants who answered the question.

Table 13
Examples of Teachers' Responses to the Open-Ended Question and Themes Emerging from Teachers' Responses

Themes	Teachers' Responses
The impact of the results on teachers' sense of efficacy	▪ " Benchmark test validate my feelings of efficacy in math and science instruction" ▪ "Benchmark scores do not effect my view of my teaching ability…. I know now that benchmark scores do not measure my ability as a teacher."
The accuracy of the benchmark test in reflecting students' performance	▪ "I don't believe all learning can be tested by a state test. These tests don't show the level of understanding a student has accurately." ▪ "… Benchmark exam is a knowledge based exam not a skills based exam." ▪ " Benchmark is not always ideal …"
Teachers' attitudes towards standardized testing	▪ I feel it is a knowledge based exam not a skills based exam." ▪ "Benchmark scores are minimum requirement. Students could get basic skills and pass that test." ▪ "I would like to see all students proficient or advanced."
How teachers use the benchmark scores	d. To improve instruction ▪ "…Indicate areas of strength and weakness that help in driving instruction" ▪ "… I use to create my lesson plan and guide my instruction" e. To evaluate students' growth ▪ "… I worry less about the benchmark scores and more about whether students have made growth in their learning." ▪ "I want to see growth." ▪ "… Help me to analyze growth…" f. To identify students strengths and weakness ▪ "Help me identify common areas that students may lack understanding." ▪ "They indicate areas of strength and weakness…" ▪ "I look for low scoring areas and high scoring areas."

Summary

The relationship between teachers' sense of efficacy and their students' performance in the Benchmark test and the examination of factors that may contribute to teachers' sense of efficacy was the main focus of this study. The analysis of the data from the Teachers' Sense of Efficacy Scale, the demographic questionnaire, and from students' mean score in the Benchmark test was presented in this chapter. Findings from analyzing the data were presented, as well as the answers to research questions.

As regards to the first question that examines the impact of some of teachers' characteristics and their efficacy levels, two characteristics were examined: teachers' teaching experience and teachers' education. Results revealed a non-significant difference in teachers' efficacy based on their teaching experience. However, when comparing fifth grade mathematics and science teachers' efficacy beliefs for teachers with master's degree and teachers who hold a bachelor degree, a significant difference in teachers' efficacy beliefs emerged based on their degrees. Teachers who have a Bachelor degree have higher total efficacy than teachers who hold Master's degrees. That is, teachers who have Bachelor degrees have higher efficacy for classroom management and instructional strategies than teachers who hold Master's degrees, but do not have higher efficacy in student engagement than teachers who have Master's degrees.

Then, a further investigation occurred of the impact of teachers' degree on teachers' efficacy beliefs in the three subscale of teachers' efficacy (for classroom management, for student engagement, and for instructional strategies). Results showed a significant difference in teachers' efficacy for classroom management and for instructional strategies but not for student engagement.

The second question assessed the impact of teachers' sense of efficacy beliefs on students' achievement in mathematics and science. Results indicated that there is no relationship between the two variables. As indicated in the tables presented throughout this section, there was a non-statistically significant difference between fifth grade teachers' sense of efficacy and students' achievement in the benchmark test in mathematics and science.

The third research question investigated the impact of the results of the Benchmark test on teachers' sense of efficacy. Analyzing the data revealed that out of 37 teachers who answered the open-ended question, 11 teachers stated that the Benchmark scores have an impact on their efficacy level. Eight teachers stated that the benchmark test is not accurate in reflecting students' performance. However, some teachers stated that they use the scores in three different ways: (1) to evaluate students' growth (six teachers), (2) to improve their instruction (twelve teachers), and (3) to identify students' strengths and weaknesses (twelve teachers).

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

The primary purpose of the present study was to examine fifth grade teachers' sense of efficacy in Northwest Arkansas teachers who teach mathematics and science and to examine what teachers' characteristics contribute to teachers' efficacy. In addition, the impact of teachers' sense of efficacy on student achievement was examined. In this section, finding and conclusions of the investigation are presented. The Teachers' Sense of Efficacy Scale (TSES) by Hammond (2001) was used to measure teachers' sense of efficacy. Students' performance on the benchmark test from the school year of 2013-2014 was used to investigate the relationship between efficacy and student achievement. In addition, teachers' demographic data, like gender, teaching experience, and weekly hours of teaching mathematics and science, was collected.

The research questions that guided the investigation are:

1. What teacher characteristics impact teachers' sense of efficacy?
2. Does teacher efficacy impact student achievement in mathematics and science?
3. How does testing impact teacher's feelings of self-efficacy?

In this chapter, a dissection of the findings of each question, the limitations, and the implications and recommendations for future research will be presented.

Discussions of Findings

When examining some factors that might contribute to total teacher efficacy, including teachers' efficacy for classroom management, teachers' sense of efficacy for instructional strategies, and teachers' efficacy for student engagement and the highest degree attained by teachers, results suggest a significant difference in the total efficacy level between teachers.

Teachers who have Bachelor degrees have higher total efficacy than teachers with a Master's degree. A significant difference was found in teachers' efficacy for classroom management (first subscale) between teachers who have a bachelor degree and teachers who have a Master's degree. Teachers who have a Bachelor degree have higher efficacy for classroom management than teachers with a Master's degree. A significant difference in teachers' efficacy for instructional strategies between teachers who have a bachelor degree and teachers who have a Master's degree was found; teachers who have a Bachelor degree have higher efficacy for instructional strategies than teachers who hold a Master's degree. However, no significant difference was found in teachers' efficacy for student engagement between teachers who have a bachelor and teachers who have a Master's degree. Another factor that was examined to investigate its impact on teacher efficacy was teachers' teaching experience. Results revealed that teachers' teaching experience has no impact on teachers' efficacy level.

Teachers' sense of efficacy level has been linked with and considered a contributing factor to student achievement (Ashton and Webb, 1986; Khan, 2011; Caprara, Barbaranelli, Steca, and Malone, 2006;Holzberger, Phlipp, & Kunter, 2013). Several studies reported that teacher beliefs about their ability to influence student learning are one of the variables that influence students' performance (Armor et al., 1976). However, in the present study, results came to contradict previous research. The data revealed that there is no significant relationship between fifth grade mathematics and science teachers' sense of efficacy and their students' performances in the Benchmark test.

There are several possible explanations for the lack of relationship between teachers' efficacy and students' performances in this particular study. One possibility is that in this study, teachers' behavior was examined only though the cognitive / personal factors aspect, while

Bandura, in his social cognitive theory, claims that behaviors can be explained through the interaction among behaviors; cognitive or personal factors; and environmental aspects (Bandura, 1997). These factors interact with and determine each other, through what Bandura calls reciprocal determinism (1997). Teachers' behaviors in the classroom were not observed or examined. Data relied on a self-reported survey. Moreover, environmental aspects also were not considered in this study, such as students' characteristics, class size, activity structure, school size, demographic characteristics, school norms, collegial relations, principal- teacher relations, decision-making structures, home-school relations, or the socioeconomic level of the community (Ashton &Webb, 1986). In addition, one possible explanation could be the effective of high-stakes tests.

Another possible reason for the difference in the results of this study as compared to prior research is that all the teachers participating in the study reported themselves as highly efficacious teachers. The average of students' performance in math is 669.70, performing at proficient level, while the average of students' performance in science is 212.83, performing also at the proficient level. Although teachers who participated in this study have high efficacy beliefs and they believe they are capable of influencing students' learning, they may not have the plan or the knowledge on how to achieve that. A number of the teachers who participated in the study said they teach for the test so students can perform well in the Benchmark test.

The instrument used in this study is the Teachers' Sense of Efficacy Scale. It is a self-reported scale. Therefore, the accuracy of the information obtained from it depends basically on the participants' honest responses (Ary, Jacobs, Razavieh, & Sorensen, 2006). Elementary school teachers, in general, score high sense of efficacy when reporting their efficacy beliefs. (Klassen & Chiu 2010).

Limitations of the Study

There are several limitations that need to be acknowledged. First, the study is limited only to fifth grade mathematics and science teachers from Northwest Arkansas. The reason for focusing on fifth grade is due to the fact that the researcher wanted to measure student achievement in mathematics and science at the elementary level. The state tests both subjects in grades 5, 8, and 11. Since the focus of this study was elementary teachers' sense of efficacy, data were collected only from fifth grade. Therefore, findings cannot be generalized to other elementary teachers nationwide. Second, some of the participants were teachers in self-contained classrooms, which may limit the results because some of the teachers might fill out the survey twice, one for math and another time for science.

Another limitation is related to the instrument used in this study. The Teacher Sense of Efficacy Scale is a self-reported instrument and teachers' were assumed to be honest regarding their efficacy beliefs. In this study, the impact of teachers' efficacy on students' achievement was the main focus. Other factors on students' achievement like students' socioeconomic status was not studied or taken into account in this study.

Finally, the fact that the state of Arkansas is currently transitioning from the Benchmark test to a new test based on Common Core Standards is another limitation. This transitioning can positively or negatively impact teachers' beliefs, and their perceptions of their ability to teach under the new standards might change as well.

Implications for Practice

Although the findings of this study indicated that teachers' sense of efficacy is not related to students' performance, previous studies reported that teachers' sense of efficacy is one of the factors that influence students' achievement. Research shows that students who are assigned to effective teachers scored higher on standardized tests that other students (Darling-Hammond, 2000). Therefore, the fact that teachers' sense of efficacy is an important component that influences students' achievement should be considered when hiring new teachers. In addition, since an efficacy belief is a construct of a specific belief (Bandura, 1981), a teacher may feel more efficacious to teach certain subjects. Therefore, teachers' impact on students' learning would be positive if teachers are allowed to teach subjects they are comfortable with.

Teacher preparation programs should provide pre-service teachers with opportunities to be exposed to a variety of courses that help them develop teaching skills in instructional strategies, classroom management, and students' motivation. Third, Professional development should be developed with a consideration of teachers' efficacy levels in order to meet teachers' needs to improve their teaching skills.

Recommendations for Future Research

There are three recommendations for future research based on this study. The first recommendation is related to teachers' education, whether master's or bachelor's degree. Findings revealed that a significant difference in teachers' efficacy level existed based on their degrees. Teachers who have a bachelor's degree were found to be more efficacious in classroom management and in instructional strategies than teachers who have a master's degree. It is recommended that future research investigate these findings to answer questions like "are the

variations in teachers' efficacy levels based on teachers' degrees due to the type of teachers' degrees?" to investigate whether a field related degree, like mathematics or science, has an impact on their efficacy levels. Another question would be "what it is about the master's and the bachelor's degrees that might affect teachers' efficacy?" Is it the courses they study, their field placement, their professional development hours, or a combination of these factors? Professional development has proven its influence in teachers' efficacy (Tschannen- Moran and McMaster, 2009). Another recommendation is to develop specific programs that target the needs of teachers to improve their teaching skills.

The second recommendation is related to the instrument used to measure teachers' sense of efficacy. Although the Teachers' Sense of Efficacy Scale (TSES) is supposed to measure requirements for effective teachers (Tschannen-Moran and Hoy, 2001), research states that efficacy beliefs are dependent on the subject area (Bandura, 1981) teachers teach. Therefore, my recommendation for future research is to use a subject specific instrument that might yield different results. In addition, data was collected primarily relying on the TSES. In order to provide a richer description of efficacy, it would be recommended for future researchers to assess classroom observation. This will allow in-depth examination of not only teachers' beliefs about what they can do, but also to what degree teachers perform their teaching tasks instead of merely giving their beliefs about them.

Finally, 2013-2014 students' data in the benchmark was used to measure students' achievement. Moreover, findings indicated that students' performance in the benchmark test is not related to teachers' level of efficacy. It is recommended to expand this study and follow the students' growth for more than one year or to use different assessment methods, which might

yield different findings. Another recommendation related to measuring students' performance is to reconsider the way students are being assessed.

Summary

This study examined mathematics and science fifth grade teachers' sense of efficacy in Northwest Arkansas and what teachers' characteristics contribute to teachers' efficacy. In addition, the impact of teachers' sense of efficacy on student achievement was examined. Regarding teachers characteristics that impact their efficacy levels, findings revealed that teachers' degree has an impact on teachers' efficacy level. Teachers who have Bachelor degrees have higher total efficacy, higher efficacy for classroom management, and have higher efficacy for instructional strategies than teachers with a Master's degree. On the other hand, a non-significant difference was found in teachers' efficacy for student engagement between teachers who have a Bachelor and teachers who have a Master's degree. Data also revealed that there is no significant relationship between fifth grade mathematics and science teachers' sense of efficacy and their students' performances in the Benchmark test. In this chapter, possible explanations and discussion of the findings were presented, as well as a review of the limitations of the study. Finally, implications and recommendations were presented.

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Appendix A
Consent Letter

Teachers' Sense of Efficacy: Examining the Relationship of Teacher Efficacy and Student Achievement
Consent to Participate in a Research Study

Dear Teachers:

You are invited to participate in a research study to examine the relationship between teachers' sense of efficacy in Northwest Arkansas teachers and student performance on the Arkansas Benchmark test (2014).

The purpose is to examine the relationship between teachers' sense of efficacy and student achievement.

If you agree to participate in this study, you will be asked to complete a survey that will take a few minutes to complete. Participation is voluntary and you may choose to withdraw from this study at any time. All information will be kept confidential and responses will be kept anonymous and no identifying information will be collected.
There is no anticipated discomfort if you are willing to contribute to this study, so there is no risk to participants.

If you wish to be informed about the results, you have the right to request feedback about the results; or if you have a question about the study or about any item in the survey, please contact the researcher.

Nouf Alrefaei
[redacted]

You may also contact the University of Arkansas Research Compliance office listed below if you have questions about your rights as a participant, or to discuss any concerns about, or problems with the research.

Ro Windwalker, CIP
Institutional Review Board Coordinator
Research Compliance
University of Arkansas
210 Administration
Fayetteville, AR 72701-1201
479-575-2208
irb@uark.edu

Appendix B
Instructions

Dear Teachers:

You are invited to participate in a research study to examine the relationship between the sense of efficacy in Northwest Arkansas teachers and student performance on the Arkansas Benchmark test (2014). This study is being conducted by Nouf Alrefaei, a PH.D. candidate at the University of Arkansas, as part of a doctoral dissertation.

If you agree to participate in this study, please do the following:

1. Complete the demographic questionnaire about your teaching background (years of teaching experience, degree achieved, etc.).
2. Think of fifth grade students whom you taught mathematics and/or science in the 2013-2014 school year.
3. Complete the Teachers' Sense of Efficacy Scale, a 12-item survey that measures teachers' beliefs about their ability to influence students' learning.

When you finish, please put the questionnaire in the provided envelop and return it to the front desk to be collected by the researcher.

Your participation is essential to complete this project.

Thank you for completing this survey,

Nouf Alrefaei

Appendix C
Teachers Demographic Questionnaire

Please answer the following questions:

1. What is your age group?

☐ Below 25 ☐ 25-29 ☐ 30-34 ☐ 35-39 ☐ 40-44 ☐ 45+

2. How long have you been teaching?

☐ 1-4 years ☐ 10-14 years ☐ 20-24 years ☐ 30+ years

☐ 5-9 years ☐ 15-19 years ☐ 25-29 years

3. Please identify your gender

☐ Male ☐ Female

4. Which grade(s) of students do you teach? *(Circle all that apply.)*

1 2 3 4 5 6

5. Did you teach in the 2013-2014 school year?

☐ Yes ☐ No

6. What content area(s) did you teach in the 2013-2014 school year? *(Check all that apply.)*

☐ Self-contained (All subjects)

☐ English

☐ Foreign language

☐ Math

☐ Science

☐ Social studies

☐ Other (please specify: _____)

7. Please identify how many weekly hours you teach Mathematics ----------.

8. Please identify how many weekly hours you teach Science ----------.

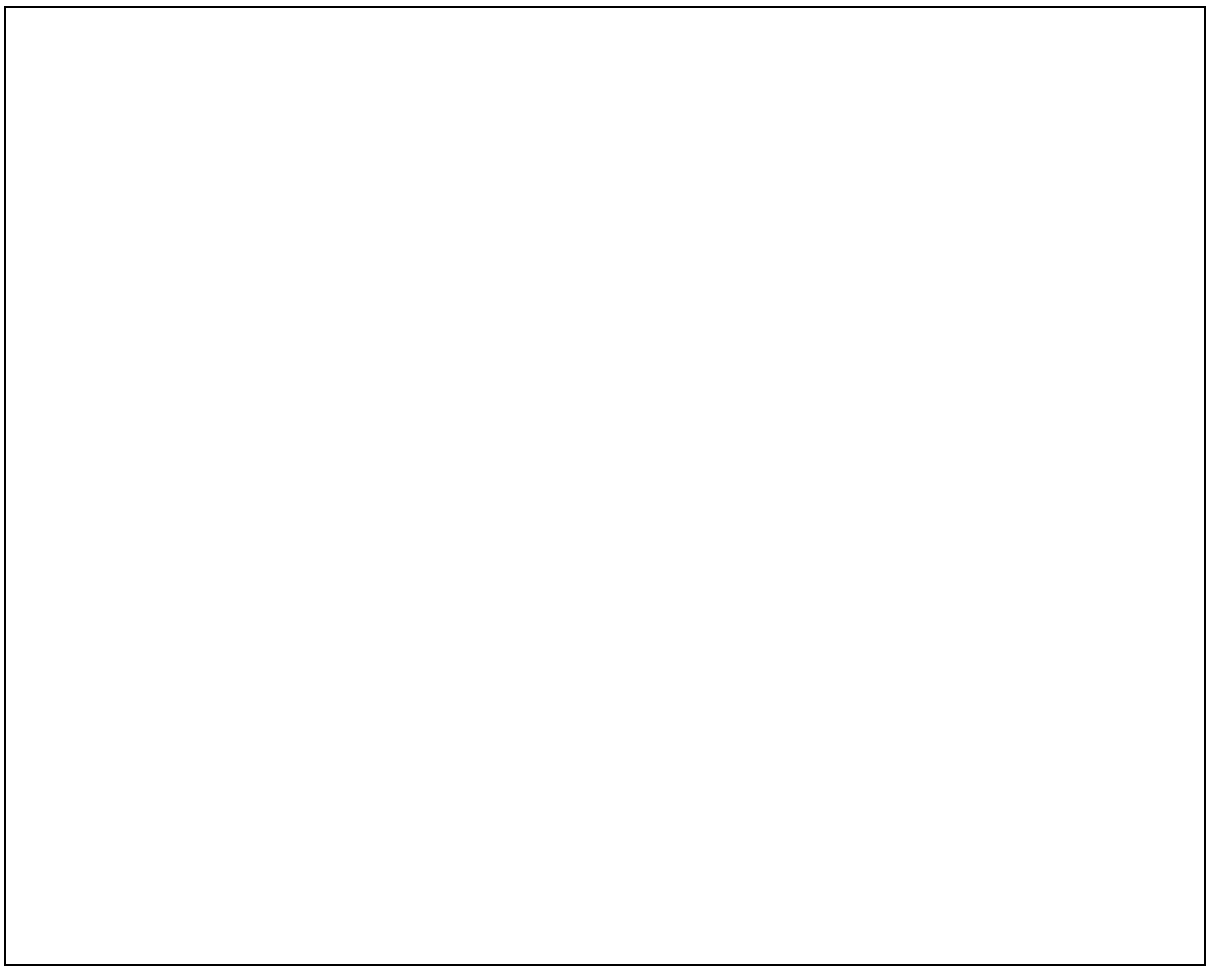
9. What is the highest degree you have attained?

☐ Bachelor's ☐ Master's ☐ Doctorate

Appendix D
Open-Ended Question

10. How do benchmark scores impact your feelings of efficacy in teaching math or science?

(Your beliefs in influencing students' learning)



11. Will you be willing to take part in follow up question(s)? If yes, please write your email below.

Appendix E
Permission to use the TSES

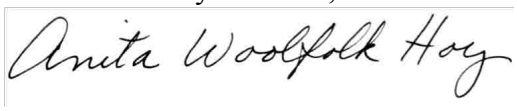
Anita Woolfolk Hoy, Ph.D.
Professor

Psychological Studies in Education

Dear

You have my permission to use the *Teachers' Sense of Efficacy Scale* in your research. A copy of both the long and short forms of the instrument as well as scoring instructions can be found at:
http://www.coe.ohio-state.edu/ahoy/researchinstruments.htm

Best wishes in your work,



Anita Woolfolk Hoy, Ph.D.
Professor

College of Education Phone 614-292-3774
29 West Woodruff Avenue www.coe.ohio-state.edu/ahoy FAX 614-292-7900
Columbus, Ohio 43210-1177
Hoy.17@osu.edu

Appendix F

Teachers' Sense of Efficacy Scale (short form)

Directions: This questionnaire is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers in their school activities. Please indicate your opinion about each of the statements below. Your answers are confidential.

Subject: **Math** **Science** **(Circle one)**	How much can you do?								
Teacher Beliefs	Nothing		Very Little		Some Influence		Quite A Bit		A Great Deal
1. How much can you do to control disruptive behavior in the classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2. How much can you do to motivate students who show low interest in schoolwork?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3. How much can you do to get students to believe they can do well in schoolwork?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4. How much can you do to help your students value learning?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5. To what extent can you craft good questions for your students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6. How much can you do to get children to follow classroom rules?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
7. How much can you do to calm a student who is disruptive or noisy?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8. How well can you establish a classroom management system with each group of students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9. How much can you use a variety of assessment strategies?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
10. To what extent can you provide an alternative explanation or example when students are confused?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
11. How much can you assist families in helping their children do well in school?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
12. How well can you implement alternative strategies in your classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Appendix G
Science and Math Performance level

Science Performance Level Descriptors

Performance Level	Score Range	Descriptor
Advanced	250 and Above	Students consistently demonstrate the knowledge and reasoning ability required for understanding scientific concepts. Students can perform and critique basic investigations, make connections from one or more of the sciences to predict or conclude, and apply fundamental concepts to practical applications.
Proficient	200–249	Students demonstrate the knowledge and reasoning abilities required for understanding scientific concepts. Students can perform basic investigations, formulate solutions to familiar problems, and communicate the results.
Basic	154–199	Students demonstrate a limited understanding of scientific concepts and some ability to use reasoning to apply this knowledge. Students can carry out basic investigations.
Below Basic	153 and Below	Students fail to show sufficient mastery of skills in science to attain the Basic level.

Mathematics Performance Level Descriptors

Performance Level	Score Range	Descriptor
Advanced	697 and Above	Students apply integrated procedural knowledge and conceptual understanding to solve complex problems in the five mathematics content strands.
Proficient	604–696	Students consistently apply integrated procedural knowledge and conceptual understanding to solve problems in the five mathematics content strands.
Basic	544–603	Students show some evidence of understanding the mathematical concepts and procedures in the five mathematics content strands.
Below Basic	543 and Below	Students fail to show sufficient mastery of skills in mathematics to attain the Basic level.

Appendix H
Benchmark Examination Report

ACTAAP
Arkansas Comprehensive Testing, Assessment, and Accountability Program

GRADE 5 AUGMENTED BENCHMARK EXAMINATION
CLASS ROSTER REPORT: CRT SCORES

Date of Test: April
Page: 2

COMBINED POPULATION: Mean Scale Scores for School/District/Region/State

	School	District	Region	State
Mathematics	713	654	647	638
Literacy	866	758	774	756

District Number:
District Name:
School Number:
School Name:
Class Name:

PERFORMANCE LEVEL SCALE SCORES

	Below Basic (BEL)	Basic (BAS)	Proficient (PRO)	Advanced (ADV
Mathematics	543 and below	544–603	604–696	697 and above
Literacy	381 and below	382–603	604–798	799 and above

NA = No Attempt (Zero Score)
* = Not Proficient in one or more areas
& = Modified form adapted to Braille

Student Information	MATHEMATICS							LITERACY		READING			WRITING			
	PERFORMANCE LEVEL	MATHEMATICS SCALE SCORE	Number and Operations	Algebra	Geometry	Measurement	Data Analysis and Probability	PERFORMANCE LEVEL	LITERACY SCALE SCORE	Literary	Content	Practical	Multiple-Choice Writing	Content	Style	Sentence Formation
Multiple-Choice/Open-Response Points Possible			9/8	9/8	8/8	7/8	7/8			8/8	8/8	8/8	8	8.0	8.0	8.0
	ADV	725	6/6	8/6	6/8	7/4	7/6	ADV	960	8/7	7/8	6/8	6	7.5	7.5	8.0
	ADV	739	7/8	7/6	7/4	6/8	7/6	ADV	965	8/8	8/8	7/8	5	8.0	8.0	8.0
	ADV	774	8/8	8/6	8/2	7/8	7/8	ADV	965	7/7	8/8	8/8	7	7.5	7.5	8.0
	ADV	725	7/7	6/6	8/4	7/8	5/6	ADV	813	7/8	7/3	3/6	5	6.5	6.5	7.0
	ADV	739	8/8	6/6	7/8	7/5	3/8	ADV	963	7/8	8/6	8/8	7	7.5	7.5	8.0
	ADV	701	7/8	7/6	8/6	6/0	4/8	PRO	794	8/3	8/4	5/8	6	5.0	5.0	7.0
	ADV	756	7/8	8/4	8/7	6/8	6/6	PRO	748	6/3	6/3	5/8	3	6.0	6.0	7.5
	PRO	633	4/7	7/0	5/0	5/8	4/4	ADV	903	6/7	7/6	7/6	5	7.0	7.0	7.5
	ADV	756	9/8	7/6	8/6	7/5	6/6	ADV	928	8/2	8/4	8/8	8	6.5	6.5	8.0
	ADV	764	8/8	5/6	8/5	7/8	6/8	ADV	959	7/7	8/4	7/8	7	8.0	8.0	8.0
	PRO	668	7/4	6/4	7/4	5/4	6/6	ADV	928	6/5	8/8	7/8	4	7.0	7.0	7.0
	ADV	739	8/8	8/2	7/6	7/6	6/8	ADV	928	7/2	7/8	7/8	7	6.5	6.5	8.0
	PRO	652	6/0	7/4	7/4	6/4	5/6	PRO	661	7/2	8/2	5/4	8	4.5	4.5	5.0
	BAS	558	3/2	1/4	5/4	5/0	2/0	BAS	521	5/2	4/2	4/2	2	4.0	4.0	5.5
	PRO	636	7/0	5/0	8/4	5/4	6/6	ADV	903	8/7	8/4	7/8	3	6.0	6.5	8.0
	ADV	810	8/8	9/6	8/6	7/8	7/6	ADV	958	8/6	7/8	8/8	8	5.0	5.0	8.0
	BEL	523	2/0	4/4	2/0	4/0	4/0	BEL	303	5/2	6/2	2/NA	6	1.0	1.0	1.0
	ADV	810	9/8	9/8	8/6	7/4	6/8	ADV	963	8/8	7/6	8/8	7	7.5	7.5	8.0
	PRO	633	9/0	7/2	8/4	5/0	5/4	PRO	794	6/2	7/5	7/8	4	6.0	6.0	8.0
	ADV	701	8/8	8/6	8/0	7/3	6/6	ADV	819	8/4	7/2	6/8	5	6.0	6.0	7.5
	ADV	701	6/8	7/4	7/6	6/7	3/6	ADV	832	7/3	7/6	6/8	6	6.0	6.0	7.0
	PRO	648	4/8	3/4	7/4	6/4	3/5	ADV	937	5/8	8/6	7/8	4	7.0	7.0	7.5
	PRO	664	8/0	5/2	6/6	6/8	5/6	PRO	704	7/2	7/2	5/8	3	5.5	5.5	6.5
	ADV	707	7/6	6/4	7/6	6/8	5/6	PRO	672	4/4	5/3	5/4	5	6.0	6.0	6.5

L: 1st Year LEP Student

Averages do not include the following groups: 1) 1st Year

Appendix I
IRB Approval

UNIVERSITY OF ARKANSAS

Office of Research Compliance
Institutional Review Board

September 15, 2014

MEMORANDUM

TO:	Nouf Alrefaei Jennifer Beasley
FROM:	Ro Windwalker IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	14-03-623
Protocol Title:	*Teachers' Sense of Efficacy: Examining the Relationship of Teacher Efficacy and Student Achievement*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 09/15/2014 Expiration Date: 09/14/2015

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (http://vpred.uark.edu/210.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

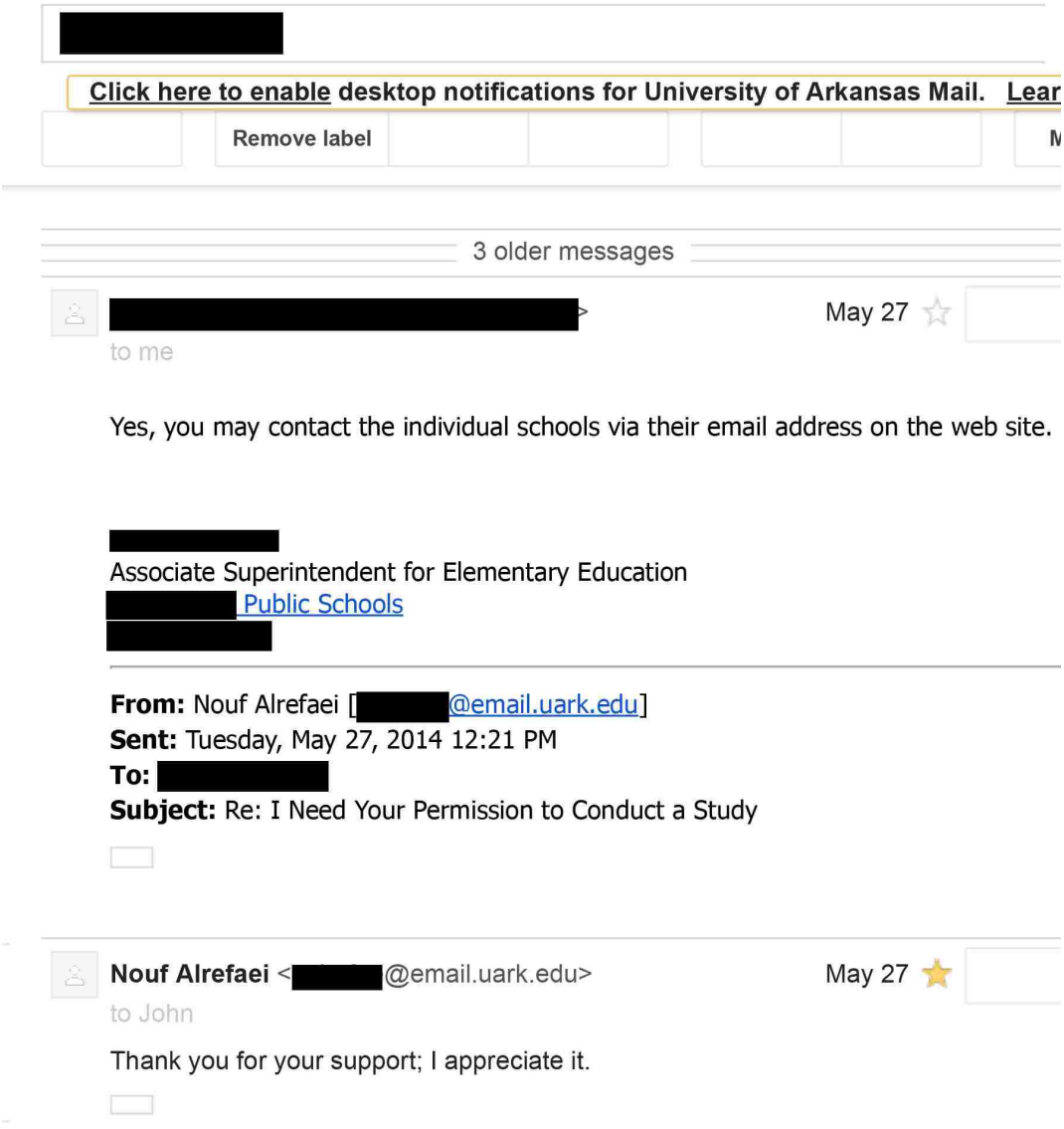
This protocol has been approved for 150 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

210 Administration Building • 1 University of Arkansas • Fayetteville, AR 72701
Voice (479) 575-2208 • Fax (479) 575-3846 • Email irb@uark.edu

Appendix J

District (A) Approval



[redacted]

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3 older messages

[redacted] May 27

to me

Yes, you may contact the individual schools via their email address on the web site.

[redacted]
Associate Superintendent for Elementary Education
[redacted] Public Schools
[redacted]

From: Nouf Alrefaei [[redacted]@email.uark.edu]
Sent: Tuesday, May 27, 2014 12:21 PM
To: [redacted]
Subject: Re: I Need Your Permission to Conduct a Study

Nouf Alrefaei <[redacted]@email.uark.edu> May 27

to John

Thank you for your support; I appreciate it.

Appendix K
District (B) Approval

[redacted] SCHOOL DISTRICT

[redacted]
Assistant Superintendent

TO: Nouf Alrefaei

FROM: [redacted], Assistant Superintendent

DATE: September 10, 2014

SUBJECT: Research Request

Mr. Alrefaei,

Thank you for your submission to the [redacted] School District to conduct research in our district.

The committee has reviewed your proposal and responses to follow up questions for the research approval and has provided approval based on the agreed upon parameters for this study.

You have permission to contact the following building principals in the following locations to seek their approval and interest to become a research partner in their building:

1. [redacted] Elementary School
2. [redacted] Elementary School
3. [redacted] Elementary School
4. [redacted] Elementary School
5. [redacted] Elementary School

Sincerely,

[redacted]
Assistant Superintendent
[redacted] School District

Appendix L
District (C) Approval

Nouf,

I will give you permission to reach out to the fifth grade teachers to seek participation in your research. It will be each individual teachers decision to participate or not. [redacted] schedule is extremely busy. I cannot promise that she will have the time to pull the necessary information you are requesting on student achievement.

I wish you the very best in your endeavors.

[redacted]

Assistant Superintendent

From: Nouf Alrefaei [mailto:[redacted]@email.uark.edu]
Sent: Tuesday, November 04, 2014 2:12 PM
To: [redacted]
Subject: Re: Research Study

[Quoted text hidden]
[Quoted text hidden]