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Impact of Inclusion Teachers' Mathematics Anxiety and Mathematics Self-Efficacy on the Mathematics Achievement of Learning Disabled Students

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Walden University
2015

Abstract

Impact of Inclusion Teachers' Mathematics Anxiety and Mathematics Self-Efficacy on the Mathematics Achievement of Learning Disabled Students

by

Vladimir Sylne

MA, New Jersey City University, 2008

BS, New Jersey City University, 2000

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

K-12 Educational Leadership

Walden University

November 2015

Abstract

Learning disabled (LD) students are put in inclusion classrooms in order to experience the mainstream environment and to receive the same level of education as their regular education counterparts. Unfortunately, LD students do not always get the mathematics education that they deserve because inclusion mathematics teachers are not required to be highly qualified in mathematics. The focus of this study was on the relationship between mathematics anxiety and self-efficacy of inclusion teachers and the academic achievement of the LD students they serve. The theoretical framework of this study involved the concepts of student achievement, teacher efficacy, mathematics anxiety, and best practices in teaching. The research questions of this study involved understanding the impact of inclusion teachers' mathematics anxiety and mathematics self-efficacy on the mathematics achievement of LD students. A quantitative survey design was used, and data were collected from 15 volunteered participating inclusion math teachers using the Learning Mathematics Anxiety subscale; the Personal Mathematics Teaching Efficacy subscale; a demographic questionnaire; and students' school level state standardized test scores and end-of-course final average in Geometry, Trigonometry, Algebra I, or Algebra II. Regression analyses were used to evaluate the relationship between the variables of mathematics teachers' anxiety, mathematics teachers' self-efficacy, and student achievement. The findings of this study revealed that inclusion teachers' mathematics anxiety and teaching efficacy did not significantly predict mathematics achievement of LD students. The implication for social change is that further research that includes variables other than teacher mathematics anxiety and teaching efficacy is needed to understand mathematics performance of learning disabled students.

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Dedication

I dedicate this doctoral study to my father, my mother, and my three brothers. It pains me a great deal that my father cannot be here to witness this achievement. He was a firm believer in education. I am not here today by accident. I am here because I am my father's son. Because of my father, I have become a proud and responsible human being. Because of my father, I am a teacher. Equally important in my journey has been my mother's selfless contribution. In order to make sure that I focused solely on my undergraduate studies, after my father passed away, my mother went to work at a factory at the age of 53. She would take two buses and three different trains to make the round trip from Jersey City, NJ to Queens, NY. She would leave the apartment at 5 am and return after 5 pm every day from Monday to Friday. After a long and arduous day, every night she would find the time to prepare dinner for the entire family. This dissertation is as much the product of her unbelievable sacrifices that started when I was a young boy. Finally, I would like to dedicate this study to my brothers, Aldrin, Rio, and Jean-Marais. Their support and encouragement made it a lot easier for me to persevere and achieve my goal. Thank you for being yourselves. Thank you for being there for me. Without all of you, I would not be who I am today. Thank you!

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Chapter 1: Introduction to the Study

Introduction

Since the 1960s, according to Swanson (2008), many legislative efforts such as the Elementary and Secondary Education Act of 1965, the Education for All Handicapped Children Act of 1975, and the Individuals with Disabilities Education Act of 1990 and its reauthorizations of 1997 and 2004 have been made to improve education for special education students, especially those with learning disabilities (LD). However, a continuing gap remains in the mathematics achievement of LD students compared to their non-LD counterparts. According to Calhoon et al. (as cited in Colsman, 2012), "High school students with SLD (Specific LD) have been shown to perform at levels equivalent to third graders without disabilities in computational fluency and significantly low on other measures of mathematics proficiency" (p. 1). As long as this gap exists, when they become adults, LD students will be less likely to find employment opportunities in order to achieve economic and social advancement (Colsman, 2012). This study investigated the relationship between inclusion mathematics teachers' anxiety and efficacy and the mathematics achievement of LD students. Inclusion mathematics teachers are special education teachers who are assigned to regular mathematics classrooms (Algebra I and II, Geometry, and Trigonometry) to work side by side with general education teachers and collaborate in all academic matters including grading, discussing, and assessing the progress of LD students. LD students are students with special learning disabilities who receive differentiated instruction from inclusion teachers. LD students have a disorder "that may manifest itself in the imperfect ability to

listen, think, speak, read, write, spell, or do mathematical calculations" (U.S. Department of Education, 2006, p. 46757).

Since the beginning of the 19th century, children with various disabilities have been provided educational services. Unfortunately, asylums were the popular setting for providing such services until the early part of the 20th century, when special day schools began to emerge (Thompkins & Deloney, 1995). Parent advocacy during the 1950s and 1960s in public school education for children with disabilities led to the passage of Public Law 94-142, the Education for All Handicapped Children Act, in 1975, which contained the declaration that "All children, regardless of disability, had the right to a free, appropriate education in the least restrictive environment" (Thompkins & Deloney, 1995, Historical Background section, para. 2).

After the passage of PL 94-142, public schools implemented a variety of strategies to help educate students with disabilities. According to Thompkins and Deloney (1995), two such approaches included resource rooms and self-contained classrooms. *Resource rooms* were classrooms designed to accommodate LD students who were removed from their regular classrooms for a portion of the day. They were under the supervision of a special education teacher (resource teacher in this setting), whose duty was to teach LD students the core subjects (English, mathematics, science, and social studies). *Self-contained classrooms* were the primary classrooms of LD students. Unlike regular classrooms, they were smaller and had students with distinctive academic difficulties, developmental issues, and behavioral concerns. These students spent the entire school day in the self-contained classroom environment under the

supervision of a special education teacher who taught them the core subjects and/or provided assistance to them according to their weaknesses (Chen, 2009).

In 1986, Madeleine Will, then Assistant Secretary for the Office of Special Education and Rehabilitative Services, argued that the resource and self-contained classrooms approach was based on "the presumption that students with learning problems cannot be effectively taught in regular education programs even with a variety of support" (p. 412) and proposed that LD students would be better served in the regular classroom environment, leading to the advent of the inclusion classroom strategy. Inclusion allowed LD students to receive regular instruction from general education teachers as well as individualized differentiated instruction from inclusion teachers in the regular classroom environment.

While this partnership between general education and inclusion teachers held great promise (Lingo, Barton-Arwood, & Jolivetter, 2011), several factors were found to weaken its effectiveness (Hwang & Evans, 2011), including teacher anxiety regarding the subject being taught and lack of efficacy in teaching ability. This study examined these factors as they apply to inclusion mathematics teachers who work with LD students. When the inclusion teacher has limited ability to help the LD students, the responsibility falls on the general education teacher. Consequently, the general education teacher has to modify his or her teaching in order to accommodate the academic needs of LD students, potentially limiting the achievement of the entire class.

Recent studies have found that math anxiety (Hadley & Dorward, 2011) and teacher efficacy (Shidler, 2009; Tschannen-Moran & Barr, 2004) impact the effectiveness of teachers of non-LD students. This study extends the coverage of previous research and

adds to the literature in investigating the relationship between math anxiety, teacher efficacy, and the effectiveness of inclusion teachers who teach LD students. The remainder of this chapter describes the background for this study, the problem in the U.S. education system that this study addressed, and the contribution that this study makes to the existing body of knowledge in this area. In addition, the chapter briefly outlines how the study was conducted, how data were collected, and how data were analyzed and interpreted.

Background

The literature is unambiguous about the effect of math anxiety on mathematics achievement. According to Tobias (1993), mathematics anxiety is the feeling of tension and anxiety of not knowing whether or not one is capable of doing well in mathematics or anything associated with numbers. Khatoon and Mahmood's (2010) study found a significant negative correlation between math anxiety and mathematics achievement. Equally important, Furner and Berman (2003) contended that math anxiety must be dealt with to improve student achievement in mathematics. Hadley and Dorward's (2011) study found that teachers who did not have math anxiety tended not to be anxious about teaching mathematics and that teachers who were anxious about teaching mathematics were more likely to have a more traditional style of teaching than the standards-based style proposed by the National Council of Teachers of Mathematics (NCTM). According to Wiske and Levinson (1993), teachers who use the NCTM standards-based approach make students the center of the classroom. They use guided inquiry and inductive reasoning to help their students develop and defend their own ideas rather than relying on information presented by others. Similarly, Patton (2002) studied mathematics anxiety in

preservice elementary teachers and found that the level of mathematics anxiety in preservice teachers was predicted significantly by their competence and confidence in teaching.

Likewise, many studies in the literature relate teacher efficacy to student achievement. *Teacher efficacy* is teachers' belief that they have the skills necessary to successfully develop students' learning and commitment (Shaughnessy, 2004). Khan (2011) argued that teacher efficacy has an important role in the academic achievement of students. This role means that teachers who exert extra effort tend to get the best out of their students. Tschannen-Moran and Barr's (2004) study suggested that factors such as mastery experiences, vicarious experiences, social persuasion, and affective states that strengthen collective teacher efficacy may assist in improving student achievement. Milner's (2002) study suggested that teachers who are self-efficacious are more likely to persist and succeed when faced with adversity.

There are also studies in the literature that connect mathematics anxiety to efficacy in teaching mathematics and mathematics anxiety to confidence in teaching mathematics. Swars, Daane, and Geisen (2006) analyzed the relationship of mathematics anxiety and mathematics teacher efficacy in preservice teachers. Their findings revealed a significant, moderate negative relationship between mathematics anxiety and mathematics teacher efficacy ($r = -.440$, $p < .05$). Bursal and Paznakos (2006) investigated the relationships between mathematics anxiety level and confidence level to teach math in elementary teachers. Negative correlations were found between preservice teachers' math anxiety and their confidence to teach elementary mathematics ($r = -.638$).

The research literature suggests that high levels of math anxiety in preservice and elementary teachers are detrimental to their practice. The literature also suggests that preservice or elementary teacher efficacy is a predictor of student achievement. The research, however, addressed only preservice teachers in college, elementary classroom teachers, and non-LD students. The literature seems to be silent on issues of math anxiety and teacher efficacy that affect inclusion teachers and LD students. Although troubles with mathematics are not exclusive to LD students, teaching mathematics to a LD student is different than teaching mathematics to a non-LD student because LD students have "persistent difficulties with computation and problem-solving" and "perform far below their grade-level peers and progress at half their speed" (Louie et al., 2008, p. 2).

Math teachers who have not been trained in special education may have subject matter competency but are often unsure about learning characteristics and specific mathematics teaching strategies that are effective in helping LD students in their inclusion classrooms (Desimone & Parmar, 2006). Inclusion mathematics teachers, on the other hand, may possess the tactics to help LD students because of their special education training but may lack mathematics content knowledge (Rosas & Campbell, 2010). The research supports the need for additional studies to expand and create generalizations about math anxiety and teaching efficacy in regular education teachers as well as inclusion teachers. The investigation of math anxiety and teacher efficacy in inclusion teachers and their impact on the achievement of LD students adds to the body of research by showing that subject matter anxiety and teaching efficacy are important variables in the effectiveness of special education teachers who work with special needs students.

Problem Statement

The average failure rate of special education students on the New Jersey standardized mathematics test from 2009 to 2011 was 67.8% (New Jersey Department of Education, 2013a). LD students, who are not exempt from having to pass the test, failed at a rate of 56.17% during these 3 years, whereas general education students failed at a rate of only 17.27%. In the 2010-2011 academic year, 54.7% of LD students failed, whereas only 16.4% of general education students failed (New Jersey Department of Education, 2013a). This gap is consistent throughout the country. According to the National Longitudinal Transition Study-2, a nationwide study involving 12,000 students (ages 13 through 16), 44% of LD students test more than three grade levels behind in mathematics (Cortiella, 2011).

In seven of the school districts where this study was conducted**,** 83% of LD students and 34% of non-LD students failed the state standardized test in mathematics in the 2010-2011 academic year (New Jersey Department of Education, 2013). These numbers and those above demonstrate that LD students are not effectively learning mathematics in these school districts. Because LD students under the No Child Left Behind Act (NCLB) are expected to perform at a high level, reasons for their dismal performance on standardized tests need to be systematically investigated. Research suggests that subject matter anxiety (Khatoon & Mahmood, 2010; Ramirez, 2012; Witt, 2012; Zakaria, Zain, Ahmad, & Erlina, 2012) and teaching efficacy (Holzberger, Philipp, & Kunter, 2013; Khan, 2011; Mojavezi & Tamiz, 2012; Tschannen-Moran & Barr, 2004) might be contributing factors to the academic achievement of non-LD students. These findings are important to the academic achievement of non-LD students; however, it is

unclear to what extent these findings can be applied to the academic achievement of LD students.

Purpose of Study

The purpose of this quantitative study was to investigate the relationship between inclusion mathematics teachers' anxiety and efficacy and the mathematics achievement of LD students in a group of public school districts in the United States. There were two independent variables in this study: mathematics anxiety and teacher efficacy. The independent variable *mathematics anxiety* is the uneasy feeling of fear that prevents people from performing in mathematics, which is often caused by negative experiences in mathematics classrooms (Bekdemir, 2010). These experiences include hostile behavior of teachers, the teaching style of teachers, inadequacy of teachers, and difficulty of content. Research shows that mathematics anxiety has a negative impact on teachers' performance (Betz, 1978; Woodard, 2004). Teachers with high mathematics anxiety will not have the command of the contents of the curriculum and will not teach according to the standards set by the National Council of Teachers of Mathematics (NCTM). They will be likely to be providers of instruction, and their classrooms will be centered on their inputs. On the other hand, teachers with low math anxiety will be confident in their abilities to teach mathematics and will develop challenging, appropriate, and relevant lessons based on the NCTM Standards. They will be more likely to be facilitators of instruction in a student-centered environment (Gresham, 2010).

The second independent variable, *teacher efficacy*, is defined as teachers' ability to get the best academic outcomes out of their students regardless of the level of motivation of their students (Tschannen-Moran & Hoy, 2001). The literature indicates

that teacher efficacy is a product of previous performance experiences, vicarious experiences, verbal persuasion, and emotional arousal (Bandura, 1977). Teachers with low levels of efficacy will be more likely to settle for their students' failure, whereas teachers with high levels of efficacy will be more likely to be demanding and have high expectations for their students' achievement in mathematics (Tschannen-Moran & Barr, 2004).

Student achievement, as measured by mathematics standardized test scores or end-of-course final average in Geometry, Trigonometry, and Algebra I and II, was the only dependent variable in this study. The literature indicates that teacher efficacy has a positive impact on student achievement and that lack of teacher efficacy has a negative impact on student achievement (Khan, 2011; Tschannen-Moran & Barr, 2004). According to the literature, there are many definitions of student achievement. Some are short and specific; others are long and extensive. There are some broad definitions that describe student achievement as a series of specific goals that must be accomplished and other definitions that are centered on a single objective. *Student achievement* in this study is defined as the specific goal of students to pass their state standardized tests in mathematics or to obtain a passing grade in the following courses: Geometry, Trigonometry, Algebra I, or Algebra II.

Research Questions and Hypotheses

This quantitative study investigated the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the mathematics achievement of LD students in a group of public school districts in the United States. Specific research questions that guided the conduct of this study include the following:

RQ1: What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

RQ2: What is the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

RQ3: What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

Theoretical Framework

The increasing pressure on inclusion teachers from administrators and parents to make sure that LD students receive equal education emphasizes potential worries about how inclusion teachers' math anxiety and efficacy may affect LD students' academic achievement. The purpose of this study was to investigate the relationship between inclusion mathematics teachers' anxiety and efficacy and the mathematics achievement of LD students.

Mathematics anxiety is described as "a construct that involves cognitive and affective behaviors" (Whyte & Anthony, 2012; Zakaria, Zain, Ahmad, & Erlina, 2012). According to Carroll (2010), the theory associated with math anxiety is related to the cognitive and affective behaviors associated with learning mathematics and math anxiety. The cognitive behavior or domain is based on knowledge or facts and involves the development of intellectual skills (Bloom, 1956). Bloom (1956) described the cognitive domain as involving learning through the following six steps: knowledge, comprehension, application, analysis, synthesis, and evaluation. Learning can only be achieved when the six steps are mastered, one after the other (Carroll, 2010). The affective domain deals with factors such as attitudes, values, motivations, enthusiasm, appreciation, and feelings (Carroll, 2010). Math anxiety is also a product of this domain; it is the uneasy feeling of fear that prevents people from performing in mathematics (Bekdemir, 2010). A lack of performance in mathematics due to math anxiety may lead to underachievement in mathematics (Khatoon & Mahmood, 2010). Taking the above into consideration, it is rational to believe that teachers with high mathematics anxiety will not have a command of the contents of the curriculum and will not teach according

to the standards set by the National Council of Teachers of Mathematics (NCTM). Gresham (2010) argued that these teachers will more likely be providers of instruction and that their classrooms will be centered on their inputs, whereas teachers with low math anxiety will be confident in their abilities to teach mathematics and will develop challenging, appropriate, and relevant lessons based on the NCTM Standards. They will more likely be facilitators of instruction in a student-centered environment.

Teacher efficacy is a teacher's "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" (Tschannen-Moran & Hoy, 2001, p. 783). Teacher efficacy is a form of self-efficacy, which is a person's belief in his or her ability to reach a certain goal (Bandura, 1977). Self-efficacy originated from Bandura's (2001) social cognitive theory. One assumption of social cognitive theory is that people possess the ability to influence their own behavior and their surroundings in a resolute and purposeful manner (Bandura, 2001). Teachers possess the ability to influence their own behavior, their classrooms, as well as their students. Teachers with high levels of efficacy beliefs have students with better academic achievement than teachers with lower teacher efficacy (Tschannen-Moran, Woolfolk Hoy, & Wayne Hoy, 1998).

Ross and Bruce (2007) suggested that student achievement is enhanced when highly efficacious teachers are engaged in implementing the following factors:

- Taking care of their more at-risk students.
- Using innovative and difficult teaching strategies that lead students to be more involved in the learning process.

- Applying unorthodox classroom management methods that encourage student self-sufficiency.
- Adjustment in teacher conduct that influences students' awareness of their academic abilities. (pp. 50-51)

Because of the above, it is rational to believe that teachers with low levels of efficacy will be more likely to settle for their students' failure, whereas teachers with high levels of efficacy will be more likely to be demanding and have high expectations for their students' achievement in mathematics (Tschannen-Moran & Barr, 2004).

Nature of the Study

According to Creswell (2009), quantitative research is "a means for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures" (p. 4). This study meets this definition as quantitative research because it was designed to determine the relationships between two independent variables (math anxiety and teacher efficacy) and a dependent variable (student achievement). In addition, the variables in this study were measured using the Revised Mathematics Anxiety Rating Scale (RMARS) and the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) surveys. Moreover, the numbered data collected were analyzed using statistical analysis.

There were two independent variables in this study: inclusion mathematics teachers' anxiety and inclusion mathematics teachers' self-efficacy. The first independent variable, inclusion mathematics teachers' anxiety, is the inability of these teachers to do well in mathematics because of their terrifying or sickening feeling toward the subject

(Tobias, 1993). The second independent variable, inclusion mathematics teachers' self-efficacy, is described as the distinct ability of these teachers to believe they have the right tools to help their students succeed in mathematics (Tschannen-Moran & Woolfolk, 2001). There is one dependent variable in this study: the mathematics achievement of LD students. The mathematics achievement of these students is the level of proficiency that they have reached, as documented in their state standardized test scores for the 2013-2014 academic school year or their end-of-course final averages in Geometry, Trigonometry, Algebra I, or Algebra II.

Data from this study were gathered from two groups: (a) high school inclusion teachers who taught Geometry, Trigonometry, Algebra I, or Algebra II and (b) LD students who were instructed by these inclusion teachers. The inclusion mathematics teachers who participated in this research were surveyed using the RMARS to gather data on their apprehension toward mathematics. This study also used the MTEBI to gather information on the inclusion teachers' beliefs about their effectiveness in teaching mathematics. Items in the RMARS survey address inclusion mathematics teachers' own trepidation toward teaching mathematics. Likewise, the MTEBI was used to collect information on how comfortable inclusion teachers were with their mathematics teaching. Participants answered each item in the survey by indicating the degree to which they agreed or disagreed with the item. A combination of the two surveys helped in gathering the data necessary to make an appropriate determination regarding the research problem. These data were analyzed using the Statistical Package for Social Sciences (SPSS). Pearson product correlation, linear regression, multiple regression, and ANOVA were used as statistical approaches to help answer the research questions.

Definition of Terms

The terms listed below are key to understanding the research and are defined below in accordance with the context of the study.

Inclusion teachers: "Inclusion teachers are educators who maintain a general education classroom with the enrollment of at least one student with special needs while establishing and maintaining a community environment where each of their students is welcome and attended to" (Alexander & Winstrom, 2012, para. 2). This study involved only inclusion teachers who taught the following mathematics courses: Geometry, Trigonometry, Algebra I, or Algebra II. These inclusion teachers were required to possess a Certificate of Eligibility with Advanced Standing (CEAS) or a standard instructional certificate with an appropriate endorsement for the subject or grade level to be taught. They were required to complete a state-approved special education teacher training program that culminated in student teaching (New Jersey Department of Education, 2013). According to Alexander and Winstrom (2012), the following are the required duties of the inclusion teacher:

- Attends to the requirements detailed in the education plans of their special needs students, such as a 504 Plan, Transition Plan (a post-secondary plan), IFSP (Individual Family Service Plan), or IEP (Individual Education Plan) in coordination with implementation and review by the special education team (parents, special education teacher, specialized personnel, service providers and many times the student).
- Plans lessons and classroom activities with the help of the general education teacher according to the assigned curriculum.

- Gathers information on the student's strengths and weaknesses and develops ways to address them by reviewing past performances on state tests, semester exams, or report cards and the student's personal history.
- Opens a line of communication between the student's parents to provide progress and request feedback to share with the general education teacher and other team members.
- Meets with team members and solicits the support of the school principal and special education supervisor for help with materials and resources necessary to make inclusion beneficial for all involved.
- Sets up a cooperative teaching arrangement that uses a variety of styles to fit students' needs, resources, time, and teacher skill for a dynamic learning experience prior to the students' introduction and throughout their time in the environment.
- Modifies lessons, materials, and tests as needed per the student's education plan. An example of a modification is to use lower level reading materials for a lesson or shortening the number of multiple choice options on a test.
- Accommodates the student's needs such as allowing for extra time to turn in assignments for homework, on tests, or providing a separate area for testing.
- Identifies and synthesizes classroom instruction with state requirements while meeting the needs of the student.
- Provides alternate assessments as mandated by law when students cannot participate in testing with their peers.

- Seeks, attends, and adheres to professional development required by the state department of education, as well as any other programs that will benefit the classroom as a whole.

The reauthorization of the Individuals with Disabilities Education Improvement Act (IDEIA) Part B that was signed into law in 2004 guarantees that children and youth (ages 3-21) with disabilities throughout the nation receive special education and related services (U.S. Department of Education, 2006). Under the official umbrella of IDEIA and NCLB, these special education and related services should in part be provided in classrooms across the state and throughout the country by highly qualified special education teachers in self-contained or inclusion environments (U.S. Department of Education, 2006).

Learning disabled students: IDEIA of 2004 defines a learning disabled student as a student who has

> a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

This definition excludes "learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage" (USDOE, 2006, p. 46757).

Mathematics anxiety: Mathematics anxiety is the feeling of tension and anxiety of not knowing whether or not one is capable of doing well in mathematics or anything

associated with numbers (Tobias, 1993). Mathematics anxiety was measured in this study using the Revised Mathematics Anxiety Rating Scale developed by Plake and Parker (1982).

Teacher efficacy or teacher's self-efficacy: A teacher's "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" (Tschannen-Moran & Hoy, 2001, p. 783). In this study, teacher efficacy was measured using the Mathematics Teaching Efficacy Beliefs Instrument developed by Enochs, Smith, and Huinker (2000).

Assumptions

One of the aspects of this study that could not be easily verified and therefore was accepted as true is the assumption that inclusion teachers were candid in their responses to the survey questions. Within the context of this study, this assumption is relevant because the participating inclusion teachers were not under any obligation to get involved in this study. As a result, the inclusion teachers had no reason to not be candid. Therefore, their responses to the items in the surveys were interpreted as an accurate reflection of their feelings at that point in time.

Scope and Delimitations

The following are the scope and delimitations of the study:

1. This study focused on inclusion teacher mathematics anxiety and teacher efficacy and LD students' academic achievement because it was intended to explore likely obstacles that may hinder the effectiveness of special education teachers who are responsible for assisting LD students who are taking higher level mathematics classes (Geometry, Trigonometry, and Algebra I or II).

2. This study involved inclusion teachers in U.S. school districts. Other partnerships and coteaching situations (e.g., with teacher aides, parents, team teachers) were not included because they would not have fully captured the delicate relationship that exists between general education teachers and inclusion teachers.
3. While it is possible that inclusion teachers influence the achievement of non-LD students, this study collected only the test scores of LD students of inclusion teachers. Test scores of non-LD students were not included because they would not have been pertinent to answering the research questions specified for this study. Spence (2010) found that non-LD students in noninclusive settings scored higher than non-LD students in inclusive settings. Although it is possible that inclusion teachers can influence the achievement of non-LD students, this study focused on the impact of the relationship between inclusion teachers and LD students because inclusion teachers are directly responsible for working with LD students in the classroom.
4. While acknowledging the existence of other influences on student academic achievement such as parent academic achievement, school climate, and socioeconomic factors, I did not take these factors into consideration because the study focused only on the role of the inclusion teacher assigned to specific mathematics classes.
5. This study took place in a group of public school districts in the United States. These districts may not reflect the diversity and/or unique situations that may exist in rural, suburban, or other urban school districts that have LD students

and implement inclusion procedures in their regular classrooms. As a result, the outcome of the study may not be readily generalized to other populations or school districts. Nevertheless, according to Frankfort-Nachmias and Nachmias (2008), "to make possible generalizations beyond the limited scope of this study," the participants should be selected using the simple random sampling method to make sure that the sample selected is an appropriate representation of the population (pp. 101-102). "Probability methods such as random sampling make generalizations to larger and clearly defined populations possible" (Frankfort-Nachmias & Nachmias, 2008, p. 102).

6. This study targeted inclusion mathematics teachers at the high school level. It did not address inclusion teachers at any other school level because of the limited number of higher level mathematics classes (Geometry, Trigonometry, Algebra I or II) that are taught. The external validity of the study was not compromised because "the characteristics of the subjects must reflect the characteristics of the population the researcher is investigating" (Frankfort-Nachmias & Nachmias, 2008, p. 101). Possessing the ability to teach higher level mathematics classes was a main characteristic of the population that was being investigated that should have been reflected in the participants. Therefore, only high school inclusion teachers who taught Geometry, Trigonometry, or Algebra I or II were eligible for selection.
7. Inclusion teachers impact more than academic achievement for inclusion students. This study did not address other impacts, such as class participation and peer interaction, that inclusion teachers may have on their students. The

focus of this study was on academic achievement because this is how teacher effectiveness is usually measured. This study was about teacher efficacy; therefore, student achievement was the most valid measure of teacher effectiveness.

Limitations

The following were the limitations of the study:

1. This study has limited generalizability due to the sample size. Many inclusion teachers did not have the opportunity to participate in this study. Therefore, the validity of the two surveys may have decreased due to nonresponse of potential participants. However, as explained earlier, this study was not a bigger study because a sample of participants taken through a simple random sampling was good enough to understand the nature of the phenomenon while maintaining the external validity of the study (Frankfort-Nachmias & Nachmias, 2008).
2. While there are other instruments that measure anxiety and teaching efficacy, this study used only the Learning Mathematics Anxiety (LMA), a subscale of the Revised Mathematics Anxiety Rating Scale (RMARS), to measure accurately the level of anxiety in inclusion teachers and the Personal Mathematics Teaching Efficacy (PMTE), a subscale of the Mathematics Teaching Efficacy Belief Instruments (MTEBI), to measure correctly teachers' beliefs in their individual capabilities to teach math. Other available instruments to measure mathematics anxiety include Richardson and Suinn's (1972) Mathematics Anxiety Rating Scale; Betz's (1978) Mathematics

Anxiety Scale Revised; Fennema and Sherman's (1976) Fennema-Sherman Mathematics Attitudes Scales; Sandman's (1980) Anxiety Towards Mathematics Scale; and Wigfield and Meece's (1988) Mathematics Anxiety Questionnaire. However, the RMARS designed by Plake and Parker (1982) was appropriate for this study because it was designed for use with smaller sample sizes ($n > 100$). Moreover, this subscale has strong internal consistency. Its Cronbach's alpha coefficient is .92 (Hopko, 2003). There are also other instruments to measure teacher efficacy (e.g., Gibson & Dembo's [1984] Teacher Efficacy Scale; Tschannen-Moran and Woolfolk Hoy's [2001] Teachers' Sense of Efficacy Scale; Schwarzer & Jerusalem's [1995] General Perceived Self-Efficacy Scale; Bandura's [2001] Teacher Self-Efficacy Scale; Riggs & Enochs's [1990] Science Teaching Efficacy Belief Instrument). However, this study was focused on teacher efficacy in mathematics. The PMTE subscale of the MTEBI was appropriate for this study because it is short and is designed specifically to collect personal data by addressing teachers' belief in their abilities to teach mathematics. This subscale has strong internal consistency. Its Cronbach's alpha reliability coefficient is .88 (Enochs et al., 2000).

3. A snapshot data collection approach was used in this study. The LMA and the PMTE was administered only once at a specific point in time. Taken at a different point in time, the data collected from the surveys could show different results due to the changes that could occur in the lives of the participants. Multiple data collection over an expanded period of time could

provide more accurate results. This snapshot approach is still acceptable because it is cost effective and provides a quick and easy way to collect data and identify association between the variables in the study. "Methodological limitations" of this snapshot approach (cross-sectional survey design) was overcome using statistical analysis designed to assess relationships between the variables in the study (Frankfort-Nachmias & Nachmias, 2008, p. 117).

4. In this study, student achievement was measured using school state standardized math tests or student end-of-course final averages in Geometry, Trigonometry, and Algebra I and II.

Significance of the Study

Many studies have already indicated that math anxiety (Hadley & Dorward, 2011) and efficacy (Shidler, 2009; Tschannen-Moran & Barr, 2004) impact the effectiveness of teachers of non-LD students. This study extends the coverage of previous studies and adds to the literature by showing that math anxiety and efficacy also impact the effectiveness of inclusion teachers who teach LD students. The knowledge acquired from this study about mathematics anxiety and teacher efficacy might be used to achieve a better understanding of strategies that might be successful in helping inclusion teachers acquire the characteristics necessary to enable their LD students to succeed in higher level mathematics classes.

By itself, mathematics anxiety impacts mathematics teachers' capacity to be proficient with the mathematics curriculum and to be able to comfortably deliver instruction based on standards established by the state and adopted by the district. When mathematics teachers are not well prepared, their students tend not to be successful.

Likewise, working independently, teacher efficacy impacts mathematics teachers' drive and self-belief in providing effective instruction and never giving up on students, whether they are motivated or not. Teachers who are not self-efficacious have a propensity to be helpless. They blame their students rather than finding solutions to help them do well (Khan, 2011). The level of efficacy toward the practice of teaching mathematics is associated with mathematics anxiety and is at the foundation of the mathematics teaching belief of teachers (Gresham, 2010). Working together, a low level of mathematics anxiety and a high level of efficacy in inclusion teachers are essential to the achievement of LD students.

The results of this study may be useful to school districts as staff consider ways to handle the assignment of inclusion mathematics that can help to improve the achievement of LD students in mathematics inclusion classrooms. One of the promises of the No Child Left Behind Act is to improve academic achievement for public school LD students (Cole, 2006). If anxiety and self-efficacy are taken into consideration in the assignment of mathematics inclusion teachers to mathematics classrooms, it may be possible to improve their impact on the achievement of inclusion students in those classes.

This study may promote social change by bringing awareness to district officials that LD students get educated under the same standards created for their non-LD counterparts, thereby increasing the likelihood that these students will experience success in high school and increase their employability and potential for becoming productive citizens.

Summary

The purpose of this quantitative study was to investigate the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the mathematics achievement of LD students in a group of public school districts in the United States. In this study, I attempted to answer the following three research questions: (a) What is the relationship between a group of inclusion mathematics teachers' anxiety scores and the average mathematics score of the LD students they serve? (b) What is the relationship between a group of inclusion mathematics teachers' self-efficacy scores and the average mathematics score of the LD students they serve? And (c) What is the relationship between a group of inclusion mathematics teachers' anxiety and self-efficacy scores and the average mathematics score of the LD students they serve? This study used survey research design in order to collect data from participants. School district staff may use this study as they contemplate more practical ways to assign inclusion teachers to mathematics classrooms.

In this chapter, I have introduced the study, developed the research questions, and laid out the assumptions, scope, delimitations, and limitations of the study. I have also explained the significance of the study and the type of social impact it could have on the community. In Chapter 2, I examined the theoretical framework of the study by reviewing the literature on student achievement, math anxiety, teacher efficacy, and best practice in teaching. Chapter 3 focused on the methodology of the study. Chapter 4 was used to present the data collection and results analysis. Chapter 5 was used to summarize the findings and to make recommendations for future research.

Chapter 2: Literature Review

Purpose of the Study

The purpose of this quantitative study was to investigate the relationship between inclusion mathematics teachers' anxiety and efficacy and the mathematics achievement of learning disabled (LD) special education students in a group of public school districts in the United States. There were two independent variables in this study: mathematics anxiety and teacher efficacy. The independent variable mathematics anxiety is the uneasy feeling of fear that prevents people from performing in mathematics, which is often caused by negative experiences in mathematics classrooms (Bekdemir, 2010). These experiences include, but are not limited to, hostile behavior of teachers, teaching style of teachers, inadequacy of teachers, and difficulty of content. Research shows that mathematics anxiety has a negative impact on teachers' performance (Betz, 1978; Woodard, 2004). Teachers with high mathematics anxiety will likely not have command of the contents of the curriculum and not teach according to the standards set by the National Council of Teachers of Mathematics (NCTM). They will more likely be only providers of instruction, and their classrooms are likely to be centered on their inputs. On the other hand, teachers with low math anxiety will likely be confident in their abilities to teach mathematics and will develop challenging, appropriate, and relevant lessons based on the NCTM Standards. They will more likely be facilitators of instruction in a student-centered environment (Gresham, 2010).

The second independent variable, teacher efficacy, is defined as teachers' ability to get the best academic outcome out of their students regardless of the level of

motivation of their students (Tschannen-Moran & Hoy, 2001). The literature indicates that teacher efficacy is a product of previous performance experiences, vicarious experiences, verbal persuasion, and emotional arousal (Bandura, 1977). Teachers with low levels of efficacy will be more likely to settle for their students' failure, whereas teachers with high levels of efficacy will more likely be demanding and have high expectations for their students' achievement in mathematics (Tschannen-Moran & Barr, 2004).

Student achievement was the only dependent variable in this study. According to the literature, there are many definitions of student achievement. Some are short, and specific others are long and extensive. There are some broad definitions that describe student achievement as a series of specific goals that must be accomplished and other definitions that are centered on a single objective. Student achievement in this study was defined as the specific goal of students to pass their state standardized tests or their Geometry, Trigonometry, or Algebra I or II classes.

Research Questions and Hypotheses

This quantitative study investigated the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the mathematics achievement of LD students in a group of public school districts in the United States. Specific research questions that guided the conduct of this study included the following:

RQ1: What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

RQ2: What is the relationship between a group of inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

RQ3: What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

Introduction

The literature pertaining to the concepts associated with the independent and dependent variables and the theoretical framework undergirding the study is presented in this chapter. The review is divided into five parts: student achievement, mathematics anxiety, teacher efficacy, theoretical framework, and best practices in teaching. In the student achievement section, factors that contribute to and impair student achievement,

particularly in math, are investigated. In the mathematics anxiety section, likely causes and effects associated with math anxiety are enumerated. Strategies that can help decrease math anxiety are also considered. In the teacher efficacy section, the concept of self-efficacy is reviewed, a theoretical perspective of self-efficacy is presented, and research on self-efficacy and self-efficacy in teaching is explored. Moreover, in the theoretical framework section, connections between mathematics teachers' self-efficacy, anxiety, and student achievement are clarified, and the selection of the framework is justified. Finally, in the best practices in teaching section, general subject-matter and mathematics best practices are examined.

The literature search used the following databases: EBSCOhost, Academic Search Complete, Education Research Complete, Google Scholar, Sage, ProQuest, ProQuest Central, PsycARTICLES, PsycINFO, and Dissertations and Theses at Walden University. The following keywords were used: *math*, *anxiety*, *math anxiety*, *mathematics*, *mathematics anxiety*, *test anxiety*, *inclusion*, *efficacy*, *self-efficacy*, *teacher efficacy*, *achievement*, *student achievement*, and *best practices*.

Student Achievement

Student achievement in this study was measured by how well students performed on their state standardized test and in their final average in Geometry, Trigonometry, Algebra I, or Algebra II. A review of the literature has shown that student achievement has been influenced by many factors including student background factors, teacher characteristics, school factors, and resources. In this section of the study, student achievement is examined through the lenses of these factors. In addition, student

achievement in mathematics is explored by reviewing factors that improve student achievement in mathematics and factors that impair student achievement in mathematics.

Student Background and Student Achievement

According to the literature, many factors related to students' background are linked with their academic achievement. Bharadwaj, loken, and Neilson (2012) in their discussion paper studied the effects of improved neonatal health care on mortality and long-term academic achievement in school. Using administrative data collected from Norway and Chile, they found that children who weighed at birth just less than 1,500 grams (3.30693 lbs) had a much higher rate of survival and tended to have higher grades and test scores when they grew up. Bharadwaj et al. suggested that in order to improve student achievement, public officials should consider an investment in neonatal care in addition to their traditional investments in better teachers, books, and school infrastructures. These findings are consistent with those of Figlio, Guryan, Karbownik, and Roth (2013), who studied 14,000 pairs of twins from birth through middle school. Using the birth and school records of all students born in Florida from 1992 to 2002, they found that poor neonatal weight constantly affected students' cognitive development throughout their school career. In addition, they suggested that although the effects of neonatal weight appeared to be consistent across a wide range of demographics and socioeconomic dimensions, children with poor neonatal health who came from highly educated parents outperformed children with good neonatal health who came from poorly educated families. This finding suggested that "nurture can at least partially overcome nature" (Figlio et al., 2012, p. 35). According to Walberg (2010), poor neonatal care is among 20 family factors shown in Table 1 that are related to school failure. Many factors

illustrated in Table 1 happen before birth and are exhibited in low birth weight. Other factors start at birth and continue to affect the child throughout the school years.

Table 1

Poverty-Related Factors That Impede Achievement

A. Prenatal and perinatal factors	E. Child rearing
1. Stress and disease	13. Fewer verbal interchanges between parents and children
2. Premature birth	14. Less exposure to stimulating vocabularies
3. Low birth weight	15. Punitive practices
B. Family status	16. Less praise and affection
4. Adolescent parenthood	17. Provision of poor problem-solving strategies
5. Single parenthood	F. Resulting child problems
C. Divorce and frequent parental consequences	18. Inability to cope with stress and frustration
6. Depression	19. Incapacity to postpone gratification
7. Anxiety	20. Poor readiness for reading
8. Irritability	
9. Decreased income	
10. Lowered self-esteem	
D. Frequent moving	
11. Residence	
12. School	

Note. From *Advancing Student Achievement* (p. 34), by H. J. Walberg, 2010, Stanford, CA: Education Next Books.

Another factor associated with student background that has ties with student achievement is parents' socioeconomic status (SES). Walberg (2010) found a big difference between higher SES parents and lower SES parents. This difference is

illustrated in Table 2. The first column in the Table 2 identifies things that higher SES parents do with their children, and the second column describes things that lower SES parents do with their children.

Table 2

Difference Between Parents of Different Level of SES

Higher SES parents	Lower SES parents
Talk more often with their children	Talk less with their children
Speak 2,000 words per hour to their children	Speak 500 words per hour to their children
Use a wider variety of words	Use a simple vocabulary
Use more complicated sentences	Use less complicated sentences
Use more verb tenses	Use fewer verb tenses
Use more sentence types	Use fewer sentence types
Give 6 times more positive feedback	Give 2.2 times more negative or discouraging feedback
Interact with their children more	
Expect their children to achieve more	Expect their children to do well less often
Help their children to achieve more	Tend to do tasks for their children (neglecting the development of their problem solving skills)
	View schools as inaccessible places where they have little control

Note. From *Advancing Student Achievement*, by H. J. Walberg, 2010, Stanford, CA: Education Next Books.

In a longitudinal study of 24,599 eighth grade students and their parents, teachers, and school administrators, Houtenville and Conway (2008) investigated five variables that showcased the impact of parental effort on student achievement. These variables were divided into two categories. The first category, labeled *dinnertime* because of its home-based characteristic, contained three variables: how frequently parents (a) discuss activities or events of particular interest with the child, (b) discuss things the child studied in class, and (c) discuss selecting courses or program at school. The second category, labeled *school-related* because of its in-school characteristic, contained two variables: how frequently parents (a) attend school meetings and (b) volunteer at the child's school. Houtenville and Conway found that the three dinnertime variables were positively related to student achievement and that of the two school-related variables, only attending school meetings had a statistically significant relationship with student achievement, suggesting that students whose parents attend school meetings and talk with their children about school matters tend do better academically. Houtenville and Conway also found that in order to attain the same level of student achievement generated by parental effort, $1,000 in additional per-pupil expenditure would have to be included in the school budget or the parent would have to have more than 4 additional years of education. The study also revealed a negative relationship between school resources and parental effort, suggesting that parents who realize that the school has the necessary resources tend to decrease their effort and involvement in their child's school experience.

Topor et al. (2010) also conducted a student background study that examined the ability of the child's perceived cognitive competence and the quality of the student-teacher relationship to explain the relationship between parent involvement and the

child's academic performance. They collected data from a sample of 158 7-year-old participants, their mothers, and their fathers using the Parent-Teacher Involvement Questionnaire, the Student-Teacher Relationship Scale, the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children, the Wechsler Individual Achievement Test—Second Edition, and the Academic Performance Rating Scale. They found that increased parental involvement was significantly related to increased student academic performance regardless of level of intelligence, indicating that students whose parents were involved in their academic work tended to be successful whether they were academically strong or not. Another finding from the study was that increased parental involvement was also related to increased quality of the student-teacher relationship, suggesting that students of involved parents were more likely to have good relationships with their teachers. Finally, the results also revealed that the quality of the teacher-student relationship was a mediator of the relationship between parent involvement and teacher ratings of the child's classroom academic performance. This implies that without a good teacher-student relationship, the involvement of parent would not have had any influence on teacher ratings of the child's classroom academic achievement.

Another student background factor that seems to influence student achievement is parental expectation. Grossman, Kuhn-McKearin, and Strein (2010) and Yamamoto and Holloway (2010) found a positive correlation between parental expectations and student achievement. In a literature review on parental expectations and their effects on student achievement within and across diverse racial groups, Yamamoto and Holloway (2010) reported that teachers should have a clear understanding of how parental expectations are formed and interpreted by students to be well placed to help students overcome the

effects of either extremely low or excessively high parental expectations. Grossman et al. (2010) echoed the previous suggestion. They used the Early Childhood Longitudinal Study to collect data from 4,535 fifth and eighth graders from 399 public and 103 private schools and found that individual parental expectations were significant predictors of fifth and eighth grade reading as well as math achievement when controlling for student gender and socioeconomic status. They proposed that schools should help parents understand the magnitude of their expectations concerning their children's academic performance. Another equally important parental factor associated with student achievement is parental style. Dehyadegary, Yaacob, Juhari, and Talib (2012) studied 382 high school students in Iran to determine the relationship between parental styles and academic achievement. They reported that an authoritative parenting style (i.e., parents who hold high expectations and set clear guidelines but are responsive and nurturing toward their children) had a significant positive correlation with academic achievement. This suggests that students benefit academically when their parents are authoritative. On the other hand, an authoritarian parenting style (i.e., parents who are strict and who use shame and punishment to control a child's behavior) had no significant relationship with academic achievement. This indicates that authoritarian parents do not affect their children's academic achievement. However, a permissive parenting style (i.e., parents who are loving and nurturing but lack rules and offer little to no discipline) has a negative correlation with academic achievement. This suggests that students' academic progress gets hindered when their parents are permissive.

The underlying theme in this review of the present literature is that student background factors can have overwhelming influences on student achievement. Such

factors as poor neonatal weight, poverty-related factors, lower SES parents, and authoritarian parents have been found to have negative influences on student achievement. On the other hand, factors such as good neonatal care, high-SES parents, healthy parental expectations, increased parental involvement, parental effort, and authoritative parenting style have been found to contribute positively to student achievement.

Teacher Characteristics and Student Achievement

Another extensively researched area that has been associated with student achievement is teacher characteristics. Evidence indicates, for example, that prior academic achievement, licensure scores, subject-matter knowledge and grade-level teaching experience may influence student achievement. According to Walberg (2010) "Teach for America showed that recent graduates of elite colleges who are knowledgeable in their subjects, with no experience and little pedagogical training . . . are able to better promote student achievement than other teachers" (p. 61). Using data collected from the New York City Department of Education and Teach for America admission records from 2004-2005 through 2009-2010, Dobbie (2011) reported that a teacher's prior academic achievement, leadership, and perseverance are associated with student gains in math in a teacher's firs year. Wayne and Youngs (2003) reviewed 21 studies on the impacts of teacher characteristics on student achievement gains. Among the twenty-one studies, seven studies of student achievement assessed the importance of teacher licensure examination scores on verbal skills and other tests. They found that five studies reported a positive association between teachers with higher test scores and student achievement and two studies reported a negative association between teachers

with higher test scores and student achievement. The findings also revealed that the two studies that reported a negative association were controlled for college ratings (university/college quality) contrary to the five studies that reported a positive association. This finding suggested that the quality of the institution that teachers graduated from may have contributed to the negative association between teachers with higher test scores and student achievement. "Thus, the negative findings may support the five positive findings" (Wayne & Youngs, 2003).

These results are echoed by Walberg (2010) who found that teachers who passed the American Board for the Certification of Teacher Excellence (ABCTE) exams improved student achievement more than teachers who failed. Using a value-added model, Huang and Moon (2009) analyzed data from 1,544 students, 154 teachers, and 53 schools using three levels of hierarchical linear modeling. They found that highly qualified teachers were not necessarily highly effective teachers. They also found that student achievement is not dependent on teachers who are certified, not certified, hold bachelor's degrees, or hold master's degrees. Walberg agreed and found that overall, certified teachers perform very little or no better than those who are not certified. However, Wayne and Youngs (2003) found that teachers with standard mathematics certification do better than teachers with no mathematics-related certification. This finding indicated that subject-specific measures matter. Nevertheless, using data collected from the Florida Department of Education of all public school students including student-level achievement test data for both math and reading in grade 3-10 for the years 1999-2000 through 2004-2005, Harris and Sass (2011) reported that no evidence showed that teachers with education majors were more productive than teachers with non-education

majors. However, completing more subject-content credits correlated positively with the performance of high school math teachers.

Huang and Moon (2009) found that teaching experience at a particular grade level was significant to student achievement as opposed to teaching experience in general, indicating that students who are taught by experienced teachers in their particular grade are more likely to succeed compared to students who are taught by teachers who have simply been teaching for a while. However, Harris and Sass (2011) found that teacher experience increases teacher productivity at all grade levels in elementary and middle school math but the effect decreases as students move from elementary all the way to the high school level. Walberg (2010) however argued that aside from the first two years of teaching experience, completing an education degree, additional years of experience, and taking more education courses are not associated with student achievement gains.

Other teacher characteristics that appear to be related to student achievement include performance pay, professional development, attendance, and effectiveness. According to Walberg (2010), research in education has suggested that performance pay leads to the recruitment and retention of better teachers and also improves student achievement. Harris and Sass (2011) found no positive effects for in-service professional development on the productivity of elementary teachers. On the other hand, they found a positive effect of the prior professional development training on the productivity of math teachers at the middle school and high school levels. Tingle et al. (2012) studied the relationship between teacher absence and student achievement in a large urban school district in the southeastern section of the United States. The study took place in a school district with 178 schools that enrolled 138,807 students from pre-K to 12th grade. Tingle

et al. (2012) found that teacher absence had a statistically negative impact on student achievement. However, the study showed that this relationship was significantly stronger in schools where the average teacher absence was historically low. On the other hand, if a teacher was frequently absent in a school where the average absence was historically high, the relationship was not significant. In a two-phase study, Stronge et al. (2011) examined classroom practices of effective teachers (e.g. understand feelings of students, communicate clearly, admit to mistakes and correct them immediately, think about and reflect on practice, display a sense of humor, etc.) versus less effective teachers (e.g. believe that teaching is just a job, arrive late to school and class on a regular basis, has classroom discipline problems, express bias with regard to students, works on paperwork during class rather than working with students, etc.). In phase I of the study, they collected data from 307 fifth-grade teachers and two years of student test scores in reading and math from three public school districts in a state located in the southeastern of the United States. In phase II of the study, they collected data from 32 teachers divided in two groups. The first group had seventeen teachers and was considered effective while the second group had 15 ineffective teachers. The results of their analysis revealed that more than 30 percentile points separated the differences in student achievement in mathematics and reading between effective teachers and less effective teachers. Moreover, they found that effective teachers had fewer classroom disruptions, better classroom management skills, and better relationship with their students than their less effective colleagues. According to Stronge et al. (2011), this suggested that "teachers who are effective in terms of their student achievement results have some particular set of

attitudes, approaches, strategies, or connections with students that manifest themselves in nonacademic ways and that lead to higher achievement" (p. 348).

The shared consensus among these studies in the existing literature revealed that teachers play an integral part in the achievement of their students. This part can lead to negative outcomes when teachers among other things score low on their licensure examination, when they have a propensity of being absent, and when they are not effective. However, this part can lead to positive outcomes when teachers are effective in their instruction, when they have experienced at a specific grade level, and when they get rewarded for their performance.

School Factors Associated With Student Achievement

Classroom practices have also been associated with student achievement. According to Walberg (2010) student achievement can be strongly influenced by one-on-one and small-group tutoring through quick and individualized feedback. In addition, Walberg (2010) believed that student achievement could be attained by implementing the following practices when teaching courses: (a) listen to student; (b) give feedback on homework that is related to real-world tasks; (d) give work-related and/or open-book tests; (e) allow students to practice with instructor supervision, encouragement, and feedback; (f) and encourage peer-to-peer teaching. Incidentally, Burke and Sass (2011) studied the relationship between classroom peer effects and student achievement at the elementary, middle, and high-school levels for both math and reading. They found that peer effects are stronger at the classroom level than at the grade level and moreover, peer effects are small but statistically significant.

According to Walberg (2010), "Schools that are secure and friendly appear to be better than others in promoting learning" (pp. 81-82). School safety has always been an important issue for students, parents, educators, and policymakers. Clarke and Russell's (2009) study of 2,400 students in California used data collected from the 2003, 2004, and 2005 Preventing School Harassment Survey. This survey was designed to "study the experiences of lesbian, gay, bisexual, transgender, queer, and questioning high school students and their straight allies, and steps schools can take to make schools safer" (p. 4). They found that students who strongly feel safe at school were more likely to have higher grade point average. By contrast, students whose grades were mostly below B's and C's did not strongly agree that they felt safe. This finding was consistent with straight students as well as LGBT students. Likewise, Milam, Furr-Holden, and Leaf (2010) investigated the effect of school safety and neighborhood violence on academic achievement of 3rd - 5th grade students in an urban public school system. Using the School Climate Survey, the Neighborhood Inventory for Environmental Typology, and the Maryland State Assessment, the analysis of the data revealed that increasing neighborhood violence was associated with statistically significant decreases from 4.2 to 8.7% in math and reading achievement. On the other hand, an increase in perceived safety was associated with significant increases in achievement from 16 to 22%. Moreover, in 2011, Juvonen, Wang, and Espinoza's longitudinal study of 2,300 sixth graders from 11 public middle schools found that the academic performances of students who were bullied the most were worse than their peers. In addition, they found that on the four-point bullying scale, a one-point increase was equivalent to a 1.5 decrease in GPA for one academic subject (e. g., math).

Another important school factor that is linked to student achievement is school leadership. Based on extensive research and field-testing, Goldring, Porter, Murphy, Elliot, and Craven (2007) developed the following school leadership indicative of effective principals: (a) High standards for student learning, (b) rigorous curriculum, (c) quality instruction, (d) culture of learning and professional behavior, (e) connections to external communities, (f) performance accountability, (g) and individual and collective responsibility for learning. These attributes are consistent with essential core leadership practices established by the International Successful School Principalship Project (ISSPP; the largest and most sustained international research network on the work of successful principals). Based on a review of the leadership literature with findings drawn from the ISSPP, Jacobson (2010) reported that improving the learning environment is essential for successful school proposals in areas stricken by high poverty. In addition, direction setting, developing people, and redesigning the organization are also considered core practices necessary for school success. Moreover, according to Jacobson, these practices are more effective when they are implemented in ways that are culturally sensitive, i.e., collegial and collaborative.

Nash (2011) investigated the leadership styles of principals who are successful in improving schools. Using data collected in a case study of 15 elementary school principals from a large metropolitan school district in North Carolina, her investigation revealed a positive relationship between transformational leadership (i.e., leadership style that leads to changes) and student achievement. On the other hand, Uline and Tschannen-Moran (2007) found that the principal's leadership style was not related to student achievement. They found however that the principal's leadership style was related to

three school climate variables (students respect others who get good grades, community members are responsive to requests for participation, teachers are committed to helping students) which were related to student achievement. This relation suggested that principals mediate student achievement by fostering an environment driven by rigorous academic principles and teacher professionalism. Uline and Tschannen-Moran also found a link between quality of school facilities and academic achievement. They reported, "When learning is taking place in inadequate facilities, there tends not to be as clear a focus on academics, and the learning environment is less likely to be perceived as orderly and serious" (p. 66).

The recent literature review through this group of studies has shown that student achievement could also be influenced by many school related factors. Among these prevailing factors are consistent and effective classroom practices that allow teachers and students to get the best out of each other, a secure, adequate, and friendly environment where students feel safe, and having an effective leader as a principal.

Resource Factors Associated With Student Achievement

The research on the association between student performance and such school resources as class size and funding has been mixed over the years. In a meta-analysis of 17 studies conducted in the United States to review the effect of class size on student achievement, Shin and Chung (2009) found that student achievement is better in small class size than in larger class size by .20 standard deviations, suggesting that students learn better in smaller classes. In addition, the meta-analysis revealed that class size reduction (CSR) at the elementary level is more effective than reducing classroom size at the secondary level. In addition, the mean effect sizes of social science (.20), math (.20),

and reading (.19) were positive while the mean effect sizes of writing (-.09) and SAT (-.29) were negative through reduced class size, indicating that learning certain subjects could be benefited or hindered from a reduced class size. These findings were consistent with Jepsen and Rivkin (2009) who investigated the effects of California's billion-dollar class-size-reduction program on student achievement. They used the California Department of Education to collect data from second graders through fourth graders from all public elementary schools with the exception of charter schools and alternative schools during the 1990-91, 1995-96, and 1997-98 through 2001-2002 academic years. They found that CSR increased achievement in the early grades regardless of student demographic groups but cautioned that the substantial costs of implementing CSR may outweigh its benefits. Fan (2012) also supported these findings and reported that "the effects of class size were greatest for either disadvantaged and minority students or students of low socio-economic status … and government should ensure that there is a reduction of class size to the barest minimum" (p. 97). However, these findings were in contradiction with Chingos and Harvard University (2010) who collected data from the K-20 Education Data Warehouse assembled by the Florida Department of Education. This database contains observation in every student in Florida who was administered the state assessment tests from 1999 to 2009. The results of their data analyses revealed that the effects of mandated CSR in Florida on cognitive and non-cognitive outcomes were insignificant and likely close to zero, suggesting that class size reduction did not contribute anything to student achievement. Likewise, Owoeye and Yara (2011) found no significant difference in the achievement scores of students in small and large classes from urban and rural schools.

Another resource factor that has been linked to student achievement is funding. Neymotin (2010) examined the relationship between school funding and student achievement. She collected data from the Kansas State Department Board of Education on student achievement test scores, graduation rates, and dropout rates. She also collected data from the National Center for Education Statistics on school district characteristics, revenues per student, and the diploma rate. The results of her data analysis showed that increasing school funding based on the number of at-risk youth in the state of Kansas had little positive effect on student achievement. In addition, Neymotin warned that the relationship between school funding and student achievement could also be influenced by other variables including the availability and the allocation of resources, how effectively resources are employed in helping students to succeed, and whether funds are allocated based on whoever has the right political connections.

School choice and vouchers have also been connected to student achievement. In a review of the literature on the use of achievement data in the assessment of vouchers for private schools, Lubienski and Weitzel (2008) reported that, "Vouchers and other forms of school choice, which were famously pushed as a 'panacea' for schools, do not appear to be providing any substantial advantages for families when measured by student achievement" (p. 484). Rouse and Barrow (2009) supported this sentiment in their literature review of the empirical evidence on the impact of education vouchers on student achievement and found that students who are offered education vouchers have only made insignificant (not statistically different from zero) small academic gains.

The review of the current literature through these studies has revealed that student achievement may be influenced by some resources factors. While the literature is

consistent on the impact that such resources as the amount of funding schools receive and how the funds are applied have on student achievement, the impact of other resources such as the use of education voucher, the choice of school parents make for their children, and student to teacher ratio in the classroom are still being debated.

Improving Achievement in Mathematics

While the above sections examined factors that might have been related to student achievement in general, this section will review factors that might have an impact on student achievement specifically in mathematics. In this review, several factors were found that could possibly enhance student achievement in mathematics while other factors were found that could possibly impair student achievement in mathematics.

Factors That Contribute to Student Achievement in Mathematics

A review of the literature revealed several factors that could be used to increase student achievement in mathematics. Maguire (2011) studied the strength of the relationship between teacher efficacy and student academic achievement in mathematics in two southeastern suburban school districts. He collected the end-of-course archived test scores (2009-2010 school-year) of 535 ninth and tenth grade students and surveyed 12 math teachers. Through a linear regression analysis, the findings showed that teacher efficacy in student engagement and teacher age were significant predictors of student achievement in mathematics. On the other hand, the findings reported that teacher efficacy in instructional strategies, teacher efficacy in classroom management, and teacher experience did not predict student achievement in mathematics. However, using a step-wise multiple regression analysis, the results suggested that when teacher efficacy in classroom management and teacher experience joined teacher efficacy in student

engagement and teacher age, the combination of these independent variables was the best predictor for student achievement. This suggests that students benefited more academically from older and more experienced teachers who are effective classroom managers and know how to engage their students' learning.

Furthermore, Marat (2007) surveyed 91 students (40 females, 51 males) and 10 math teachers from a secondary school in New Zealand to explore the role of self-efficacy and learning strategies in students' achievement in mathematics. The results showed a significant positive correlation (r = .296) between the student's beliefs in use of strategies for practicing mathematics to learn and student achievement. This suggests that students who bought in the idea of using strategies to learn were better off academically. In addition, using resources provided by the school was also found to have a positive correlation (r = .347) with student achievement, indicating that students who took advantage of school resources achieved at a better rate. Finally, increasing confidence in one's capability to perform successfully in the forthcoming mathematics examinations was also positively correlated (r = .341) with student achievement in mathematics, suggesting that students who were convinced that they were going to do well on their test because of their abilities were more likely to succeed in mathematics. Moreover, Tella (2008) surveyed 120 primary school students and 254 primary school teachers in Nigeria to examine the relationship between teacher self-efficacy, interest, attitude, qualification, experience, and student academic achievement in mathematics. The findings indicated that teacher self-efficacy (r = .267) along with teacher interest (r = .313) had a significant correlation with student mathematics achievement outcomes. This implies that when teachers are confident in their abilities to teach mathematics and show concern and

curiosity about teaching the subject their students tend to succeed. Other variables such as teacher attitude, qualification, and experiences indicated low, insignificant, and weak relationships with mathematics achievement.

Larwin (2010) studied the effect of reading achievement in the mathematics achievement of 10^{th} graders in the United States. He collected data from 442 tenth grade students from different schools using the third edition of the Trends in International Mathematics and Science Study (TIMSS 2003). After a hierarchical linear regression analysis of the collected data, the study revealed that reading achievement accounted for 56.1% of the variance in the student's level of mathematics achievement. These results suggested that reading achievement was a significant predictor of mathematics achievement. When computer-assisted instruction use in math education, student's math self-efficacy, and teacher's expectations of the student were added to the final model, the combination of the four independent variables accounted for 63.8% of the variance of the student's level of math achievement. This suggests that together these variables could strongly predict students' level of math achievement. Individually, in addition to reading achievement, students' math self-efficacy and teachers' expectations were associated with higher math achievement scores. However, the level of computer assisted instruction had a negative association with students' mathematics achievement, indicating the more time students spent in using the computer to learn mathematics the less likely they are to succeed in mathematics.

Jitendra et al. (2013) examined whether students with mathematics difficulty (MD) benefited more from small-group tutoring, using either a schema-based instruction (SBI) or a school-provided standard-based curriculum (SBC) on word problem-solving

(WPS) and whether the treatment effects are long lasting. They collected data from 136 third-grade students from 35 classrooms in 12 elementary schools in a large urban school district in the midwestern section of the United States. They found that students who scored higher in their pretest who received SBI tutoring (N = 72) scored higher in their posttest than students who received SBC small group tutoring (N = 64). On the other hand, students who scored lower in their pretest who received SBC tutoring scored higher in their posttest than students who received SBI tutoring. SBI tutoring favored students who had already mastered the basic skills of computational strategies. Similarly, Beal, Walles, Arroyo, and Woolf (2007) suggested that on-line tutoring activity appeared to mostly benefit students with the weakest math proficiency. They conducted a study using an experimental group (N = 153) and a control group (N = 49) to uncover whether improvement in problem solving was attributed specifically to the multimedia instruction. Using data collected from 202 students in geometry classes at two high schools in Western Massachusetts, they found that students who were tutored by the online program (experimental group) after their initial pre-test received better scores on their post-test compared to students in the control group who did not improve on the post-test.

Moreover Choi, Calero, Escardibul (2012) studied the impact of time spent on private tutoring on the academic achievement in math, reading, and science of 3,147 fifteen-year-old Korean students. Using data collected from the third edition of the Program for International Student Assessment (PISA), they found that spending one or two hours on private tutoring increased the performance score in mathematics and reading by approximately 16 points and 12.5 points respectively. On the other hand, the same amount of time in science tutoring was statistically insignificant. According to Choi

et al. (2012), these results were consistent with the findings of Park and Lee (2005) about mathematics achievement but contradicted Sung and Kim (2010) who reported that private tutoring had a negative impact on mathematics achievement.

Furthermore, Mohd et al. (2012) explored the level of attitude (i.e., patience, confidence, and willingness) towards problem solving and mathematics achievement among students from the Malaysian Institute of Information Technology, University Kuala Lumpur. They surveyed 153 semester one students in the diploma and bachelor programs and found a significant relationship between the level of attitude towards problem solving and math achievement. When attitude was broken down into patience, confidence, or willingness, Mohd et al. found a significant relationship between the level of patience towards problem solving and math achievement. However, there was not a significant relationship between the level of confidence and willingness towards problem solving and math achievement. This suggests that students who were patient in their approach to problem solving achieved better in math while students who were too confident and eager about their ability to solve problems did not do as well.

Additionally, Jebson (2012) collected data on 120 students randomly selected from three senior secondary schools. An experimental group and a control group were created and tested using the Mathematical Test of Assimilation to study the impact of cooperative learning (CL) on the performance of secondary students. Using a t-test from the analysis of scores for the experimental and control group, the findings revealed that the mean (41.91) of the experimental group was significantly higher than the mean (36.60) of the control group. This implies that students who participated in the

experimental group and were taught using the cooperative learning approach did better on their mathematics performance compared to the other students.

Douglas et al. (2008) conducted a quantitative study to compare two distinct instructional methods: multiple intelligence (MI) and direct instruction (DI). MI teaching strategy comes from Howard Gardner's 1983 multiple intelligences theory based on multiple skills and abilities. Gardner believed that since students have different sets of skills and abilities, educators should design appropriate methods of teaching to match the diversity of their expertise rather than focusing on strategies limited to their linguistic and mathematics aptitudes. DI was introduced by Siegfried Engelmann in1963. DI employs a teaching strategy where the teacher is the provider of knowledge and the student is the recipient. Joyce at al. (as cited in Magliaro et al., 2009) believed that "DI is modeling with reinforced guided performance" (p. 41). In their comparison of the two methods, Douglas et al. (2008) studied 57 eighth graders from a public middle school in North Carolina. They divided the students into an experimental group (N = 28) subject to the MI method and a control group (N = 29) subject to the DI method. They administered to the students a pretest and later after the implementation of the methods a posttest to evaluate the strength of each instructional strategy. They found a significant difference between the post-test means of the two groups: MI = 79.07 and DI = 71.24 and on average, students who were exposed to the MI teaching strategies scored approximately 25.48 points higher on the posttest as compared to 17.25 points for the participants in the control group. These findings indicated that students who were taught using the MI method had better academic achievement in math than students who were taught using the DI teaching strategies. Likewise, Ghazi et al. (2011) found a significant positive

correlation between self-perceived multiple intelligences (verbal/linguistic, logical/mathematical, interpersonal, intrapersonal, & naturalistic) and their academic achievement. According to Ghazi et al., educators would be better off if they used students-centered approach because they would present students the opportunities to apply their various forms of intelligence.

Savas, Tas, and Duru (2010) investigated the factors affecting the mathematics achievement of 275 students from one private school (N = 58) and two state schools (N = 217) in Van, Turkey. The findings revealed that private as opposed to public schools, family income, studying time, students' attitude towards mathematics, and attendance to private courses positively affect mathematics achievement of students.

Mason et al. (2012) in a review of the literature reported that in order to systematically improve student academic achievement in math and science school districts need to: (a) provide professional development in math and science content knowledge; (b) provide professional development in evidence-based pedagogical practices; (c) develop integrated STEM (science, technology, engineering, and mathematics) curriculum projects related to career clusters; (d) align STEM curriculum projects with mathematics and science standards; (e) build strong, collaborative relationships among K-12, higher education, and business partners. Likewise, the National Council of Supervisors of Mathematics (2013) developed a series of researched-informed answers for mathematics education leaders designed to improve student achievement in mathematics. They found that student achievement could be improved by: (a) leading effective teams of collaborative teachers, (b) leading sustained professional learning for mathematics content and pedagogical knowledge development, (c) leading

the pursuit for a vision for equity, (d) leading highly effective assessment practices, (e) addressing the needs of English language learners, (f) promoting positive self-beliefs, (g) systematically integrating effective technology, (h) expanding opportunities for our most promising students of mathematics, (i) expanding learning opportunities for the young, (j) using manipulatives with classroom instruction, (k) and infusing highly effective instructional strategies into RtI (response to intervention) Tier I instruction.

The findings through the preceding group of studies support the contemporary literature and have demonstrated that many factors contribute to student achievement in mathematics. Factors such as students' reading ability allows students to have a better understanding of the text of a math problem while students' level of attitude and self-efficacy provide them with the positive mindset, the patience, the skills, and the belief required to solve problem. In addition, teachers' self-efficacy, their instructional methods, and their expectations for students provide students with the necessary tools they need to achieve in mathematics.

Factors That Impair Student Achievement in Mathematics

Many factors have been shown to have a negative impact on student achievement in mathematics. Zakaria, Zain, Ahmad, and Erlina (2012) tried to determine the mathematics anxiety and mathematics achievement among secondary school students in Selangor, Malaysia. Using the Fennema-Sherman Mathematics Attitudes Scale (i.e., a questionnaire used to assess the level of math anxiety), they collected data from 195 (86 boys, 109 girls) secondary school students and found significant differences in mean mathematics achievement scores based on the level of anxiety. This suggests that the higher students scored on the math anxiety scale the less likely they were to succeed in

mathematics. Likewise, Karimi and Venkatesen (2009) examined the relationships between levels of mathematics anxiety, mathematics performance and academic hardiness (i.e., student attitudes regarding academic success) among high school students in Karnataka, India. They surveyed 284 8^{th} grade students (144 males, 140 females) and found a significant negative correlation ($r = -.15$, $p < .05$) between math anxiety and math performance, a significant positive correlation ($r = .14$, $p < .05$) between academic hardiness and math performance, and no significant correlation ($r = .09$, $p > .05$) between math anxiety and academic hardiness. This suggests that students who were highly mathematically anxious tended to under-perform in math, while students who wanted to succeed tended to be more driven and devoted to their work which led to having better math performance. Moreover, Ramirez, Gunderson, Levine, and Beilock (2012) explored whether math anxiety was related to young children's math achievement. They collected data from 154 first and second grade students (69 boys, 85 girls) from five public schools in a large urban school district and found a negative relationship between math anxiety and math achievement of students who relied more heavily on their working memory (WM). Ramirez et al. suggested that, "children who rely more heavily on WM when solving math problems are most impacted by math anxiety because worries about the situation deplete or interfere with the cognitive resources that support their math performance" (p. 196). The literature is altogether consistent on the negative effects of math anxiety on student achievement (Erden & Akgul, 2010; Hamid et al., 2013; Leppavirta, 2011; Ovez, 2012; Wu et al., 2012). Additional studies on the effects of math anxiety on student achievement will be reviewed in the mathematics anxiety section.

In addition to math anxiety, other factors have affected student achievement in mathematics. Lamb and Fullarton (2002), used data from the Third International Mathematics and Science Study (TIMSS) to examine student, classroom, and school factors influencing mathematics achievement in the United States and Australia. In total, 7,087 eighth graders from 348 classrooms and 183 schools participated from the United States and 6,916 eighth graders from 309 classrooms and 158 schools participated from Australia. The student-level variable was divided into two categories: student background variables (e.g. sex, family size, socioeconomic status, etc.) and student mediating variables (e.g. time spent on homework, attitude toward math, etc.). The classroom-level variable was also divided into two categories: classroom composition variables (e.g. grouping practice, average socioeconomic status of the classroom, etc.) and classroom teacher variables (e.g. years teaching, teaching practice, etc.). School size, class size, and pupil in-take policy belong to the school-level variable. A hierarchical linear modeling (HLM) design was used to study the impacts of student, classroom, and school-level factors on student achievement in mathematics. "This procedure allows modeling of outcomes at several levels (e.g. student level, classroom level, school level), partitioning the variance at each level while controlling for the variance across levels" (Lamb & Fullarton, 2002, p. 160). Three levels of variance were used to explain student achievement in grade 8 mathematics. When the student-level variables were introduced in the intermediate model, the amount of variance explained at the student level increased to 12% in the United States and 19.3% in Australia. It also increased at the classroom level to 15.7% in the U.S. and 27.6% in Australia. Then, when the classroom composition variables were introduced in the intermediate model, the amount of variance explained

between the classrooms jumped from 15.7% to 64.6% in the U.S. and from 27.6% to 74.3% in Australia. However, the introduction of classroom teacher variables only increased the amount of variance explained between the classrooms by 3% in the U.S. and Australia. The school-level variables introduced in the full model explained 13% of variance between schools in the U.S. and about 6% in Australia. These findings suggest that teachers did not have too much of an impact on the student achievement in mathematics. However, the findings also suggest that classroom composition factors such as grouping/tracking of students were vital in explaining classroom differences in student achievement in mathematics.

Likewise, Perse, Kozina, and Leban (2011) used data from TIMSS 2003 to determine how negative school factors such as aggression are associated to 4^{th} and 5^{th} grade student mathematics and science achievement in Slovenia. They found that students who experienced aggressive behaviors such as being the victim of thefts, physical abuses, negative peer pressures, name callings, and neglects scored lower in math and science. Furthermore, Shin, Lee, and Kim's (2009) study comparatively analyzed student and school-level factors affecting math achievement of 15-year-old Korean, Japanese, and American students. They used data from the Program for International Student Assessment (PISA) 2003. In total, 5,067 Korean students from 149 schools, 4,669 Japanese students from 144 schools, and 5,292 American students from 274 schools provided data for the study. The student-level variables used in this study were instrumental motivation, competitive-learning preference, and subject interest in mathematics. The school-level variables were student-teacher relationship and school disciplinary climate. An HLM model was used for the multi-level analysis of the data.

The introduction of the student-level variables in the intermediate model explained a proportion of variance in student math achievement of 12% in Korea, 6% in Japan, and 6% in the United States. Then, the introduction of the school-level variables in the full model explained a proportion of variance in student math achievement of 27%, in Korea, 56% in Japan, and 29% in the United States. These findings suggested that the student-level variables used in the study did not have a significant effect on student achievement in mathematics. These results also suggested that the school-level variables used in the study could be used as good predictors for school differences in mathematics achievement.

Akinsola, Tella, and Tella (2007) examined whether procrastination affects student achievement in mathematics at the university level. They collected data from 150 students at the university Idaban and university of Lagos, Nigeria and found a significant correlation (r = .82) between procrastination and mathematics achievement, suggesting that the more students procrastinate the more their mathematics achievement decreased. According to Akinsola et al., this finding was consistent with the results of previous studies (Popoola, 2005; Smith, 2002) on the relationship between math achievement and procrastination. In 2013, Balkis echoed these results by finding a negative relationship between academic procrastination and academic achievement. In addition, Akinsola et al. suggested that low levels of self-esteem and self-efficacy might be a contributor to the low academic performance of students who procrastinate (p. 368). Contrary to Akinsola et al. (2007), Seo (2011) did not find any relationship between procrastination and academic achievement. However, using data gathered from 172 students (155 women, 17 men) enrolled on an educational psychology course at two universities in South Korea,

Seo found that procrastination variables accounted for approximately 86% in students' flow (i.e., the state of total involvement in an activity that consumes one's complete attention). These results suggested that, although students who procrastinate reach a state where they immerse themselves in studying by loosing awareness of everything else, this effort (i.e., cramming) does not seem to have any significance on their performance. However, Seo (2012) found a significant difference in academic achievement between active procrastinators (make intentional decision to procrastinate) and passive procrastinators (postpone their task until the last minute). According to Seo, these results suggested that, "whether or not an individual is an active procrastinator is a more powerful factor in academic achievement than how long before the exam an individual start to study" (p. 1338). Finally, Seo found that active procrastinators do better than passive procrastinators when they start to study on the day of, or one day before an exam.

The collective outcome of these studies supported the current literature and revealed that many factors impair student achievement in mathematics. Among these factors, math anxiety has been shown to have strong debilitating effects on student achievement. Other factors such as how students are being grouped in the classroom, teacher inefficacy, student procrastination, and student experience of aggressive behaviors have also negative effects. In addition to these factors, many student background factors such as students' family size and their SES have also been shown to impair student achievement.

Mathematics Anxiety

According to the literature reviewed, mathematics anxiety is a real problem that affects teachers and also students at every level. This section will offer a historical

perspective of math anxiety followed by an understanding of math anxiety in which the definition, the difference between math anxiety and test anxiety, and the causes and the effects of the phenomenon will be pointed out. Strategies that can help overcome the negative consequences of math anxiety will be presented.

Historical Perspective on Math Anxiety

Prior to the launch of Sputnik 1 in 1957, the Life Adjustment Movement introduced a decade earlier by the United States Commissioner of Education had for objective the total development of the individual (Sister Mary Janet, 1954). This development was based partly on the knowledge of basic skills (i.e., arithmetic) that could be applied daily to practical problems in real world contexts. On October 1st of that year, Dreger and Aiken published their study, "The Identification of Number Anxiety in a Population" in the Journal of Educational Psychology. Using data collected from 704 students in basic mathematics classes at Florida State University, Dreger and Aiken (1957) investigated the presence of a syndrome of emotional reactions to arithmetic and mathematics, tentatively designated "Number Anxiety". The results of the analysis of the data collected through the use of the Taylor Manifest Anxiety Scale revealed that Number Anxiety appeared to be a separate factor from "general anxiety". In addition, they found that Number Anxiety did not seem to be related to general intelligence. Finally, their analysis showed that people with Number Anxiety tend to make lower mathematics grades. These findings suggested that mathematics anxiety under the pseudo "Number Anxiety" was already a factor and part of the academic lexicon despite the fact that mathematics was perceived to be concrete and meaningful by most.

After the Russians launched Sputnik 1 on October 4th, According to Hellum-Alexander (2010), Americans started to question the quality of mathematics and science in their schools, colleges, and universities across the country. About a year later on September 2, 1958, Congress passed the National Defense Education Act that provided funding to all the educational institutions in the United States. One of the consequences of this act was the changes in the mathematics curriculum. The New Math, as it was called, put major emphasis on inquiry based learning (i.e., teachers acted as facilitators and students discovered their learning). In addition, basic skills were supplanted by more rigorous and advanced topics such as calculus and set theory. According to Hellum-Alexander, within a few months, solving practical problems with arithmetic was replaced by more abstract activities. Mathematics became complex, students found it difficult to make the transition from the meaningful way of applying arithmetic to solve real-life problems to perform operations without purpose. Parents could no longer help their children with their homework. Even teachers had a hard time dealing with the changes because many were trained under the Life Adjustment movement. The number of people who get emotionally disturbed in the presence of mathematics increased under these new conditions. After mathematics anxiety became an issue of concern, overtime, researchers became interested in defining it and differentiating it with other form of academic anxiety (i.e., test anxiety), finding its causes, its effects on students as well as teachers, and strategies they could use to reduce it or to get rid of it.

Definition of Math Anxiety

According to Meetei (2012), "Generally, anxiety can be either a trait anxiety or a state anxiety. A trait anxiety is a stable characteristic or trait of the person. A state

anxiety is one which is aroused by some temporary condition of the environment such as examination, accident, punishment, etc."(p. 1). Mathematics anxiety is viewed as a form of state anxiety because it takes place in specific situations (Brady & Bowd, 2005). Mathematics is a subject that characteristically arouses anxiety for many people. Richardson and Suinn (1972) maintained, "Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (p. 551). Tobias (1998) supported this definition and asserted that math anxiety is the terrifying and sickening feeling of not doing well in math. Ashcraft (2002) concurred, "Math anxiety is commonly defined as a feeling of tension, apprehension, or fear that interferes with math performance" (p. 181). Gresham (2007) added, "It is a phenomenon where students suffer from irrational fear of mathematics to the extent that they are unable to think about, learn, or be comfortable with mathematics" (p. 25). Many other researchers provide similar definitions for math anxiety, but the recurring theme is that math anxiety is a feeling of fear that interferes with someone's ability to perform mathematical operations (Thilmany, 2009; Whyte & Anthony, 2012).

Math Anxiety and Test Anxiety

Bailey and Montagano (2012) examined whether mathematics anxiety and test anxiety were two separate constructs. In their review of the literature, they reported the following findings of other researchers:

1. Richardson and Woolfolk suggested that math anxiety is a form of test anxiety.
2. Hopko argued that math anxiety is a different construct from test anxiety.
3. Newstead found that math anxiety is more than test anxiety.

4. Brush, D'Ailly, and Bergering; Hendel, Rounds, and Hendel; Hunsley, Kagan, Chui, and Henry; Sepie and Keeling; Wigfield and Meece; and Wood have questioned the separateness of mathematics anxiety and test anxiety.

In order to shed light on the preceding findings, Bailey and Montagano conducted two studies. In the first study, using the Children's Test Anxiety Scale (CTAS) and two math anxiety scales (the Newstead Math Anxiety Questionnaire and the Math Anxiety Scale for Children), they collected data from 341 children aged 9-11 (Grades 4 & 5) from a relatively rural northeastern Indiana intermediate school. In the second study, they used the CTAS, the Math Test Anxiety Scale and a math anxiety scale named the Elementary Math Anxiety Scale designed from items selected from both the Math Anxiety Scale for Children and the Newstead Math Anxiety Questionnaire to collect data from 523 children aged 9-12 (Grades 4 – 6). The results of these two studies lead Bailey and Montagano to conclude that math anxiety is unidimensional and different from test anxiety.

Causes of Math Anxiety

According to the literature, many situations contribute to math anxiety. Bekdemir's (2010) study of 167 preservice elementary teachers in a small university in Turkey examined whether the worst mathematics experience (WME) and most troublesome mathematics classroom experience (MTMCE) affect math anxiety in preservice elementary teachers. Three different instruments (Worst Experience and Most Troublesome Mathematics Classroom Experience Reflection Test, Most Troublesome Mathematics Classroom Experience Reflection Test, and Mathematics Anxiety Scale) were used to collect data through surveys and interviews. His findings suggested that many elementary teachers view their past negative relation with their former math

teachers as a major reason for their math anxiety. He also found that poor teacher behaviors as well as the complexity of mathematics in the later years of high school were important contributors to math anxiety in preservice teachers. These findings were consistent with earlier results found by Harper and Daane in 1998.

In a study of 53 elementary preservice teachers enrolled in three sections of an undergraduate elementary mathematics methods course at a mid-sized southeastern university, Harper and Daane (1998) showed that 75% of these teachers pointed out word problems as the leading factor for their math anxiety. They added that 60% of the participants revealed that, "(a) an emphasis on the right answers and the right method, (b) fear of making mistakes, (c) and frustration at the amount of time it took to do word problems" are also at the origin of their fear of mathematics (p. 32). They concluded that, "At least half of the students indicated additional reasons for their math anxiety: (a) an emphasis on timed tests, (b) feeling dumb when unable to solve a mathematics problem, (c) and having no confidence in their mathematics ability" (p. 32). Moreover, Brady and Bowd (2005) examined the relationship between preservice teacher education students' experiences with formal mathematics instruction, and their future professional practice. They used the Mathematics Anxiety Rating Score (MARS) to collect data from 238 education students (176 female, 62 male) enrolled in a mandatory course at a small Canadian university. They found that a preservice teacher's highest level of formal mathematics instruction had a significant negative correlation (r = -.28) with their total MARS score, suggesting that preservice teachers who have furthered their knowledge of mathematics through advanced mathematics courses were less likely to have math anxiety. They also found that a preservice teacher's stated enjoyment of studying math in

elementary school (r = -.36) and during secondary school (r = -.45) had a negative relationship with their total MARS score, suggesting that preservice teachers who reported that they enjoyed math in elementary school and high school tended to have low math anxiety. However, the results of the statistical analysis showed a positive relationship between total MARS score and mathematics being a participant's least liked subject in school (r = .52), indicating that preservice teachers who were highly mathematically anxious likely did not consider mathematics as their favorite subject while they were in school.

Furthermore, in a review of the literature to examine the underlying causes of math anxiety that result from a teacher's instructional practice, Furner and Gonzalez-DeHass (2011) found several connections. They reported the following relationships:

1. Williams (1988) believed that math anxiety originates from teaching and teachers of mathematics.

2. Oberlin (1982) found that the following teaching techniques were the causes of math anxiety: (a) assigning the same work for everyone, (b) covering the book problem by problem, (c) giving written work every day, (d) insisting on one only correct way to complete a problem, and assigning math problems as punishment for misbehavior.

3. According to Brush (1981), the following symptoms are attributed to the development of math anxiety: (a) mathematics becomes difficult during the early years of school, (b) students spend excessive amounts of time relearning what they were taught in past years, and (c) students are not exposed to the everyday applications of the material covered.

4. Crawford (1980) concluded that failure in math may be credited to any one of several factors: (a) a poor math instructor at some point; (b) an insufficient number of math courses in high school; (c) unintelligible textbooks; (d) or misinformation about what math is and what it is not, as well as who should do well in math.

Gresham (2007), Peker (2009), and Tatar (2012) connected math anxiety to learning style. In his study of 264 elementary teachers enrolled in an elementary mathematics methods course at a large southeastern university, Gresham (2007) investigated the relationship between math anxiety and learning styles in elementary preservice teachers. He used the Mathematics Anxiety Rating Scale and the Style Analysis Survey to collect data. He found a positive correlation between math anxiety and a global learning style (r = .42), suggesting that global learners have higher levels of math anxiety. According to Gresham, global learning is a style of learning where learners begin with the whole picture and has trouble discriminating the important fine points from a confusing language background. They are contrasted with analytical learners who like details more than the overall picture and can make the difference between the details and the background (p 25).

Peker (2009) also associated math anxiety to learning style. Peker used the Mathematics Teaching Anxiety Scale and the Learning Style Inventory to collect data from 506 preservice teachers enrolled in teacher education programs in three different universities in Turkey. The study's objective was to examine the differences in the teaching anxiety of preservice teachers in mathematics according to their learning style preferences. The study's findings suggested that people who are divergent learners (i.e.,

those who learn by combining abstract conceptualization with active experimentation) tend to have more math anxiety than individuals with other learning styles. Tatar (2012) used the Mathematics Anxiety Scale and the Learning Style Inventory to collect data from 441 eleventh grade students enrolled in six different high schools to examine the relationship between their mathematics anxiety and their learning styles. The results indicated a significant positive relation between mathematics anxiety and an avoidant learning style (e.g., unenthusiastic attitude toward learning, lack of interest in classroom activities and interaction with peers, and dislike of attending lessons and participation in the classroom). These results suggest that students who have high level of mathematics anxiety are less eager to learn mathematics.

Moreover, Yazici, Peker, Ertekin, and Dilmac (2011) found a connection between the preservice teachers' mathematical values and teaching anxiety in mathematics. They used the Mathematics Teaching Anxiety Scale and the Mathematical Value Scale to collect data from 359 preservice teachers attending the elementary school mathematics, secondary school mathematics, and primary school teaching programs. As a result of the statistical analysis, their findings suggested that people who have constructivist values (i.e., the belief that new learning begins by activating previous understanding) tend to have more anxiety about teaching mathematics. Equally important, Chinn (2009) examined aspects of mathematics in secondary schools across England and how students rated them as sources of anxiety. He used a questionnaire to collect data from 2,084 students in mainstream classrooms and 442 male students with a history of dyslexia in nine special schools. The analysis of the data revealed that examinations and tests were a source of anxiety in 4% of students. In addition, Chinn also found that the complexity of

many topics in the mathematics curriculum was a source of anxiety for students aged 11 to 17 years. Geist's (2010) review of the literature echoed Chinn's findings and reported that, "The early use of high stress techniques like timed tests instead of more developmentally appropriate interactive approaches lead to a high incidence of math anxiety" (p. 28).

In addition, Moore (2010) examined the gender differences in the impact of active perfectionism (e.g., good outcomes characterized by high personal standards and favorable perceptions of parental expectations and parental criticism) and passive perfectionism (e.g., bad outcomes characterized by concerns over mistakes and doubts over actions) on mathematics anxiety and writing anxiety. Moore gathered data from 307 Australian year 10 high school students using the Writing Apprehension Test, the Fennema-Sherman Mathematics Anxiety Scale, and the Multidimensional Perfectionism Scale. The findings revealed that students with higher levels of passive perfectionism had both mathematics anxiety and writing anxiety than other students with lower passive perfectionism. Suggesting that students who were more concerned about making mistakes experienced more mathematics anxiety and writing anxiety. In addition, the results showed that the level of mathematics anxiety among girls with low levels of active perfectionism was significantly stronger than among the boys with low levels of active perfectionism. Indicating that girls who had low personal standards and unfavorable perception of parental criticism demonstrated higher level of mathematics anxiety compared with boys with similar level of standards.

One additional perception of math anxiety is important to note. In their work, Datta and Scarfpin (as cited in Chinn, 2009) found two types of math anxiety. The first

type is mental blocks which for instance manifest themselves from the inability of students to cope with abstract concepts such as variables. The second type of math anxiety is caused by socio-cultural influences. They contended that students shown indirectly or directly by their surroundings that only an exclusive group of people who have the quality they do not possess can do math internalize that belief and live up to it (p. 62). Incidentally, Erdogan, Kesici, and Sahin (2011) tried to clarify whether achievement motivation (i.e., tendency of individuals implementing a task to achieve success and avoid failure) and social comparison (i.e., how individuals perceive themselves when they compare themselves with others) were significant predictors of high school students' mathematics anxiety. They used the Mathematics Anxiety Rating Scale, the Achievement Motivation Scale, and the Social Comparison Scale to collect data from 166 ninth grade students attending a private tutoring center in Konya City, Turkey. The analysis of the data showed that 19.5% of the variance related to mathematics anxiety was explained with achievement motivation, while 23.6% of the variation was explained with the combination of achievement motivation and social comparison. These results suggest that high achievement motivation alone is a significant predictor of mathematics anxiety. Moreover, students who were high in achievement motivation and had low self-esteem had a stronger likelihood to have mathematics anxiety.

The literature reviewed through these recent studies has shown that math anxiety could be blamed on an array of issues. Although the arguments supporting each of these issues have been substantiated through the results of the studies, some issues appeared to

have more negative impacts than others. Leading this category is the prior formal mathematical experience of teachers.

Effects of Math Anxiety

The literature review revealed several effects of math anxiety. Zakaria and Nordin (2008) and Woodard (2004) proposed that there was a strong relationship between high levels of math anxiety and mathematics achievement test scores. The purpose of Zakaria and Nordin's (2008) study was to examine whether there was a difference between matriculation students' motivation and achievement when classified according to their math anxiety levels. Using the Mathematics Anxiety Scale, the Effectance Motivation Scale, and the Mathematics Achievement Test, they collected data from 88 students (73 females and 15 males) who were at the end of their second semester of study at the University of Kebangsaan Malaysia. The findings of the study revealed a low (r = -.32) but significant negative correlation between math anxiety and achievement, suggesting as the level of math anxiety of the students increases their achievement decreases. The results also showed a strong (r = -.72) significant negative correlation between math anxiety and motivation, indicating as the level of math anxiety of the students increases their level of motivation decreases. It should also be noted that the results of the study pointed out a low but significant positive correlation between motivation and achievement, implying that students who were highly motivated tended to be more successful academically. These findings are consistent with Woodard's (2004) results. The purpose of her study was to determine if there was a relationship between math anxiety scores and achievement scores (exit exams). She investigated 125 developmental math students from Southwest Virginia Community College. The students were enrolled

in Basic Math (45), Algebra I (51), and Algebra II (29) during the spring semester of 2002. The Mathematics Anxiety Rating Scale was used to collect the data. Woodard found a significantly low negative relationship between exit exams scores and math anxiety. These findings show that the more mathematically anxious the students were the worst they did on their exit exams.

Moreover, Ashcraft and Kraus (2007) established that math anxiety has cognitive consequences (i.e., it affects mental processing during problem solving). Using a math-anxiety assessment and the Wide Range Achievement Test (a standardized math achievement test), they collected data from 80 undergraduates. They found a negative correlation (r = -.35) between math anxiety and the Wide Range Achievement Test, suggesting that the more mathematically anxious the students were the lower their achievement test scores. Moreover, when the test was broken down through line by line difficulty level, they found that the math anxiety impact was much clearer, indicating that highly math-anxious students' scores decrease as the material on the test gets more difficult. In addition, Ashcraft and Kraus argued, "a math-anxious person's working memory resources are drained only when the actual math anxiety is aroused" (p. 246), implying that math anxiety leads to a disruption of a person's ability to remember effectively. These findings are consistent with Hembree's report on the personal and educational consequences of math anxiety. According to Hembree (as cited in Ashcraft, 2002), people who are highly anxious in math tend to avoid situations that involve math and take fewer math electives in high school and in college. Those who take math tend to have lower grades. Furthermore, people who are highly anxious in math tend to adopt

negative thoughts about math and do not believe in their abilities to do math. These people were also more likely to score high on other tests of anxiety.

Witt (2012) examined whether children who report higher levels of mathematics anxiety suffer a decrement in working performance when confronted with digits as stimuli. He tested 55 students (18 males, 37 females) ages ranging from 9 years and 9 months to 10 years and 7 months from 2 state primary schools in the southwest of England. The results of the study suggested a decrease in the central executive working memory (i.e., specifically the ability to store, control, monitor, and process information concurrently) of highly math anxious students in situations that might trigger anxious feelings. The interpretation is that anxiety leads to a decline in memory performance which itself leads to a reduction in mathematical performance which suggested a potential bidirectional relationship between mathematical performance and anxiety. In addition, the results suggested that the simple presence of digits as to-be-remembered stimuli (even if there is no explicit mathematical processing required) can trigger anxious responses that inhibit central executive functioning. The digits as stimuli, as opposed to any other stimuli, may cause math anxious students to attain lower working memory scores compared to their less mathematically anxious counterparts. Moreover, Witt reported that high levels of math anxiety disrupt the central executive component of working memory rather than the visual-spatial sketchpad (visual working memory). This finding is in contradiction with the findings of Miller and Bichsel (2004) who established that math anxiety affects visual-spatial working memory (Witt, 2012).

Isiksal (2010) examined the relationship between mathematics teaching efficacy belief, mathematics anxiety, and mathematics self-concept (e.g., perceptions of personal

ability to learn and perform tasks in mathematics) in preservice teachers. Isiksal used the Mathematics Teaching Efficacy Belief Instrument, the Abbreviated Mathematics Anxiety Scale, and the Experience with Mathematics Questionnaire to collect data from 276 Turkish preservice elementary teachers enrolled in teacher education programs of two universities in the Southwest region of Turkey. He found that preservice teachers with high level of mathematics anxiety had lower beliefs in their ability to learn and perform tasks in mathematics. The results also showed an indirect effect of learning mathematics anxiety on the personal mathematics teaching efficacy of teachers through self-concept. This suggested that teachers who have high anxiety in learning mathematics will not be confident in their aptitude to teach mathematics due to their low perceptions of their personal abilities to learn and perform tasks in mathematics.

Haciomeroglu (2013) investigated whether there is a significant difference in mathematics anxiety and mathematical beliefs scores of elementary preservice teacher with respect to numbers of years spent in college and also examined the relationship between elementary preservice teachers' mathematics anxiety and mathematical beliefs. Haciomeroglu used the Mathematics Anxiety Rating Scale-Short Version and the Mathematical Beliefs Instrument to collect data from 301 preservice teachers (200 females, 101 males) enrolled in an elementary preservice teacher education program in Canakkale, Turkey. During the study, 166 preservice teachers in their third year completed mathematics education methods courses and 135 fourth year preservice teachers completed mathematics education methods courses and their internship at an elementary school. The results revealed significant differences between third year and fourth year preservice teachers vis-à-vis their mathematics anxiety and mathematical

beliefs. For instance, fourth year preservice teachers had slightly higher computation anxiety compared to third year preservice teachers. Moreover, fourth year preservice teachers had stronger mathematical beliefs compared to their third year counterparts. In addition, the findings showed that mathematics anxiety had a statistically negative relationship to the mathematical beliefs of preservice teachers (r = -.117, p < .05). Suggesting that, preservice teachers who had strong mathematical beliefs were less anxious about mathematics. The results also showed that preservice teachers who had strong beliefs about their abilities to teach mathematics effectively tend to possess more sophisticated mathematical beliefs.

Likewise, Peker and Ertekin (2011) investigated the relationship between preservice teachers' mathematics anxiety and their mathematics teaching anxiety, as well as to determine gender differences in these two anxieties. 316 preservice teachers teaching at the primary, the elementary, and the high school levels participated in the study. The Mathematics Teaching Anxiety Sale and the Mathematics anxiety scale were used to collect the data. The data analysis showed that gender did not affect the mathematics teaching anxiety of the preservice teachers. However, the results suggested that the preservice teachers' mathematics teaching anxiety increased as their level of math anxiety increased. Brown, Westenskow, and Moyer-Packenham (2011) found that the relationship between mathematics anxiety and mathematics teaching anxiety is not always linked. They investigated the frequency with which mathematics anxiety stemming from prior experiences leads to mathematics teaching anxiety. They collected self-report data (teaching reflection assignment) from 53 preservice elementary teachers during their senior year in a Bachelor's degree program at a four-year undergraduate

institution. The analysis of the data revealed that 18.9% of preservice teachers who experienced prior math anxiety did not experience mathematics teaching anxiety. At the same time, 17% of preservice teachers who did not experience prior math anxiety, experienced mathematics teaching anxiety.

Mattarella-Micke et al. (2011) examined how a person's psychological arousal (salivary cortisol) relates to their performance in a challenging math situation as a function of individual differences in working memory capacity and math anxiety. According to Mattarella-Micke et al., the hormone cortisol was chosen because it is often linked with stressors in humans and also believed to have effects on working memory (WM). Using the Reading Span, the Short Math Anxiety Rating Scale, and Modular Arithmetic problems, they collected data from 73 students (29 male, 44 female) from the University of Chicago. They found that participants who had high WM and high concentrations of salivary cortisol performed better as long as they were low in math anxiety. On the other hand, participants who had high WM and high concentrations of salivary cortisol did not have a good performance because they were highly math anxious. These results suggested individuals' ability to perform at a high level depends on their math anxiety regardless of their level of psychological arousal such as the concentrations of salivary cortisol. Chinn (2012) studied the impact of the avoidance strategy (e.g., no attempt by fear of failing) on mathematics learning and mathematics achievement. Using a norm-referenced test/survey, Chinn collected data from 1,783 school children from age 7 years to 15 years old and 792 people from age 16 to 59 years old across the United Kingdom. The results suggested that the avoidance strategy

prevents the learner from being judged as wrong and subsequently add to their sense of helplessness, anxiety, or failure.

However, math anxiety has the opposite effect on gifted students. Tsui and Mazzocco (2007) found that math anxiety was a contributing factor to variability in test performance among mathematically gifted students. The purpose of their study was to examine the effects of math anxiety and perfectionism (i.e., feelings that any accomplishment is never quite good enough) on math performance, under timed versus untimed testing conditions. They collected data from 36 mathematically gifted sixth graders (20 boys, 16 girls) who scored at or above the 97th percentile on any nationally normed, standardized aptitude, or achievement test. As a result of their analysis, they found that students with higher levels of either math anxiety or perfectionism had a smaller performance discrepancy during timed versus untimed test performance, compared to children with lower levels of math anxiety or perfectionism. This suggests that highly anxious mathematically gifted students almost performed as well during timed versus untimed testing, while gifted students with lower levels of math anxiety did better during untimed testing.

The review of the present literature through these studies has shown that math anxiety has devastating effects that if not addressed properly could hinder people's mathematical progress by affecting their working memory and ability to process information coherently. However, gifted math students use their anxiety at their advantages to motivate them to do better.

Strategies to Decrease Math Anxiety

Educators can use many strategies to help students who experience math anxiety. These strategies include attending mathematics methods courses and changing instructional methods in the classroom.

Mathematics methods course. Sloan (2010) examined the effectiveness of a mathematics method course in reducing the levels of math anxiety of 72 preservice teachers (66 females, 6 males) from three sections of an undergraduate mathematics methods course. Sloan found that the levels of mathematics anxiety of preservice teachers were significantly reduced after the completion of the 15-week mathematics methods course. Using a qualitative approach (i.e., data collected from 12 interviews with preservice teachers who attended the methods course), Sloan also examined specific elements of the course that have been demonstrated to be effective tools in helping decrease math anxiety in preservice teachers. She found that the classroom atmosphere, the instructor's disposition, the field experience and peer teaching, and the methodology (i.e., use of manipulatives) employed by the course instructor were influential in decreasing math anxiety. It should be noted that while 10 out of 12 of the preservice teachers reported that the course instructor's methodology helped, the other two preservice teachers did not have similar success because of their unfamiliarity with manipulatives. These findings are consistent with Gresham's (2007a) study on the examination of whether preservice teachers' mathematics anxiety can be reduced after participating in a mathematics methods course. Using the Mathematics Anxiety Rating Scale, a pretest, and a posttest, she collected data from 246 junior early childhood/elementary education preservice teachers from a large southeastern university who were enrolled in a mathematics methods course. The results of the analysis showed

that the level of math anxiety was significantly reduced due to the completion of the mathematics methods course. At the foundation of these methods courses was the concept of meaningful learning theory of Jerome Bruner who put a lot of emphasis on giving meaning to lessons, by moving away from the abstract and by embracing the tangible. Similarly, Johnson & Vandersandt's (2011) study of 421 freshmen and sophomore preservice education major teachers suggested that a methodology course was statistically significant in reducing the mean mathematics anxiety level, indicating that preservice teachers who attended the methodology course were able to lower their mathematics anxiety.

Changes in classroom's instructional methods. Van Gundy, Morton, Liu, and Kline (2006) in their quasi-experiment of 175 students enrolled in four undergraduate statistics classes at a university in the northeastern part of the United States found that web-based instruction reduced math anxiety significantly from the beginning to the end of the course. According to Van Gundy et al., this suggests that being away from the traditional classroom environment and having familiarity and control over the web-based environment could prove helpful in reducing math anxiety. Equally compelling, Gresham (2007) examined the relationship between mathematics anxiety and learning style. Using the Style Analysis Survey and the Mathematics Anxiety Rating Scale, he collected data from 264 elementary preservice teachers (247 females, 17 males). The results of the data analysis revealed that when teachers understand their students' learning styles, it gives them a larger selection of strategies to choose from to minimize their students' anxiety. Moreover, Shores and Smith (2010), in their review of attribution studies from 1974 to 2008, reported that teachers who go the extra mile to identify to what (i.e., ability, effort,

task difficulty, and luck) their students attribute their success and their failure develop essential tools to help them combat math anxiety. Furthermore, Brady and Bowd (2005) shared a series of strategies that they felt would decrease math anxiety considerably if well implemented. They proposed that teachers could start by showing real interest in mathematics, design meaningful lessons based on real-world application, and use project based instruction that is focused on understanding.

Moreover, Haynes, Mullins, and Stein (2004) offered some equally persuasive recommendations. They surveyed 159 undergraduate students (80 males, 79 females) enrolled in math or statistics classes at Tennessee Technological University during a single academic term. They found a negative relationship between perceived high school math teachers' teaching methods and attitude and math anxiety, suggesting that students who were under the impression that their teachers had a positive attitude and were willing to help were less likely to have math anxiety. In addition, they found that test anxiety was a consistent predictor of math anxiety which led them to suggest that teachers need to make testing more enjoyable. They also favored a classroom where students are not pinned against each other in a constant competition. They believed cooperation among students is much more effective in decreasing math anxiety and improving success. They also recommended not setting any time limit on tests in order to allow students to be relaxed and to not worry about rushing and consequently becoming increasingly anxious. This is consistent with Tsui and Mazzocco (2007) who implied that mathematically anxious students performed better when testing is untimed.

In addition to the above, in their review of the literature to examine how students' mastery and performance goals relate to math anxiety, Furner and Gonzalez-DeHass

(2011) proposed that teachers should play an active role in not only preventing math anxiety but in implementing procedures to reducing it in their students. They believed that teachers should design mastery-oriented classrooms where students have the opportunity to grow. They reported that the following educational practices established by the National Council of Teachers of Mathematics (NCTM) in 1995 could help prevent math anxiety: (a) accommodate different learning styles; (b) create a variety of testing environments; (c) design the experience in the math class so that students feel positive about themselves; (d) remove the importance of ego from classroom practice; (e) emphasize that everyone makes mistakes in mathematics; (f) make math relevant; (g) empower students by allowing them to have some input into their own evaluations; (h) allow for different social approaches to learning mathematics; (i) emphasize the importance of original, quality thinking rather than the rote manipulation of formulas; (j) and characterize math as a human endeavor (p. 231).

Likewise, in a review of the literature, Ruffins (2007) reported the following strategies to use to overcome math anxiety: (a) provide role models in the form of a highly qualified woman or minority instructor, and also introduce historical figures who were mathematicians or scientists; (b) get a group of students to talk about a math problem before using numbers, mathematical symbols or equations. Show that even wrong answers can be useful in helping other people to look at the problem; (c) find a way to visualize a math problem in more concrete terms, perhaps using real life questions of size, distance, time or money; (d) discuss the quantitative problem in terms of ordinary words or pictures; (e) translate the problem into the formal English of mathematics; (f) translate the formal description of the problem into mathematical terms and only then try

to solve the mathematical equation (p. 19). Likewise, in a review of the literature on the influence teachers have to diminish math anxiety, Shields (2005) reported that teachers can lessen math anxiety in the classroom by encouraging students to enroll in math courses and pursue math-related careers. Teachers need to portray positive attitudes and be enthusiastic about mathematics and display firm control and mastery of the subject. They also need to design or adopt effective math curricula, implement effective pedagogy, create classrooms focused on inquiry and discovery, and assess fairly.

Shen (2009) examined the effects of emotional support and cognitive motivational messages on 109 general educational development (GED) students with math anxiety in the state of Florida. While cognitive motivational messages did not have any effects on the performance of the students with math anxiety, the results of the study revealed that students who received emotional support showed less math anxiety than students who did not receive any emotional support. Similarly, Lyons and Beilock (2011) suggested that the most successful ways to help get rid of poor performance created by math anxiety is to implement classroom practices that help students learn how to control their emotions before engaging in the math task at hand. They collected data from 28 University of Chicago students and found that the initial step in helping students to control their emotions is crucial in producing mathematical achievement. They believed that defeating math anxiety seems to be less about people's knowledge and more about their emotional strengths to get to it. On the other hand, Legg and Locker (2009) found that meta-cognitive skill is a moderator in the relationship between math anxiety and math performance. The analysis of the data collected from 56 Georgia Southern University undergraduates (41 women, 15 men) who were participating in an Introduction to

Psychology course, indicated that the math performance of students who do not have high meta-cognitive skills decreased as their math anxiety levels increased. This means that intelligent students who had the capacity to understand mathematics did not experience any decrease in their math performance even if they had math anxiety compared to unintelligent students who could not understand mathematics. Ader and Erktin (2010) also investigated the impact of cognitive (mathematical background) and affective variables (math anxiety, test anxiety, achievement motivation, and self-efficacy) on the mathematics achievement of students. They used the Coping with Mathematics Scale, the Metacognitive Skills Inventory, The Achievement Motivation Scale, the Generalized Self-Efficacy Scale, the Test Anxiety Inventory, the Math Anxiety Scale, the Test to Measure Mathematical Background, and the University Entrance Examination to collect data from 751 high school seniors (335 male and 416 female). These students attended a private institution in Turkey that prepared them for their college entrance exam. 47.6% of the students came from public schools, 17.3% from private, 2.7% from vocational schools, and 32.4% from special public schools where lessons are taught in a foreign language. The analysis of the data suggested that compared to the other affective variables, students' past experience with mathematics was the main predictor of mathematics achievement in the entrance exam. The results also suggested that non-productive coping (emotion-focused coping) as opposed to problem-focused coping was negatively correlated (Critical Ratio = -17.117, $p < .01$) with anxiety and positively associated with performance on the entrance exam. This indicates that emotional coping style was successfully used by the students to help them reduce their anxiety during the entrance exam and subsequently affected their mathematics achievement.

In addition, Lavasani and Khandan (2011) examined the effects of cooperative learning on mathematics anxiety and the help seeking behavior (e.g., willingness of student to ask for or seek help). 40 female Iranian freshmen students from two Karaj public high schools were divided evenly into a control group and an experimental group. Students in the control group were taught using traditional teaching method while students in the experimental group were taught using the cooperative learning method. They used a mathematics anxiety scale and a questionnaire on help seeking behavior for data gathering. Their findings indicated that cooperative learning method significantly decreased mathematics anxiety but also increases help seeking behavior. These results suggested that students who participated in the experimental group and were taught using the cooperative learning method had lower level of mathematics anxiety compared to the students in the control group who were taught using the conventional method. Using a pretest-posttest, control group quasi-experimental research design, Emmanuel, Ngozi, and Anayochi (2013) investigated the effects of rational emotive behavior therapy and emotional intelligence technique on the mathematics anxiety of 60 participants purposely selected from three random secondary schools in Owerri Municipal, Nigeria. Participants in the two experimental groups received an eight-week training on rationale emotive behavior therapy and emotional intelligence technique while participants in the control group did not receive any training. They used the Fennema-Sherman Mathematics Attitudes Scale to collect data from the two experimental groups as well as the control group. The results of the study showed that students in the two experimental groups were able to manage their anxiety as a result of the two treatments.

Furthermore, Griggs, Rimm-Kaufman, Merritt, and Patton (2013) examined the contributions of anxiety in math and science as well as the Responsive Classroom approach (e.g., a social and emotional learning intervention) to math and science self-efficacy among fifth graders. During a 3-year randomized control trial, using the Student Beliefs about Mathematics survey, the Patterns of Adaptive Learning Scales, the Self-Efficacy and Anxiety Questionnaire, the Classroom Practices Teacher Survey, and the Classroom Practices Frequency Survey, they collected data from 76 fifth grade math teachers and their 1,561 students from a large ethnically and socioeconomically diverse school district in a mid-Atlantic state. The participants in the study were divided into a control group and an intervention group. 40 teachers and 797 students participated in the intervention group and were subsequently exposed to the Responsive Classroom approach. The 36 teachers and 764 students who made up the control group did not get exposed to any training. The analysis of the data revealed that students who reported having high level of anxiety towards math and science also reported having fewer efficacies towards these subjects. In addition, the results suggested that students who reported experiencing greater level of math and science anxiety were less likely to experience inefficacy in these subjects when they were exposed to a social and emotional learning intervention.

The literature reviewed through this present group of studies demonstrates many strategies to help reduce and/or eliminate math anxiety. From participating in mathematics methods courses to changing classroom's instructional methods, these strategies have been shown to help students alleviate the constant pressure exerted by their fear of math.

Theoretical Perspective of Self-Efficacy

This section offered a theoretical perspective of self-efficacy by outlining the difference between self-efficacy and other concepts and by pointing out the opposing views of critics. In addition, the origin of self-efficacy was discussed and the behavioral contributions associated with self-efficacy were explored. The section was concluded with an exploration of positive and negative related research in sport, health, employment, parenting, computer technology, and leadership in order to demonstrate the impacts of self-efficacy in so many aspects of life.

Historical Perspective of Self-Efficacy

Self-efficacy is historically often confused with the notions of self-confidence which is a person having the confidence that she can do something and self-esteem which is a person's view of her own self-worth. Self-efficacy has a thirty-six-year long and disputed history. While countless researches including in the field of education, health care, leadership, and sports have spawned out of the development of the concept, self-efficacy has also been the subject of criticism. Some critics believed that the impacts of other variables like the environment, biological or hormonal processes, and innate genetic differences are overlooked in favor of the influence of self-efficacy (Flamand, 2012).

According to Pajares (2002), self-efficacy theory found its roots in a theory of social learning and imitation that was first proposed by Miller and Dollard in 1941 to reject the behaviorist notions of associationism (i.e., association is responsible for all mental activity) in favor of drive reduction principles (i.e., physiological need occurs that creates a state of tension which in turn motivates you to reduce the tension or satisfy the need). This theory was consistent with the leading contemporary behaviorist view that

human behavior could be explained by conditioning and reinforcement. Later in 1963, social learning theory was expanded by the addition of observational learning and vicarious reinforcement by Bandura and Walters (Pajares, 2002). In1977, Bandura and Adams conducted two experimental tests of the treatment of phobic individuals (e.g., fear of snakes) with mastery modeling techniques. The first study investigated whether desensitization changes behavior through its intervening effects on efficacy expectations. They found that desensitization treatment produced differential increases in self-efficacy. The second study investigated the process of efficacy and behavioral change during the course of treatment. They found that self-efficacy was a significant predictor of amount of behavioral improvement phobics gained from partial mastery of threats at different phases of treatment. Using the results on the adult snake phobia studies, in 1977, Bandura published his seminal work titled, "Self-efficacy: Toward a unifying theory of behavioral change".

Since then, the literature has been fairly consistent on the definition of self-efficacy. The term 'perceived self-efficacy' has at times been substituted in the literature in the place of self-efficacy (Bandura, 1982; 2002). According to Zulkosky (2009), "Self is the identity of a person while efficacy is defined as the power to produce an effect. . . . The combination of these meanings implies a conscious awareness of one's ability to be effective and to control actions" (p. 96). Moreover, according to Tschannen-Moran and Hoy (2001), an efficacy belief is a judgment that a person makes about his or her abilities to bring about desired outcomes especially in difficult situations, which for teachers might pertain to student engagement and learning, even among those students who may be difficult and unmotivated. These definitions show that people's self-efficacy do not

cover every challenge or task they encounter. Their self-efficacy only manifests itself in specific situations. For instance, a math teacher may be more comfortable teaching algebra as opposed to geometry.

Conceptual Perspective of Self-Efficacy

Self-belief is a major component in highly efficacious people. According to Bandura (1982), accomplished performances required more than knowledge, transformational operations, and component skills. In addition to knowledge and skills set, successful performances also require individuals to have a firm belief that they have the capability to execute the action. On the other hand, self-belief without abilities or efforts is also useless. Moreover, according to Bandura (1977), outcome expectancy is one's calculation that a given behavior will produce certain results. For instance, a boxer may spar with a left-handed partner in anticipation of fighting a southpaw (i.e., left-handed boxer) in order to be better prepared. Conversely, efficacy expectancy is the conviction that one can competently implement the essential behavior to produce the desired outcomes. Efficacy expectancy is the level of confidence people have in their ability to do a task. Outcome expectancy and efficacy expectancy are different because people may have high expectancies that certain actions could lead to positive outcomes, however if they feel any doubts about their performance they may not even attempt the actions (Bandura, 1977). On the other hand, people with high efficacy expectancy are more likely to attempt the actions. Successful actions will likely increase the efficacy expectancy. However, unsuccessful actions, mainly repeated failures will lower efficacy expectancy (Bandura, 1977). Furthermore, according to Bandura (1977), efficacy expectations differ in magnitude, generality, and strength. Magnitude refers to the level

of task difficulty people believe they can accomplish. Generality refers to the extent the expectation is widespread across situations. Finally, strength refers to the level of perseverance in coping efforts despite negative setbacks.

Self-efficacy affects the choice of activities and situations in which people engage (Bandura, 1977). For example, people without any martial arts background will more likely avoid entering a mixed martial arts competition because they know they could seriously put themselves in danger. On the other hand, people will engage gladly on behaviors in which they are confident to succeed (Bandura, 1977). Self-efficacy affects also the amount of effort and persistence people expend in completing behaviors (Bandura, 1977). Faced with tough situations, people with a lowered sense of self-efficacy are less likely to put up much effort and are more likely to withdraw from the situations. Conversely, people with a high sense of self-efficacy are more likely to do whatever possible to find desired outcomes (Bandura, 1977).

In a review of the literature on the diverse ways perceived self-efficacy contributes to cognitive development and functioning, Bandura (1993) used the findings from his previous studies and other studies on perceived self-efficacy to report that self-efficacy is connected with people's thought processes and emotional reactions to actual and anticipated behaviors. For instance, highly efficacious people attribute their failures to a lack of effort while low efficacious people blame their failures on their lack of ability. Likewise, people who believe they do not have the right coping mechanism for certain challenging situations are more likely to respond with anxiety and worries (Bandura, 1993). People with a high sense of self-efficacy are more likely to participate in more difficult behaviors while demonstrating greater attachment and determination in

succeeding at their duties. On the other hand, people with a low sense of self-efficacy tend to shy away from tough situations, give up easily at any sign of difficulty, or pick uncomplicated tasks they know they can achieve which is associated to a lack of ability and higher levels of anxiety (Bandura, 1977).

Practical Applications of Self-Efficacy Theory

In addition to cognitive development and functioning as illustrated by Bandura (1993), the literature reviewed has shown that self-efficacy has also been associated with an array of psychological contexts (Hagen, 1998). Indeed, researchers have launched numerous practical research studies in self-efficacy. A review of these studies will be broken down categorically as self-efficacy and sport, self-efficacy and health, self-efficacy and employment, self-efficacy and parenting, self-efficacy and computer technology, and self-efficacy and leadership.

Self-efficacy and sport. In the sport environment, self-efficacy theory has been applied to athletes' performance (Moritz, Feltz, Fahrbach, & Diane, 2000; Ortega, Olmedilla, Sainz de Baranda, & Gomez, 2009), decision making (Hepler & Feltz, 2012) and stress management (Nwankwo & Onyishi, 2012). These studies revealed that athletes with high levels of self-efficacy are more likely to perform better at their respective sports and develop better strategies to cope with sport stress. Moritz, Feltz, Fahrbach, and Mack (2000) conducted a meta-analysis of 45 research studies. In addition to the participants' mean age being over 15 years in every selected study, "each study had to: (a) provide a measure of self-efficacy, (b) provide a measure of performance, (c) provide a correlation between self-efficacy and performance, and (d) be related to sport rather than exercise or physical activity" (p. 282). The purpose of the meta-analysis was to

examine the relationship between self-efficacy and performance in sport. Moritz et al. found that 38% of sport performance was associated with self-efficacy. In addition, their findings revealed a higher correlation (r = .43) between self-efficacy and performance for those studies that used a task-specific measure (i.e., assessing a three-point shooter's skills in the NBA based on the number of three-point shots he makes during a game as a performance measure) of self-efficacy and assessed performance in the same manner. This means that 43% of sport performance that used task specific measure was connected with self-efficacy. Their findings also revealed a lower correlation (r = .26) between self-efficacy and performance for those studies that used a general measure (i.e., assessing a Formula 1 race car driver's dexterity at avoiding collisions based on his wins and losses in the chase for the championship as a performance measure) of self-efficacy and assessed performance in a specific manner. This means that 26% of sport performance that used a general measure was connected with self-efficacy. They also found larger correlations in studies that assessed self-efficacy after performance (r = .39) compared with studies that assessed self-efficacy before performance (r = .36). According to Feltz (as cited in Moritz et al., 2000), these findings suggest that because of the experience associated with performance over time, performance becomes a stronger predictor of self-efficacy. Similarly in their study of 187 basketball players (age < 16), Ortega, Olmedilla, Sainz de Baranda, and Gomez (2009) found that unlike players with low self-efficacy, players with high self-efficacy worked harder, welcomed competition, and bounced back rapidly from setbacks while maintaining a high level of performance.

Hepler and Feltz (2012) examined the role of taking the first option (TTF heuristic) and self-efficacy in decision making on a simulated sports task. Using a

demographic questionnaire, a basketball knowledge test, a decision-making self-efficacy questionnaire, a rating of confidence in final decision making questionnaire, and 26 video clips depicting various basketball situations (13 trials in each of two video-based basketball decision tasks), they collected data from 72 undergraduate and graduate students (34 males, 38 females) between the ages of 18 and 30 who had one year of basketball playing experience. They found that people use the heuristic (problem solving by experimental and especially trial-and-error) the majority of the time (72.3%) when making decision in dynamic, time-pressure situations in sport. The results also suggested that highly self-efficacious people take the first option in decision making more frequently and generated fewer options than those with low self-efficacy. Indicating that people with high self-efficacy beliefs have high confidence in their first options and do not have any reason to second guess themselves.

Another aspect of self-efficacy and sport is its influence on athletes coping with sport stress. Nwankwo and Onyishi (2012) examined the role of self-efficacy, gender, and category of athletes in coping with sports stress among amateur athletes. Using data collected from 236 amateur athletes (133 males, 103 females) from secondary high schools in Enugu, South East Nigeria, they found that self-efficacy was a significant factor in coping with sports stress. Sports stress is defined as "any kind of threat or pressure experienced by an athlete as a result of competition, training, pain, illness, injuries, and conflicts with coaches and colleagues" (p. 94). The results of the study showed that athletes with low self-efficacy had the lowest use of adaptive coping strategies (positive and constructive techniques used to handle a difficult challenge), while athletes with high self-efficacy used more adaptive coping strategies regardless of

their gender. This set of studies suggests that self-efficacy is positively correlated with sport performance and is an important component in coping with sports stress. The literature reviewed through these studies has shown that highly self-efficacious athletes tend to have better sport performance and are also better equipped to deal with sport related stresses.

Self-efficacy and health. Self-efficacy also has been shown to have an effect on dieting (Eunseok et al., 2014; Rimal & Moon, 2009), smoking (Berndt, Verboon, Hayes, & Bolman, 2013), and condom usage (French & Holland, 2013). Rimal and Moon (2009) conducted a study of 3,458 randomly selected U.S. households on the causal relationship between dietary knowledge and behavior by including self-efficacy. Their study revealed that self-efficacy, which manifests itself through a person reading nutritional labels, changing his/her diet to reduce the risk of diseases, and exercising three times a week to prevent health problems before feeling the symptoms, mediated the effects of dietary knowledge on dietary or healthy behavior for fresh fruits, fresh vegetables, fat, and cholesterol. This suggests that highly self-efficacious people are more likely to eat healthier if they know what kind of food is good for them. Likewise, using a cross sectional study design, Eunseok et al. (2014) examined the relationships among health literacy (individual's capability to obtain and understand health information to make appropriate health-related decisions), self-efficacy, food label use, and dietary quality in 106 young adults aged 18 through 29 living in the metropolitan Atlanta area. They found that self-efficacy and health literacy significantly predicted the use of food labels which subsequently predicted dietary quality. This suggests that highly self-efficacious people

who are capable to acquire the knowledge and make informed decisions about their health are more inclined to read food labels which can lead them to an improved diet.

Moreover, in a study conducted on 244 cardiac patients who smoked prior to their admission to a Dutch Hospital, Berndt et al. (2013) reported that self-efficacy was significantly negatively related to craving experiences and levels of depression. This means that highly inefficacious patients were more likely to be depressed and in constant need to smoke. In addition, the study disclosed a significant positive association between self-efficacy at admission and smoking-abstinence measures after 6 months. Overall, the study concluded that self-efficacy mediated the effect of craving on smoking abstinence on low to -moderately anxious patients.

Furthermore, using 259 heterosexual undergraduate students taking introductory psychology courses at a southern California university, French and Holland (2013) conducted a study that examined whether condom use self-efficacy (i.e., one's beliefs about one's capability to exert control over one's behavior in using condom) predicted the use of condom negotiation strategies. They found that condom use self-efficacy was a significant positive predictor of refusing to have sex without a condom, directly asking a partner to use a condom, and introducing a condom after arousing his or her partner. Condom use self-efficacy also predicts expressing concern for a partner or a relationship as a reason for using a condom and using the risks associated with sexually transmitted diseases to convince a partner to use a condom. In addition, highly self-efficacious condom users were more likely to refuse to have sex without a condom and to ask a partner to use a condom for sex. Also highly self-efficacious condom users tend to introduce a condom after arousing his or her partner and tend to express concern for a

partner or a relationship as a reason for using a condom. A review of the literature through these studies has suggested that highly self-efficacious individuals tend to make better decision in term of the type of food they eat, are more likely to abstain from smoking when they crave for cigarettes, and are more inclined to use a condom with their partners.

Self-efficacy and employment. Self-efficacy is also associated with job search behaviors (Fort, Jacquet, & Leroy, 2011; Moynihan, Roehling, LePine, & Boswell, 2003; Rusu, Chiriac, Salagean, and Hojbota, 2013) and workplace performance (Lai & Chen, 2012; Lunenberg, 2011; Judge, Shaw, Jackson, Scott, & Rich, 2007). Using information gathered from 187 graduating college job seekers from a major northeastern university, Moynihan et al. (2003) examined the relationship between job search self-efficacy beliefs (an individual's belief that he or she is capable of performing behaviors requisite for obtaining a desired employment outcome), number of job interviews participated in, and job search outcomes. The analysis of the data in the longitudinal study design revealed that highly efficacious people who were looking for jobs received more interviews and more offers compared to less efficacious people. Moreover, the relationship between number of interviews and number of offers received was a much stronger relationship among job seekers with high job search self-efficacy compared to those with low job search self-efficacy. This relationship indicates that job seekers with a high level of self-efficacy transformed interviews into job offers more than job seekers with a low self-efficacy. Similarly, Fort et al. (2011) conducted a study in Marseille, France to investigate the relationship between job search self-efficacy, employment goals, job search planning, job search behaviors, and effort allocated to job search. They collected

data from 54 men, 44 women, and two participants who did not provide their gender. Ages of the participants were ranged from 16 to 61 years, and education level from 6 to 20 years. The study revealed that the precision of the employment goals did not mediate the path between self-efficacy, job search planning, job search behavior, and effort allocated to job search. This suggests that regardless of the sort of jobs (e.g., type of contract, full- or part-time job, and geographical area) they were looking for, highly self-efficacious job seekers had the same intensity in planning, searching, and in their effort to find jobs. However, job search self-efficacy significantly predicted planning behaviors and job search behaviors, but did not predict effort devoted to job search. In addition, Rusu, Chiriac, Salagean, and Hojbota (2013) investigated the direct and indirect relationship between unemployment and anxiety symptoms (gastrointestinal, cardiac problems, and depression) through job search self-efficacy. Using, the Trimodal Anxiety Questionnaire and a Job Search Self-Efficacy subscale, they collected data from 30 participants who lost their job from the same employing organization during a two wave (beginning of the study and after three months) longitudinal study. They found that the anxiety level was higher in participants who were still looking for a job after three months compared to the ones who were reemployed. In addition, the results revealed that participants who were reemployed reported higher levels of job search self-efficacy compared to those who were still unemployed after three months. They also found a significant negative association between job search self-efficacy and anxiety at the beginning and three months into the study. Suggesting that, job seekers who were highly self-efficacious had less anxiety symptoms at any time during the study compare to job seekers with a low self-efficacy. Finally, the data analysis showed that job search self-

efficacy was a mediator in the relationship between employment status and anxiety symptoms. Suggesting that, job seekers whose self-efficacy decreases as a result of not being able to find employment over an expanded period of time were more susceptible to a decline in their mental or physical health.

It appears that self-efficacy also affects workplace performance. Lai and Chen (2012) conducted a study of 616 conveniently sampled automobile sales persons of Taipei, Taiwan to find the effect of personal characteristics such as self-efficacy, effort, job performance, job satisfaction, and turnover intention on organization performance. They collected data through questionnaires from 515 men and 101 women with 78.40% of them age ranged between 36 to 50 years; 60% of them have been in the job for at least six years and 68% were married. Their analysis of the data suggested that self-efficacy as well as effort had a positive effect on job performance (path coefficient = .65) and job satisfaction (path coefficient = .47). Path coefficients are the numerical estimates of the causal relationships between two variables in a path analysis. The statistical results imply that highly self-efficacious employees are likely to set higher standards for themselves and not only be satisfied with their jobs but also perform better at their jobs. The study also determined that employees who put the effort in doing their job tend to be satisfied with their job and also have better job performance. The data indicated that job satisfaction (path coefficient = -.24) and job performance (path coefficient = -. 08) have a negative effect on turnover intention, suggesting that employees who were satisfied with their job and who perform well at their job did not tend to quit the job.

Prior to the Lai and Chen, Judge et al. (2007) conducted a meta-analysis to estimate the unique contribution of self-efficacy to work-related performance. According

to the researchers, the studies chosen for the meta-analysis followed the following criteria: (a) only studies that reported task- or job-specific self-efficacy (as opposed to generalized self-efficacy), (b) self-efficacy was the predictor variable (as opposed to a criterion variable), and (d) only studies that examined the relationship between self-efficacy and behaviors that that were plausibly related to tasks performed in organizational settings were included (p. 110). The findings revealed that self-efficacy was a significant predictor of performance for task but not overall job performance. Specifically, the results showed that the correlation between self-efficacy and job performance was much stronger when the job or task was low (vs. high) in complexity. This recent group of studies of the effects of self-efficacy on job search behavior suggests that highly self-efficacious individuals are more effective job seekers and are more likely to perform better at their job.

Self-efficacy and parenting. Self-efficacy has also been connected with parenting aspects (Dumka, Gonzales, Wheeler, & Millsap, 2010; Gilmore & Cuskelly, 2012; Meyer, Jain, & Canfield-Davis, 2011; Secer, Gulay Ogelman, Onder, & Berengi, 2012; Sevigny & Loutzenhiser, 2010). Secer et al. (2012) investigated the effects of self-efficacy perception of mothers' towards parenting on the peer relations of 200 children (96 girls, 104 boys) aged between 5 and 6 and their parents in Merkez district of Aksaray Province, Turkey. They collect data from the Ladd and Profilet Child Behavior Scale, the Peer Victimization Scale, the Parenting Sense of Competence Scale-Mother Form. The results of the data analysis revealed that there was an insignificant relation between self-efficacy perception of mothers prosocial and asocial behavior levels of children. Indicating that children positive behaviors such as helping, caring, volunteering, and their

negative behaviors such as being inconsiderate and selfish were not influenced by the self-efficacy perception of their mothers. However, the findings showed a low-level negative significant relation between the self-efficacy of mothers and aggression (r = -.23, p < .01), exclusion (r = -.14, p < .001), fearful-anxiety (r = -.20, p < .001), hyperactivity (r = -.25, p < .001), and peer victimization (r = -.24, p < .001) levels of children. Suggesting that, as the self-efficacy perception scores of mothers increased, the aggression, exclusion, fearful-anxiety, hyperactivity, and peer victimization levels of children decreased. Conversely, as the self-efficacy perception scores of the mothers decreased, the aggression, exclusion, fearful-anxiety, hyperactivity, and peer victimization levels of children increased.

Gilmore and Cuskelly (2012) examined the continuities and changes in parenting sense of competence in 25 mothers of children (15 girls and 10 boys) with Down syndrome from early childhood (4-6 years) to adolescence (11-15 years) over an eight-year period in Brisbane, Australia. They use the Parenting Sense of Competence Scale and the Child Personality Scale to gather the data. The findings suggested that the level of feeling of self-efficacy and satisfaction of being a parent does not get diminish as a result of raising children with Down syndrome during the early childhood and adolescent periods.

Meyer et al. (2011) conducted a study about the impact of a parenthood education program on self-efficacy and parent effectiveness. Eighty-two students in Grades 7 through 12 from an alternative school located in a northwest state were divided into an experimental group (n = 39) and a control group (n = 43) where participants concluded a 16-session parenthood education program. The analysis of the data collected through two

surveys, which included a self-efficacy scale divided into general-efficacy and social self-efficacy subscales and a parent effectiveness measure, indicated mixed results. A two-way ANOVA analyses conducted to evaluate the effects of a participant group and identified attributes (i.e., grade, age, gender, gender of primary caregiver, and number of parents in the household) on general self-efficacy revealed a statistical significance in the difference between the experimental and control group when averaged across the primary caregiver levels (male, female), $F(1, 78) = 5.51$, $p < .05$, partial $\eta^2 = .07$. This suggests that the general self-efficacy of participants in the experimental group improved depending on the gender of their primary care giver. Similarly, a two-way ANOVA analyses on social self-efficacy indicated two main effects. First, it shows that the social self-efficacy of participants in the experimental group also improved based on the gender of the primary care giver, $F(1, 78) = 11.24$, $p < .001$, partial $\eta^2 = .13$. In addition, it shows that the level of social self-efficacy of participants in the experimental group tends to increase based on the number of parents in the household (i.e., 1, 2, or none), $F(2, 76) = 3.51$, $p < .05$, partial $\eta^2 = .08$. This statistical result implies that the level of social self-efficacy of participants in the experimental group who grew up without a full family (mother and father) was more likely to be lower than participants who had the support of a full family. Finally, there was no significant difference in the parent effectiveness means of the two groups. This means that students who participated in the parenthood program acquired new skills (e.g., parenting, child development, goal setting) that led to an increase in their general self-efficacy as well as their social self-efficacy while students in the control group tended to incorrectly rate themselves as effective parents based on their naïve and limited knowledge of parenthood (Meyer et al., 2011).

Sevigny and Loutzenhiser (2010) investigated the role that parenting self-efficacy plays in psychological child adjustment in 62 cohabitating couples in Canada whose first born child was between 18-36 months. They collected data using the Self-Efficacy for Parenting Task Index-Toddler Scale, the General Self-efficacy Scale, the Beck Depression Inventory-II, the Parenting Daily Hassles Inventory, the Infant Characteristics Questionnaire, the Dyadic Adjustment Scale, and the Family Assessment Device. They found that relational functioning (marital satisfaction and family functioning) was an important predictor of parental self-efficacy for fathers as well as for mothers. In addition, the results suggested that parenting stress was the strongest predictor of fathers' parental self-efficacy. According to Sevigny and Loutzenhiser, for men the challenges of their workplace and the burden of their young families could be blamed for elevated stress level. Moreover, general self-efficacy was found to be an important predictor of mothers' parental self-efficacy. Sevigny and Loutzenhiser hypothesized since much of mothers' time was spent engaged in childcare, their general self-efficacy (broad sense of personal competence) would more closely relate to their parental self-efficacy. However, they were wrong. A further analysis showed that when controlling for hours worked outside the home, there was still a significant positive relationship between general self-efficacy and parental self-efficacy for mothers ($r = .35$, $p < .05$). Indicating that, perceptions of efficacy differ for mothers and fathers and further researches need to be done to have a better understanding of the differing relationship between general self-efficacy and parental self-efficacy in fathers and mothers (Sevigny & Loutzenhiser, 2010).

Dumka et al. (2010) used a longitudinal design to evaluate parental self-efficacy's causal and reciprocal relations with parenting practices to predict Mexican American adolescents' conduct problems. They used the Multicultural Inventory of Parenting Self-Efficacy and other measurement tools to collect data from teachers, mothers, and adolescents in 189 Mexican American families living in the southwest United States. The findings indicated that parenting self-efficacy was a predictor of future positive control practices (monitoring and consistent disciplines). Suggesting that, highly self-efficacious parents tend to create a cooperative environment that supports their children's good behaviors and cultural values. In addition, parental self-efficacy showed direct effects on decreased adolescent conduct problems. According to Dumka et al. (2010), this indicated that highly self-efficacious parents tend to develop confidence in their abilities which in turn may lead to better outcomes including decreased conduct problems in their children. Implying that, low self-efficacious Mexican American parents should focus on strategies to help increase their parenting self-efficacy if they want to prevent their children conduct problems.

A review of the literature through these studies has indicated that self-efficacy is a predictor of parental self-efficacy and parental self-efficacy can enhance children's social competence, aggression, and conduct problems.

Self-efficacy and computer technology. Nowadays, computers are an integral part of our lives. The following studies reveal that self-efficacy has been shown to have a connection to computer technology (Hsiao, Tu, & Chung, 2012; Shu, Tu, & Wang, 2011; Simsek, 2011). Simsek (2011) examined the relationship between computer anxiety and computer self-efficacy of 722 students and 123 teachers in elementary and secondary

schools in Turkey. He found that the overall correlation coefficient between computer anxiety and computer self-efficacy was negative and significant (r = -0.52; p < .01), which implies that people who have lower levels of computer self-efficacy tend to manifest higher levels of computer anxiety and vice versa. Meanwhile, Shu et al. (2011) analyzed the impact of computer self-efficacy and technology dependence on computer-related techno-stress among employees who use computer technology routinely in their work (i.e., IT professionals and general end-users). According to Well and Rosen (as cited in Shu et al., 2011), techno-stress is the "negative impact on attitude, thoughts, behaviors, or body physiology that is caused either directly or indirectly by technology" (p. 923). Shu et al. (2011) randomly surveyed 289 employees from 22 organizations. One hundred seventy nine were male and 110 were female; 251 were younger than 35 years of age; 224 had earned at least a bachelor's degree, and 43 had completed graduate-level education. The analysis of the data reported a negative relationship between techno-stress and computer self-efficacy (r = – .169, p < .05, path coefficient = - 0.37), which according to Shu et al. (2011) indicates that "employees with higher computer self-efficacy may perceive lower techno-stress, that is, computer self-efficacy can reduce techno-stress to some extent" (p. 933). They also found that computer self-efficacy had a significant negative relationship with techno-complexity (i.e., techno-stress caused by the inability to deal with the complexity of technology) and techno-insecurity (i.e., techno-stress caused by technology induced job insecurity). However, there was no significant relationship between computer self-efficacy and the other components of techno-stress: techno-overload (i.e., techno-stress caused by information overload), techno-invasion

(i.e., techno-stress caused by technology invading personal life), and techno-uncertainty (i.e., techno-stress caused by the uncertainty of technology).

More recently, Hsiao et al. (2012) studied the function of social supports (i.e., perceived family support and perceived peer support) and computer self-efficacy in predicting the effects of computer use for high school students. Using survey data collected from 525 high school students in Taiwan, the study reported that perceived family support (i.e., my parents encourage me to use computers) had significant and positive correlation with general computer self-efficacy (i.e., basic computer and Internet skills; $r = .19$, $p < .01$) and advanced computer self-efficacy (i.e., troubleshooting computer problems; $r = .27$, $p < .01$). This suggests that parents who thought computers were important, influenced their children's abilities to use and develop more complex and effective computer skills. In addition, perceived peer support (i.e., my friends are interested in computers) was significantly and positively correlated with general computer self-efficacy ($r = .33$, $p < .01$) and advanced computer self-efficacy ($r = .36$, $p = .01$). Likewise, this suggests that friends who enjoy doing things with computers also influenced their peers' abilities to use and develop more complex and effective computer skills. Finally, general computer self-efficacy mediated perceived family support and computer use and also peer support and computer use. This means that family and friends who have the knowledge of basic computer skills were more likely to support other family members and friends to use computers. The literature reviewed has shown that people who have a high level of computer self-efficacy tend to be more confident about using computers. They are more likely to deal with the complexity surrounding computer technology and are confident in their ability to do their computer related jobs. In addition,

people who have a high level of computer self-efficacy are more likely to encourage their friends and family to engage in the use of computers.

Self-efficacy and leadership. Self-efficacy has also been shown to have a connection with leadership (Çalik, Sezgin, Kavgaci, & Kilinç, 2012; Paglis, 2010; Yueru, Weibo, Ribbens, & Juanmei, 2013). Yueru et al. (2013) examined whether knowledge sharing (i.e., personal experience, job-related documents, and know-how) and self-efficacy mediate the influence of ethical leadership (i.e., integrity, honesty, caring, openness, and justice) on employee creativity (i.e., generation, promotion, and implementation of novel and useful ideas about products). Using appropriate knowledge sharing, ethical leadership, self-efficacy, and employee creativity scales, they collected data from 309 employees (110 men and 199 women) from four Chinese companies in Changsha, Zhuzhou, Xiangtan, and Chenzhou. They found a significant positive relationship between ethical leadership and employee creativity ($r = .40$, $p < .01$). This suggests that honest and just leaders tend to inspire their followers. They also found that ethical leadership is significantly related to knowledge sharing and positively related to employee self-efficacy. According to Yueru et al., the findings suggested that employers who want to increase employee creativity should put more resources in enhancing ethical leadership by promoting activities and behaviors that focus on knowledge sharing and self-efficacy.

Çalik et al. (2012) examined the relationship between school principals' instructional leadership behaviors and self-efficacy of teachers and collective teacher efficacy. They used the Instructional Leadership Scale, the Teachers' Sense of Efficacy Scale, and the Collective Efficacy Scale to collect data from 328 classrooms and branch

teachers (215 females, 113 males) in primary schools in Ankara, Turkey. The data analysis revealed that instructional leadership had a significant direct and positive impact on collective teacher efficacy and a positive and significant effect on teachers' self-efficacy. Suggesting that, principals with high expectations, clear visions, and the behaviors of instructional leaders positively influenced collective teacher efficacy as well as individual teacher efficacy. Finally, the results suggested that instructional leadership affected the collective efficacy indirectly through teachers' self-efficacy. This indicates that, teacher perception about their own efficacy increases when principals demonstrate behaviors of instructional leaders. According to Çalik et al. (2012), as the number of efficacious teachers increased, their collective efficacy also grew stronger.

Supportively, in a review of the literature to examine self-efficacy's role in leadership, Paglis (2010) found several connections. He reported the following relationships:

1. Leadership self-efficacy (i.e., a leader's confidence judgment in his or her ability to effectively carry out the behaviors that comprise the leadership behavior) has been positively associated with both leaders' individual performance and their followers' collective efficacy and performance.
2. Anderson et al. found that leadership self-efficacy (LSE) was positively related to leadership effectiveness.
3. Watson et al. found that LSE was positively related to the collective efficacy of college basketball teams.
4. LSE could also be used as a mediator. For instance, according to Hendricks and Payne (as cited in Paglis, 2010), "LSE partially mediated the relationship between

individuals' learning goal orientation and their motivation to lead" (p. 775). This suggests that without individuals' leadership behavior, people would not be motivated to set goals and to lead.

The literature reviewed through these studies has shown that leadership self-efficacy is an essential antecedent to leadership behavior and performance in the leaders as well as their team of followers.

Negative Aspects of Self-Efficacy

The literature reviewed has shown that high levels of self-efficacy are usually associated with positive outcomes. However, there are situations in which high self-efficacy generates negative outcomes (Moores & Chang, 2009; Nease, Mudgett, & Quinones, 1999; Pillai, Goldsmith, & Giebelhausen, 2011; Vancouver, Thompson, Tichsner, & Putka, 2002; Whyte & Saks, 2007). Pillai et al. (2011) investigated the negative moderating effect of general self-efficacy on the relationship between need for cognition (i.e., the tendency for people to vary in the extent to which they engage in and enjoy effortful cognitive activities) and cognitive effort (i.e., consciously or intentionally engaging cognitive resources in order to achieve a particular end). Using measurement tools such as a need for cognition scale, a general self-efficacy scale, and a thought-listing task, they collected data from 144 undergraduate students (53 men, 91 women) who were attending a business course. They found that general self-efficacy moderates the relationship between need for cognition and cognitive effort. These results suggested that, as the level of competence of individuals who were consistently engaged in and enjoying cognitive activities increased their reasoning effort also increased.

Nease et al. (1999) examined the relationship between self-efficacy and feedback acceptance over repeated trials of feedback. According to Ilgen et al. (as cited in Nease et al., 1999), feedback acceptance is defined as "the recipient's belief that the feedback is an accurate portrayal of his or her performance" (p. 808). Using a computer Naval Air Defense Simulation which required participants to make a decision about the appropriate action that should be taken for a variety of targets, Nease et al. collected data from 80 undergraduate psychology students (39 men, 41 women). The findings revealed that while feedback acceptance ratings of low self-efficacy participants did not change over the trials, highly self-efficacious participants had significantly lower acceptance ratings after three trials of negative feedback compared to one. This suggests that people with low self-efficacy will maintain their feedback acceptance regardless of the frequency of negative feedback they receive. On the other hand, people with high self-efficacy have the tendency to decrease their feedback acceptance after repeated negative feedback because "they become increasingly frustrated with the notion that their efforts are unsuccessful and may begin to doubt the accuracy of such information" (Nease et al., 1999, p. 811).

Whyte and Saks (2007) found that high self-efficacy was related to misuse of resources. They conducted two experiments to investigate whether perceptions of self-efficacy of petroleum geologists affected the decision to drill another well subsequent to the receipt of negative feedback. They surveyed 527 members of the Canadian Society of Petroleum Geologists in two simultaneous separate studies. Study 1 had 108 men, 4 women, and one person who did not provide his/her gender. Study 2 had 383 men, 29 women, and two others who did not provide their gender. Participants in both studies

were on average 45 years old and had about 20 years of full-time work experience. Using a within-subject design where all participants are exposed to every treatment or condition, the results in Study 1 showed that high self-efficacy geologists invested more resources in a failing venture than low self-efficacy geologists. This suggests that highly self-efficacious geologists were more likely to put more resources (time, money, and effort) in the search for oil than their low self-efficacy counterparts after having drilled one dry hole, two dry holes, three dry holes, and even four dry holes. This pattern was also present in Study 2, however it was much stronger in Study 1. The results in Study 1 also showed that self-efficacy did not moderate the effect of negative feedback on behavior in escalating situations. This suggests that the level of self-efficacy of the geologists did not influence their ability to withdraw from a project in response of negative feedback in the form of dry wells. However, using a between-subjects design where participants are part of the control group or the treatment group, in Study 2, the findings revealed that post-feedback self-efficacy was a mediator in the relationship between negative feedback and behavior in escalating situations. This suggests that self-efficacy "as a mediator variable, can be invoked to explain a significant amount of variance in the individual decision to withdraw from or escalate commitment to a failing project" (Whyte & Saks, 2007, p. 39).

In another study, Vancouver et al. (2002) showed that high self-efficacy does not always have positive implications for performance. Vancouver et al. used the Mastermind game to conduct two experiments to find out whether high self-efficacy negatively influences performance. According to Vancouver et al., the Mastermind game is "an analytical game in which participants try to arrange four colored squares (out of six

possible) in the correct order . . . The object of the game is to find the solution in as few rows as possible" (p. 507). They conducted two studies where in the first; they collected data from 87 undergraduates at a large, rural, midwestern university. They divided the participants into an experimental group (n = 46) induced to have high self-efficacy and a control group (n = 41). The results showed that a manipulation (i.e., reconfiguring the solution to match the participants' guess on the third row) designed to increase self-efficacy in the experimental group, increased self-efficacy but decreased performance in the next game. This suggests that an increase in self-efficacy may have given the participants a false sense of competence or a lack of concentration in an easy task that leads them to underperform. In the second study, Vancouver et al. (2002) used the same Mastermind game to collect data from 104 undergraduate students. All the participants in the second study received the self-efficacy manipulation. The results indicated that a higher level of self-efficacy led to overconfidence which increased the possibility of committing logic errors. This suggests that highly self-efficacious participants may become brash in their approach to solving problems after experiencing early success. The review of the literature has shown that highly self-efficacious individuals do not always handle negative criticism well. They may take longer to give up on a failing venture in order to reach their goals and may be susceptible to making mistakes because of their overconfidence.

Likewise, Moores and Chang (2009) investigated the relationship between self-efficacy and performance in a field study of 108 undergraduate students taking a core IS analysis and Design course. Using the data collected from two tests given approximately four weeks apart, they found that self-efficacy was positively related to performance and

that performance was positively and significantly related to subsequent self-efficacy. This is consistent to the findings of Khurdish et al. (2012) and Bates, Kim, and Latham (2011). However, the findings revealed that when individuals become overconfident in their abilities to perform a task, their overconfidence lead to a significant negative relationship between self-efficacy and subsequent performance. Suggesting that overconfidence could lead to carelessness.

Based on the literature reviewed in the preceding sections, self-efficacy could be defined as a strong belief an individual has in her ability to conduct herself in a particular manner in order to achieve a desired goal. The importance of self-efficacy in our practical lives is its effects on our ability to self-motivate and self-regulate by exerting control over our actions, our desires, and our behaviors. Self-efficacy affects the way we think and our physical and emotional states of arousal. Although a high level of self-efficacy tends to be associated with positive outcomes, there are possibilities that it could lead to overconfidence and detrimental behaviors.

Self-Efficacy and Teaching

This section first provided a review of the four sources of self-efficacy: performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. This review of the sources of efficacy expectations was followed by a review of the possible impacts of teacher self-efficacy (TSE) and the strategies that could be used to enhance it. This section concluded with an exploration of the effects of mathematics teaching efficacy on student achievement in mathematics.

Sources of Teacher Self-Efficacy

Bandura (1977) hypothesized four sources of efficacy expectations: mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal. Bandura, Blanchard, and Ritter (1969) conducted an experiment on snake-phobic subjects to find out the effects of desensitization and modeling approaches on behavioral, affective, and attitudinal changes. They collected data from 48 participants divided into four groups. Each group had twelve participants. The first group received deep relaxation followed by fake representations of snakes. The second group watched a 35-minute long film illustrating young children, adolescents, and adults increasingly interacting with a snake in a threatening manner. Participants in the third group received live modeling with guided participation. The fourth group did not receive any treatment. The analysis of the data collected from the four groups revealed that the attitudinal changes (i.e., level of decrease in avoidance behavior toward the snake) that took place in the three experimental groups were significantly different than the attitudinal changes if any that occurred in the non-treated control group. In addition, of the three experimental groups, treatment from the third group, which received modeling combined with guided participation, was found to be the best method to eliminate phobic behavior, extinguish fear arousal, and create favorable attitudes (Bandura et al., 1969). This suggests that self-efficacy in interacting with snakes was acquired through treatment in the form of modeling (vicarious experiences) combined with guided participation (personal mastery experiences).

Likewise, teachers can increase their self-efficacy through vicarious experiences and personal mastery experiences. Redmon (2007) examined whether a teacher

preparation program designed to provide pedagogical knowledge and authentic teaching experiences in the field can increase the self-efficacy of a cohort of approximately 50 elementary and 20 secondary preservice teachers. The analysis of data collected from a self-efficacy questionnaire three times during the program (pre-, mid-, post-course) showed an overall increase in preservice teachers' self-efficacy after they had completed coursework and field experiences. This suggests that preservice teachers may be able to gain self-efficacy by watching their professors modeling lessons and participating in student teaching through field work.

Teachers are also capable of improving their self-efficacy through verbal persuasion. Bandura (1977) believed that self-efficacy developed under verbal persuasion is not as strong as self-efficacy induced through mastery experiences. Participants in the second group who watched the 35-minute film in Bandura et al.'s 1969 experiment were not able to touch and handle snakes like participants in the third group who combined modeling with guided participation. However, they still showed a decrease in their avoidance behaviors. Likewise, Hagen et al. (1998) investigated whether vicarious experiences and verbal persuasion could be used to increase perceptions of teacher self-efficacy. They collected data from 89 undergraduate preservice teachers (14 males, 75 females) enrolled in an educational course at a midwestern state university who had not completed their student teaching. Using an experimental design, Hagen et al. (1998) divided the participants into an experimental group and a control group. The experimental group was shown a 33-minute behavior management video and the control group was shown a placebo video on societal discrimination against people with handicaps. The analysis of the data obtained from the preservice teachers showed that

participants in the experimental group had significantly higher levels of self-efficacy on both the management/discipline self-efficacy and personal teaching self-efficacy measures. This suggests that the exposure to regular education teachers working with difficult-to-teach students (i.e., verbal persuasion) may help preservice teachers develop their self-efficacy in behavior management techniques.

Emotional arousal, according to Bandura (1977), suggests that teachers should not avoid classroom situations that cause them stress but rather work to build a database on how to deal with different stressful situations. The more substantial the database becomes, the more teachers will be able to enjoy their work. Participants in the snake-phobic experiment who came to believe that they were no longer afraid of snakes after watching a fearless model handle a snake and then proceed personally to touch and handle the snake themselves were less susceptible to developing frightening thoughts the next time they encountered snakes (Bandura, 1977). On the other hand, Bandura wrote, "Avoidance of stressful activities impedes the development of coping skills, and the resulting lack of competency provides a realistic basis for fear" (p. 199). This suggests that if teachers fail to build these resources to draw strength from, they could develop anxiety about their own classroom environment and also a sense of inefficacy. In summary, the literature reviewed conveys the impression that performance accomplishments, vicarious experiences, verbal persuasion, and emotional arousal are the main antecedents to TSE (Bandura, 1977).

Impacts of Teacher Self-Efficacy

A review of the literature revealed considerable evidence that TSE has beneficial impacts on student outcomes (Holzberger, Philipp, & Kunter, 2013; Khan, 2011;

Mojavezi & Tamiz, 2012; Vartuli, 2005) and on teachers' beliefs and behaviors (Dibapile, 2012; Khurdish, Qasmi, & Ashraf, 2012; Skaalvik & Skaalvik, 2010; Viel-Ruma, Houchins, Jolivette, & Benson, 2010). Holzberger et al. (2013) examined whether there was a longitudinal reciprocal effect of teacher's self-efficacy and instructional quality from the end of one school year to the end of the next. They collected data from 155 German secondary mathematics teachers and 3,483 ninth graders at 2 measurement points. Holzberger et al. confirmed a positive correlation between TSE and their instructional qualities (cognitive activation, $r = .29$; classroom management, $r = .39$; and individual learning support, $r = .42$) but failed to find any long-term effects of TSE beliefs on instructional qualities or any long-term effects of instructional qualities on TSE.

While Holzberger et al. (2013) observed mixed findings, Khan (2011) was confident with his results. In 2011, Khan collected data from secondary level students in Wah Contonment, Pakistan to investigate the effect of teacher efficacy on academic achievement. The analysis of the data revealed that teachers with a high sense of self-efficacy were able to successfully teach the relevant subject content to even the most difficult students. Moreover, Khan found that highly efficacious teachers believed that over time they will get better in addressing their students' needs and that every student is reachable and teachable. In addition, Khan pointed out that teachers with a strong sense of personal efficacy believe that if they try hard enough, they know that they can exert positive influences on both the personal and academic development of their students. Finally, Khan believed that these teachers are convinced that when a student does better than usual, many times it is because the teacher exerted a little extra effort. On the other

hand, according to Ashton and Webb (as cited in Khan, 2011), "Teachers with a low sense of efficacy appeared to establish a pattern of strategies that heightened negative effects and promoted an expectation of failure for low-achieving students" (p. 8).

Likewise, in a study conducted to examine the influence of TSE on students' motivation and achievement, Mojavezi and Tamiz (2012) collected data from eight high school teachers and 150 senior high school students in four different cities in Iran. They found a reasonably positive correlation between TSE and student motivation (r = .446). In addition, a one-way ANOVA reported that TSE had an impact on students' achievement (F = 8.402, p = .001). Moreover, in a review of the research literature on teacher beliefs about their own abilities (Ashton, & Webb, 1986; Bandura, 1997; Hoover-Dempsey, Bassler, & Brissie, 1992; Tschannen-Moran, Woolfolk Hoy, & Wayne Hoy, 1998) and teacher beliefs about the nature of teaching and learning (McMullen, 1997; McMullen & Alat, 2002), Vartuli (2005) reported that highly efficacious teachers: (a) have positive effects on student outcomes (Ashton & Webb, 1986), use effective classroom practices (Ashton & Webb, 1986), and encourage family involvement (Hoover-Dempsey, Bassler, & Brissie, 1992); (b) help children develop greater self-esteem, motivation to learn, improved self-direction, and positive attitudes toward school (Bandura, 1997); and (c) are open to new ideas, are willing to experiment, have more enthusiasm, demonstrate a greater commitment to teach, and foster a classroom climate that is warm and supportive to students' needs. Furthermore, on teachers' beliefs about the nature of teaching and learning, Vartuli (2005) reported that highly efficacious teachers are consistently more in line with developmentally appropriate practice than self-reported practices and observed practices.

The impact of TSE on teachers was also explored in the following studies. In a review of the research literature on teacher efficacy and classroom management, based on the research of Ashman and Conway (1997) and Greenberg (2005), Dibapile (2012) reported that highly efficacious teachers motivate their students to learn and engage every student in learning. On the other hand, teachers with a low sense of self-efficacy do not use instructions that will promote cognitive learning. In addition, based on Brophy's (2006) work, Dibapile also established that although classroom management is a difficult issue to master, highly efficacious teachers are effective managers and student counselors. Furthermore, Viel-Ruma et al. (2010) examined the relationship between reported levels of TSE, collective efficacy, and job satisfaction in special educators. They collected data from 70 out of 100 randomly selected special education teachers in a school district near a major southeastern metropolitan area and found a significant relationship between job satisfaction and TSE and a significant relationship between TSE and collective efficacy but failed to identify a significant relationship between collective teacher efficacy and job satisfaction. This relationship indicates that job satisfaction of one teacher does not appear to correlate to the job satisfaction of a group of teachers and brings to light the difference between collective teacher efficacy and TSE.

Keeping with the subject of job, Khurdish et al. (2012) investigated the relationship between teachers' self-efficacy and their perceived job performance. Using data retrieved from 75 teachers and 225 male and female students from public schools in Rawalpindi and Islamabad, Pakistan, they found that teachers with a high sense of efficacy had better job performance than low efficacious teachers. Also, female teachers had higher self-efficacy and better job performance than their male counterparts. In

addition, Khurdish et al. (2012) pointed out that experienced teachers had higher self-efficacy than their less experienced colleagues. Finally, highly educated teachers had higher self-efficacy and better job performance than their less educated colleagues. Also, Skaalvik and Skaalvik (2010) conducted a study to investigate the relationship between teacher efficacy and teacher burnout. They gathered data from 2,249 elementary and middle school teachers from three regions in Norway. They established that emotional exhaustion (r = -.29) and depersonalization (i.e., feelings of detachment from self and the world; r = -.41) were negatively correlated to TSE. They argued that future research could reveal a possible causal relationship between teacher self-efficacy and teacher burnout.

The collective outcome of these studies revealed that TSE is the substantial belief teachers have in their abilities to implement behaviors necessary to the academic success of their students. In addition to influencing student academic achievement in the learning environment, TSE has the capacity to motivate teachers, increase their managerial ability in the classroom, and improve their job performance. TSE affects teachers' thought patterns and how they interact physically and emotionally with their students.

Strategies to Enhance Teacher Self-Efficacy

A review of the literature theorizes that TSE can be manipulated. Many studies have reported numerous intervention strategies to enhance teacher efficacy through such approaches as degree acquisition, mentoring, collaboration, peer coaching and extended professional development (Bruce & Ross, 2008; Cantrell & Hughes, 2008; Ebmeier, 2003; Kelm & McIntosh, 2012; Shidler, 2009; Umhoefer, Beyer, & Vargas, 2012; Williams, 2009; Yost, 2002). According to Williams (2009), the literature illustrated that

self-efficacy beliefs are most flexible in the preservice years and are more likely to be resistant to change in veteran teachers. Williams studied the effect of gaining a degree on teacher self-efficacy and emotion some years after 202 active primary school teachers (188 women, 14 men) in New Zealand had earned their initial teaching credentials. She noted that the acquisition of a degree is a tremendous personal achievement that empowers teachers' sense of efficacy. She characterized it as "a disruption of their pre-existing beliefs" (p. 607). She reasoned that teachers who went on to get degrees after years in the classroom tended to have a positive outlook about their teaching; they are likely to develop the confidence that they can achieve academically and in the process erase any prior doubts that they might have in their abilities. This interaction between knowledge and confidence is one of the keys to their personal sense of efficacy and their teaching efficacy (Williams, 2009).

Another strategy that can influence TSE is mentoring. Although mentees unquestionably benefit from their relationship with their mentors, Yost (2002) believed that mentoring increases the level of efficacy in mentors as well. In her study of a mentor program at a small midwestern university, Yost interviewed and observed four mentors and three mentees. The findings of her study suggested that teachers who were selected to serve as mentors by the district were proud of the fact that they were chosen among their peers. Their selection established the fact that they have the skills, the mindset, and the leadership of capable and successful classroom teachers. In addition, the mentors thought that having the responsibility to mold a less experienced colleague into an effective one required them to be dedicated to their craft and to have continuous growth (Yost, 2002).

Another sound method to strengthen TSE is working collaboratively with a more knowledgeable colleague. In a review of the research literature on improving the teaching efficacy of general physical education (GPE) teachers, Umhoefer et al. (2012) reported that GPE teachers could increase their self-efficacy to teach disabled and non-disabled students by collaboratively working (team-teaching) with adapted physical education (APE) instructors. APE instructors are well trained in modeling how to accommodate and modify activities to meet the needs of all students. When GPE teachers implement this highly effective educational practice, they increase their confidence in working with students with disabilities. This method not only allows GPE teachers to learn vicariously from the APE instructors, it also decreases their apprehension, anxiety, and doubts to teach students with disabilities and in the process increases their efficacy (Umhoefer et al., 2012). Umhoefer et al. added that fostering and promoting self-talk, which is a learning strategy that helps teachers think and focus on their performance, can also enhance GPE teachers' self-efficacy to teach students with disabilities.

According to Bruce and Ross (2008), equally important in enhancing teachers' sense of efficacy is an effective peer coaching program that combined the coaching process with content specific pedagogy training. Bruce and Ross examined the effects of peer coaching on mathematics teaching practices and teacher beliefs about their capacity to have an impact on student learning. They collected data in the form of classroom observations, teacher self-assessments, interviews, and field notes from four pairs of grade-3 teachers and two pairs of grade-6 teachers who participated in an intensive in-service professional development program over a period of six months in Toronto, Canada. According to Bruce and Ross (2008), the focus of the program was primarily

based on effective mathematics teaching strategies and peer coaching opportunities where teachers help one another improve their expertise through constructive criticism. The results of the study revealed that mathematics teachers' sense of efficacy increased as a result of changing their teaching practices and by adopting standards-based methods and a constructivist approach that they have learned in the content specific pedagogy training. In addition, they contended that these teachers were more likely to utilize open-ended assignments in order to allow their student to develop their critical thinking abilities and to learn to solve problems in different ways.

Another way the peer coaching program enhanced teacher efficacy is through vicarious learning. Bruce and Ross (2008) argued that while teachers would incessantly rave about the usefulness of a successful method, their colleagues would implement the method in their classrooms only after it had been modeled to them. Modeling provides clarity that allows teachers to come to the unequivocal conclusion that they also can. Moreover, Bruce and Ross suggested that teachers' sense of efficacy could also be enriched when teachers received positive feedback from their "peer coaching partners" (p. 360). Consequently, it is not an accident that teachers' mastery experiences improved because they have a great deal of reliable resources at their disposal. Finally, Bruce and Ross concluded that the peer coaching program gave teachers more opportunity to reflect about their work. They believed that it is very unlikely for teachers to reflect on daily activities, lessons, or assignments because of the countless obstacles they have to deal with on a regular basis. Peer coaching is designed to invite and encourage teachers to consciously reflect repeatedly on their teaching with their coaches.

Likewise, Shidler (2009) explored the connection between hours spent coaching teachers in the classroom for efficacy in content instruction and student achievement. Using data gathered from 360 students enrolled in 12 classrooms in a Head Start program located in Central Florida over a 3 year period, Shidler established that coaching approaches that are focused and sharpened to prepare teachers for instructional efficacy in specific contents and teaching methods where coaches are able to directly facilitate theory into practice are more effective. Shidler (2009) further suggested that in order to increase teacher efficacy, coaches need to effectively balance the time they spend with teachers in instructing for specific content, modeling techniques and instructional practices, observing teacher practices, and consulting for reflection. Spending too much time or not enough time in any of the aforementioned components of effective coaching could respectively attenuate the focus or leave questions unanswered. In other words, the quality of the interaction between coaches and teachers is more important than how much time coaches spend with teachers.

In a different study, Cantrell and Hughes (2008) investigated the effects of a yearlong professional development with coaching on sixth- and ninth-grade teachers' efficacy for teaching literacy and collective efficacy. The analysis of data collected in the form of teacher survey, classroom observations, and teacher interviews suggested that coaching appears to provide support for teachers as they gain mastery experiences with new techniques (p. 120). In addition, their study suggested that coaching is an important component in helping content area teachers to develop efficacy with integrating literacy strategies into the teaching of their subject area. Moreover, they found that extended professional developments had a positive impact on teacher efficacy and implementing

professional developments from a team approach was beneficial to teachers' sense of collective efficacy. Ongoing professional development creates a partnership between teachers who incidentally learn from each other's best work. "Ongoing support is essential in enabling teachers to internalize innovations and to change their practice in significant ways" (Cantrell & Hughes, 2008, p. 120).

In addition to coaching, supervision also has an impact on TSE. Ebmeier (2003) studied how supervision works in schools to influence teacher efficacy and commitment. Ebmeier used a 50-item questionnaire on commitment to the organization and teaching and confidence in peers and in the principal to collect data from K-12 teachers in a large midwestern area. Ebmeier (2003) found an indirect connection between principal supervision and personal teacher efficacy. The results of the study indicate that principal supervision becomes effective in increasing teacher commitment and building individual teacher efficacy only when teachers realize that the principal is truly concerned about and dedicated to supporting teaching. In addition, the findings also revealed that teachers trust in their peers plays an essential role in the development of teacher's commitment to teaching and their efficacy beliefs. This suggests that peers are very important to teachers and they influence their perception of the school.

Another support program that helps increase TSE is the implementation of school-wide positive behavior. Kelm and McIntosh (2012) examined the relationship between the implementation of a school-wide positive behavior support (SWPBS) program and teacher efficacy in Vancouver, Canada. Using a questionnaire measuring aspects of self-efficacy, Kelm and McIntosh collected data from 62 teachers (48 female, 14 male), with 22 teachers being from schools implementing SWPBS and 40 teachers

from schools not implementing SWPBS. They found that teachers from schools implementing SWPBS reported significantly higher levels of teacher self-efficacy than teachers from schools not implementing SWPBS. They reported that teachers from SWPBS schools were more likely to engage students in their classrooms and use strategies differentiated to their student needs. Moreover, they found that teachers from SWPBS schools had more opportunity to develop a shared sense of purpose since they spent less time involved in discipline issues and more time on teaching.

The literature reviewed seems to strongly suggest that TSE can be enhanced. Such approaches/strategies as encouraging teachers to pursue advanced degrees, appointing mentors and/or coaches for novice as well as experienced teachers, providing supervision and support for struggling teachers, and encouraging teachers to participate in contents specific and ongoing professional development have been found to be effective.

Mathematics Teaching Efficacy and Student Achievement in Mathematics

Highly efficacious mathematics teachers are essential to student achievement in mathematics. In their longitudinal study of 1,329 students, Midgley et al. (1989) examined the relationship between students' beliefs about their academic competency and potential in mathematics and teachers' sense of efficacy. The analysis of the collected data for this study which expanded during the 1984 (8^{th} grade) and 1985 (9^{th} grade) school year revealed very important findings. They concluded that students who were taught by teachers with a more positive sense of efficacy believed that they were improving in mathematics and that this improvement was more likely to continue in the future. This was contrasted with the point of view of students with teachers with a more negative sense of efficacy. In addition to their increased beliefs in their mathematics

abilities, in the spring of their 9th grade, the results suggested that students with teachers with a positive sense of efficacy also believed that mathematics was getting easier. However, at the same time, students who had teachers who did not have such a strong sense of efficacy were not too confident in their abilities. They undervalued their capacity to perform in math and they perceived math as being more difficult.

Moreover, Midgley et al. (1989) found that students who were taught by teachers with a high sense of efficacy in the 8th grade and taught by teachers with a low sense of efficacy in 9th grade had expectedly a drop in their enthusiasm, work ethics, and accomplishments. This decline was even sharper in students who were taught by teachers with a low sense of efficacy during both years. "In contrast, students who move into classrooms taught by teachers with a high sense of efficacy show either less negative change or some positive change" (Midgley et al., 1989, p. 256), while students who were taught by teachers with a high sense of efficacy during both years were more likely to perceive mathematics as an easy subject. However, students who were taught by teachers with a much lower sense of efficacy during the 8th and 9th grade perceive mathematics as an increasingly more difficult subject. Midgley et al. (1989) study demonstrated that teacher sense of efficacy was related to students' beliefs about their academic competency and potential in mathematics.

Maguire's (2011) study of 12 mathematics teachers and 535 9th and 10th grade students went further and examined whether TSE was a predictor of student academic achievement in mathematics. Maguire used student engagement, instructional strategies, and classroom management as attributes in order to evaluate TSE. According to Maguire (2011), teacher efficacy in student engagement was measured by how teachers encourage

their students to think critically, how teachers motivate uninterested students, and how teachers foster student creativity. Teacher efficacy in instructional strategies was measured by how teachers respond to difficult questions posed by students, how teachers gauge student comprehension, and how teachers are able to adjust lessons to the appropriate level for individual students. Teacher efficacy in classroom management was measured by how teachers are able to control disruptive behavior in the classroom, how well teachers can establish routines to foster student compliance, and how well teachers can make expectations clear about student behavior. Using a linear regression analysis, Maguire observed that teacher efficacy in student engagement was a significant predictor of student academic achievement in mathematics. Teacher efficacy in student engagement represented 2.6% of the variance of the dependent variable student academic achievement in mathematics. In contrast, teacher efficacy in instructional strategies was merely responsible for .03% of the variation in student academic achievement in mathematics (Maguire, 2011). As a result, teacher efficacy in instructional strategies was not a significant predictor of student achievement. Equally, teacher efficacy in classroom management did not significantly predict student achievement in mathematics, accounting for only 0.0% of the variation in student academic achievement in mathematics (Maguire, 2011). Other variables like years of experience were found to be insignificant in predicting student academic achievement in mathematics, while teacher age, representing 1.7% in variation, was a significant predictor of student academic achievement (Maguire, 2011). It is important to note that most of these predictor variables, when separated, did not appear to make any substantial impact on student academic achievement in mathematics, but when joined they became more relevant.

Maguire observed that when teacher efficacy in student engagement, teacher efficacy in classroom management, teacher age, and teacher experience are combined, they were able to create 6.4% of the variation in student academic achievement in mathematics, making them a significant predictor.

A review of the literature gives the impression that student achievement in mathematics depends on the mathematics teaching efficacy of their teachers. This reliance is based on the findings that highly efficacious math teachers because of their ability to engage, manage, and support their students can raise the level of enthusiasm and efforts of their students and make math easier to them.

Theoretical Framework

The theoretical framework used in this study helps to clarify the connection between math teachers' self-efficacy, anxiety and student achievement. As a result, the findings were examined through the lens of Bandura's self-efficacy theory and theories related to best practices in teaching in general as well as best practices in teaching mathematics. Pertinent theories related to each area are presented below. Also presented are explanations of how the theories have been applied in previous studies related to teacher self-efficacy and/or math anxiety and student achievement and how the theories were applied in this study.

Anxiety, Self-Efficacy, and Student Achievement

Anxiety is defined by the online Merriam-Webster dictionary as an abnormal and overwhelming sense of apprehension and fear often marked by physiological signs such as sweating, tension, and increased pulse; by doubt concerning the reality and nature of the threat; and by self-doubt about one's capacity to cope with it. At the educational

level, anxiety has been connected with teachers' job performance. Beilock, Gunderson, Ramirez, and Levine (2010), for example, examined the math anxiety of 17 first and second grade female teachers and their students (52 boys, 65 girls) from five public elementary schools in a large mid-western school district over a one year period. The results of their study showed that the girls' math performance was negatively affected by the level of math anxiety of their female teachers. This implies that female students who attend highly anxious female math teachers' classrooms are more likely to fail.

Teacher's self-efficacy, according to Tschannen-Moran and Hoy (2001) is a teacher's "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). At the educational level, self-efficacy has been associated with teachers' ability to teach. Bates, kim, and Latham (2011) examined the mathematics self-efficacy and mathematics teaching efficacy of preservice teachers and compared them to their mathematical performance. Using the Mathematics Self-Efficacy Scale, the Mathematics Teaching Efficacy Beliefs Instrument, and the Illinois Certification Testing System Basic Skill Test, they collected data from 89 early childhood preservice teachers at a Midwestern university. The analysis of the data revealed that preservice teachers who are highly self-efficacious in math are confident in their abilities to teach math but they do not believe they have the capacity to influence their students. According to Bates, Kim, and Latham, this could be due to a lack of experience on the part of the preservice teachers. In addition, the results indicated that mathematically highly self-efficacious preservice teachers who believe in their ability to teach math scored higher on their Basic Skills Test mathematics section. Lastly, the findings showed that high scoring preservice

teachers on the Basic Skills Test mathematics section had higher levels of math self-efficacy compared to preservice teachers who scored low in their Basic Skills Test mathematics section. However, when it comes to mathematics teaching ability or influencing their students, the scores of preservice teachers on the Basic Skills Test math section did not matter. Suggesting that preservice teachers who scored low on the Basic Skills Test mathematics section believe in their abilities to teach and to influence their students as much as preservice teachers who scored higher.

Student achievement is defined as a series of specific goals that must be accomplished. In this study, student achievement is determined when Learning Disabled (LD) students pass their state standardized tests or obtain a passing grade in the following courses: Geometry, Trigonometry, Algebra I, or Algebra II. LD students with an Individualized Educational Program (IEP) that includes a specific exemption from passing any section of their state exam will be omitted from data collection. Only test data collected from LD students who do not have any exemption from passing any section of their state exam will be collected for this study. Depending on their needs, these LD students will be provided with appropriate modifications and accommodations (i.e., a longer time to complete the test, increasing the font of the text to accommodate vision disability, and being tested in Braille or with the help of a sign language; TestScoreHelp, 2013).

Selection of the Framework

Goddard, Hoy, Woolfolk-Hoy (2000), in their work on the theoretical and empirical analysis of collective teacher efficacy, suggested that teacher self-efficacy (TSE) can be studied from two frameworks - Rotter's (1966) theory of internal locus of

control and from Bandura's (1977) self-efficacy theory. Rotter's (1966) theory of internal locus of control is based on the concept that people's lives and decision making processes are only controlled by themselves and not by any outside entities or events. Rotter's (1966) theory of internal locus of control influenced the Rand Corporation's studies about teacher efficacy. The researchers at the Rand Corporation defined TSE as "the extent to which teachers believed that they could control the reinforcement of their actions" (Goddard et al., 2000, p. 481).

On the other hand, Bandura's (1977) self-efficacy theory argues that teachers can believe that they have the cognitive capacity to rise to the complexity of any task and succeed. This concept comes from Bandura's social cognitive theory which contends that people acquire their knowledge and develop their personality through social experiences, observations, and the interaction between their behavior, the environment, and their thought processes. Bandura examined this personality development or change in behavior in 1977 when he and his colleague Adam conducted two experiments on the treatments of phobic individuals (i.e., fear of sneak). The findings lead him to conclude that self-efficacy played a major role in the level of behavioral improvement of the phobic individuals participating in the two studies, in the process giving birth to the concept of self-efficacy as a predictor of behavioral changes. According to Bandura (1993), in educational studies, self-efficacy has contributed in students' beliefs in their efficacy to regulate their own learning, teachers' beliefs in their personal efficacy to motivate and promote learning, and faculties' beliefs in their collective instructional efficacy.

Powerful constructs can be taken equally from both theoretical frameworks. However, Bandura's self-efficacy theory as opposed to Rotter's internal locus of control

theory was selected as a theoretical framework for this study because the personal efficacy of inclusion mathematics teachers is deemed important in determining the level of confidence they have in producing the appropriate behavior to influence the mathematics achievement of LD students. According to Goddard, Hoy, and Woolfolk-Hoy (2000), "Rotter's scheme of internal-external locus of control is concerned primarily with causal beliefs about the relationship between actions and outcomes, not with personal efficacy" (p. 481). While inclusion teachers may believe that the achievement of LD students could be caused by their mastery of the contents, if they do not possess such mastery or are not confident in their abilities to implement such mastery they will not be able to help their students.

Bandura (2005) argued that teachers' beliefs in their personal efficacy and students' assurance in their own ability to regulate their learning are major predictors of academic achievement. Caprara, Barbaranelli, Steca, and Malone (2006) examined whether TSE were determinants of their job satisfaction and students' academic achievement. They collected data from 2,184 teachers and their students in 75 junior high schools. The statistical analysis of the data revealed that TSE had a significant and positive influence on their job satisfaction. This suggests that highly self-efficacious teachers were more likely to be contented with their jobs compared to inefficacious teachers. In addition, the data also entailed that TSE was a significant predictor of student academic achievement, suggesting that students who had highly efficacious teachers were more likely to succeed compared to students who were taught by low efficacious teachers. Moreover, Caprara et al. (2006) believed that "The beliefs teachers have in their capacity to master their profession, namely, to cope effectively with the variety of

interrelated tasks and circumstances it may carry, are ultimately decisive in supporting children's academic achievement" (p. 487). In contrast, adolescents who developed negative self-beliefs about an academic subject because of constant failing would find it difficult to achieve success even when presented with effective learning. Simply put, achievement tends to increase self-efficacy while disappointment diminishes it (Pajares, 2005). Likewise, according to Bandura (2005), teachers who doubt their abilities, foster classroom environments that also cultivate uncertainties in their students. Self-inefficacy could be unequivocally damaging. When individuals are left with the prospect that they are powerless against conditions or situations that directly or indirectly impact them, they tend to embrace defeat (Bandura, 1982).

Best Practices in Teaching

According to Zemelman, Danields, and Hyde (2012) the quality of teaching matters. In a review of the literature to examine the importance of teaching on student achievement, they reported the following:

- Zuckerman found that students who are taught by effective teachers for three years in a row have achievement scores 50 percent higher than students who are taught by ineffective teachers during the same period.
- Durlack found that both achievement test scores and grades rise 11 percent for children who are explicitly taught the social skills of collaboration.
- Newmann found that students' test scores rise as a result of their interaction and personal relationships with their teachers.

In addition, Zemelman et al. (2012) believed that the teaching quality students receive is more important than school funding or students' socioeconomic status.

According to them, the quality of the teaching is the single most powerful variable in student achievement. Best practices in teaching provide teachers with the necessary tools to improve the quality of their teaching and in the process ensuring that students receive the best instruction regardless of their upbringings. King (2007) reported that the term best practice could be credited to two origins. It could be attributed to Frederick Taylor's 1919 Principles of Scientific Management where the expression "One best way" was coined after it was recognized that, "among the various methods and implements used in each element of each trade, there is always one method and one implement which is quicker and better than any of the rest" (p. 10). The second possible origin of best practice, according to McKeon (as cited in King, 2007) could be linked with the practical orientation of the agricultural research system, where research-based innovations were promoted at the county and state levels (p. 10). Best practices in teaching, according to Zemelman et al. (2012), found its roots in the progressive era of 1930 with John Dewey and the ideas of Jean Piaget, Lev Vygotsky, James Britton, James Moffett, Jerome Bruner, Erik Erikson, Carl Rogers, Jerome Harste, John Holt, Herbert Kohl, Neil Postman, and Charles Weingartner in the 1960s and early1970s. They believed that schools that implement best practices in teaching are "more student-centered, active, experiential, authentic, democratic, collaborative, rigorous, and challenging" (p. 2). These characteristics are supported by the curriculum standards movement which philosophy to school improvement lies in more authentic curriculum and revamped teaching methods. This movement is composed of subject-matter experts, educational researchers, professional associations, and classroom teachers. The curriculum standards movement is

working through many organizations to get the application of best practices across every academic subject.

General Subject-Matter Best Practices

The curriculum standards movement followed a progressive ideology and synthesized the recommendations of many organizations including the followings: The National Council of Teachers of Mathematics (NCTM), the National Board for Professional Teaching Standards (NBPTS), the National Council for the Social Studies (NCSS), the American Association for the Advancement of Science (AAAS), the National Council of Teachers of English (NCTE), the National Association for the Education of Young Children (NAEYC), and the International Reading Association (IRA). In addition to the information gathered from all these organizations, recommendations were also drawn from the Common Core State Standards (CCSS), a state-led effort coordinated by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO).

The result of this synthesis is the Common Recommendations of National Curriculum Reports illustrated in Table 3 that can be applied to any subject-matter. The first column of the table identifies things that teachers should do less in the classroom and the second column explains things that are recommended that teachers do more in the classroom to support student achievement. According to Zemelman et al. (2012), the ideology presented in this table is student-centered, promotes higher-order thinking, and encourages interaction among students. These are best practices that inclusion mathematics teachers can implement in the teaching of LD students.

Table 3

Common Recommendations of National Curriculum Reports

Do less …	Do more …
Less whole-class, teacher-directed instruction (e.g., lecturing)	More experiential, hands-on learning
Less student passivity: sitting, listening, receiving, and absorbing information	More active learning, with all the attendant noise and movement of students doing and talking
Less solitude and working alone	More student-student interaction
Less presentational, one-way transmission of information from teacher to student	More flexible seating and working areas in the classroom
Less rigidity in classroom seating arrangements	More diverse roles for teachers, including coaching, demonstrating, and modeling
Less prizing of silence in the classroom	More emphasis on higher-order thinking, on learning a field's key concepts and principles
Less classroom time devoted to fill-in-the-blank worksheets, dittos, workbooks, and other "seatwork"	More deep study of a smaller number of topics, so that students internalize the field's way of inquiry
Less student time spent reading textbooks and basal readers	More development of students' curiosity and intrinsic motivation to drive learning
Less focus on "covering" large amounts of material in every subject area	More reading of real texts: whole books, primary sources, and nonfiction materials
Less rote memorization of facts and details	More responsibility transferred to students for their work: goal setting, record keeping, monitoring, sharing, exhibiting, and evaluating
Less reliance on shaping behavior through punishments and rewards	More choice for students (e.g., choosing their own books, writing topics, team partners, and research projects)
Less tracking or leveling of students into "ability groups"	More enacting and modeling of the principles of democracy in school
Less use of pull-out special programs	More attention to affective needs and varying cognitive styles of individual students
Less emphasis on the competition and grades in school	More cooperative, collaborative activity; developing the classroom as an interdependent community
Less time given to standardized test preparation	More heterogeneous classrooms where individual needs are met through individualized activities, not segregation of bodies
Less use of and reliance on standardized tests	More delivery of special help to students in regular classrooms
	More varied and cooperative roles for teachers, parents, and administrators
	More use of formative assessments to guide student learning
	More reliance on descriptive evaluations of student growth, including observational/anecdotal records, conference notes, and performance assessment rubrics

Zemelman et al., 2012, pp. 6-7

Mathematics Best Practices

The best practices demonstrated in Table 3 could be applied to the teaching of any academic disciplines. The No Child Left Behind Act (NCLB) has targeted the school year 2013-2014 as the time when all students in the United States would attain proficiency or better level of achievement in all subjects including mathematics. However, American students still lag behind in mathematics compared to students in other developed countries. According to the fifth Trends in International Mathematics and Science Study (TIMSS 2011), the United States was only in the top 15 education systems in mathematics at Grade 4 and among the top 24 education systems in mathematics at Grade 8. Fourth and eighth graders in Korea, Singapore, Chinese Taipei, Hong Kong, Japan, and Finland consistently scored higher in mathematics than their American counterparts. In order to fulfill the projected objective of NCLB in mathematics, American students need to be taught using the best available practices. In their book entitled, Best Practice: Bringing Standards to Life in America's Classrooms, Zemelman et al. (2012) provided such practices that can allow students to reach and enthusiastically surpass the content standards.

Table 4 illustrates the summary of these best practices. The first column of the table identifies things that teachers should increase (do more often) in their mathematics classrooms. The second column identifies things that teachers should decrease (rarely do) in their mathematics classrooms. These best practices can inform inclusion math teachers on the right ways to instruct their LD students.

Table 4

Recommendations on Teaching Mathematics

Increase	Decrease
Problem solving • Word problems with a variety of structures and solution path • Open-ended problems and extended problem-solving projects • Investigating and formulating questions from problem situations	Problem solving • Use of cue words to determine operation to be used • Practicing routine, one-step problems
Creating representations • Creating one's own representations that make sense • Creating multiple presentations of the same problem or situation • Using representations to make the abstract ideas more concrete • Using representations to build understanding of concepts through reflection • Sharing representations to communicate ideas	Creating representations • Copying conventional representations without understanding • Reliance on a few representations • Premature introduction of highly abstract representations • Forms representations as an end product or goal
Communicating math ideas • Discussing math ideas • Reading mathematics • Writing mathematics	Communicating math ideas • Doing fill-in-the-blank worksheets • Answering questions that need only yes or no or numerical responses
Reasoning and proof • Justifying answers and solution processes • Reasoning inductively and deductively	Reasoning and proof • Relying on authorities (teacher, answer key)
Making connections • Connecting mathematics to other subjects and to the real world • Connecting topics with mathematics	Making connections • Learning isolated topics • Developing skills out of context

(*table continues*)

Increase	Decrease
Numbers/operations/computation • Developing number and operation sense • Understanding the meaning of key concepts • Using calculators for complex calculations	Numbers/operations/computation • Early use of symbolic notation • Memorizing rules and procedures without understanding • Complex and tedious paper-and-pencil computations
Geometry/measurement • Using geometry in problem solving • Developing spatial sense using objects • Measuring and exploring the concepts related to units of measure	Geometry/measurement • Memorizing facts and formula • Memorizing equivalencies between units of measure
Statistics/probability • Collecting and organizing data • Using statistical methods to describe, analyze, evaluate, and make decisions	Statistics/probability • Memorizing formulas
Algebra • Recognizing and describing patterns • Identifying and using functional relationships • Developing and using tables, graphs, and rules to describe situations • Using variables to express relationships	Algebra • Manipulating Symbols • Memorizing procedures
Assessment • Making assessment an integral part of teaching • Assessing a broad range of mathematical tasks • Using multiple assessment formats, including written, oral, and demonstration	Assessment • Using assessment only to assign grades • Focusing on a large number of isolated skills • Using only written tests

Zemelman et al., 2012, p. 185

These best practices by the Common Recommendations of National Curriculum Reports and the Recommendations on Teaching Mathematics for use in mathematics education are needed to help American students connect with mathematics and close the achievement gap with the rest of the other developed countries. District officials should follow this blueprint and provide teachers with the necessary resources to become regular practitioners of these proven practices.

Summary

In this chapter, the theoretical framework of the study was examined through a literature review of student achievement, math anxiety, teacher efficacy, and best practices in teaching. The overarching theme in the current review of the literature demonstrated without a doubt that mathematics anxiety is detrimental to the academic achievement of non-LD students while teacher efficacy is instrumental to their academic achievement. However, the degree that mathematics anxiety and teacher efficacy of inclusion teachers impact the academic achievement of LD students remains unclear. This study focused on gathering information to have a better understanding of the impacts that mathematics anxiety and teacher efficacy have on LD students. A quantitative approach was used to obtain this information. Chapter 3 focused on the methodology of the study. A cross-sectional survey was used as the research design and instruments such as the RMARS and the MTEBI were illustrated and presented for the study's data collection.

Chapter 3: Research Method

The purpose of this quantitative study, as explained earlier, was to examine the relationship between math anxiety and efficacy in high school inclusion mathematics teachers and the achievement of the LD students they serve. This chapter contains a description of the methodology that was used to conduct this study, including the questions that guided the study; the research design and approach; the population; the sample and sampling procedures; procedures for recruitment, participation, and data collection; instrumentation and materials; data collection and analysis; threats to validity; and ethical procedures.

Research Questions and Hypotheses

The specific questions that guided this study were the following:

RQ1: What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

RQ2: What is the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

RQ3: What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

Research Design and Approach

The two independent variables in this study were inclusion mathematics teachers' anxiety and inclusion mathematics teachers' self-efficacy. The dependent variable was the archived mathematics achievement of learning disabled (LD) students on their state standardized tests or their end-of-course final average in Geometry, Trigonometry, Algebra I, or Algebra II. The cross-sectional survey research design was the most appropriate design for this study. It is referred to as *cross-sectional design* because any data collected for the study were taken at only one specific point in time (Creswell, 2009). This design is used to collect data to describe relationships between variables in order to draw possible conclusions about the population or a sample of the population in question (Frankfort-Nachmias & Nachmias, 2008). This design allowed the study to answer the research questions through measurement of the perceptions and feelings associated with math anxiety and the efficacy of inclusion mathematics teachers in a consistent manner. The cross-sectional survey design generates meaningful results

through the use of reliable and valid instruments (Keough & Tanabe, 2011). The instruments that were used in this study were the Revised Mathematics Anxiety Rating Scale (RMARS; Plake & Parker, 1982) and the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI; Enochs, Smith, & Huinker, 2000). The archived mathematics achievement scores were measured on a ratio scale.

Methodology

Population

For the purpose of this study, high school inclusion teachers in school districts in the United States who were assigned to Geometry, Trigonometry, Algebra I, or Algebra II represented the population. As explained above in the definition of terms section, inclusion teachers are special education teachers who share regular classrooms with general education teachers because of the inclusion of at least one LD student in the regular classroom.

Sample and Sampling Procedures

A convenience sample of the population was obtained by inviting all inclusion mathematics teachers in the United States to participate in the study. “Researchers obtain a convenience sample by selecting whatever sampling units are conveniently available.” (Frankfort-Nachmias & Nachmias, 2008, p. 168).

The sample was drawn from inclusion teachers in the United States who were assigned to Geometry, Trigonometry, Algebra I, or Algebra II classes prior to the administration of the state standardized test during the 2013-2014 academic year. These four courses are usually required courses that students must complete in order to be eligible to take their state standardized mathematics test. Other inclusion teachers, such as

those who teach specifically science, language arts, social studies, and/or world languages, did not participate in this study because the dependent variable focused exclusively on mathematics.

Procedures for Recruitment, Participation, and Data Collection

Once permission was obtained from the Institutional Review Board (IRB; approval # 06-25-14-0141746), a flyer (see Appendix F) sanctioned by the IRB was posted on social networking as well as professional networking websites to collect data from willing practicing inclusion mathematics teachers. The first hyperlink on the flyer led to the consent form, which explained the following: the purpose of the study, how participants were selected, what was requested of the participants, possible benefits and risks of being in the study, to whom the results would be available and for what purpose, the voluntary nature of the study (participants could leave the study at any time), and the confidentiality of the data and people participating in the study. This information was provided to potential participants in the study to make them aware of their rights if they chose to participate in the study. The second hyperlink guided them to the web pages where they were able to easily fill out and submit the RMARS and the MTEBI surveys upon their consent to participate in the study. Data were collected from all inclusion mathematics teachers who voluntarily responded to the survey. Those inclusion teachers who responded before the deadline provided on the flyer were added to the group of teachers who had already completed the survey, and together they made up the final sample that was used for the study's data collection. If a teacher submitted a survey and later indicated that he or she did not want to be part of the study, his or her data coupled with his or her students' data were excluded from the final data collection file.

Once the data were received from the inclusion teachers, I visited their respective state education websites to retrieve the publicized school-level archived standardized test data of their students. Only the 2013-2014 school-level test scores of LD students whose inclusion teachers had filled out the surveys and end-of-course final averages were used for the study. In order to preserve the confidentiality of students and teachers associated with the data, only the participants' school districts and high schools names were requested in the demographic portion of the survey. This information was used only to locate the test scores and was not mentioned in any reports.

This study's data collection chart is in Table 5. In the first column of the chart, the three research questions that I attempted to answer in the study are presented. The second column identifies the source of the collected data. The third column explains the type of data that was measured by the study. Finally, the fourth column presents the type of statistical analysis that was performed on the data to help answer the three research questions.

Table 5

Data Collection Matrix

Research question	Data source	Type of data	Analysis plan
RQ1: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.	Learning Mathematics Anxiety (LMA): a subscale of the Revised Mathematics Anxiety Rating Scale (RMARS). Questions 1-16. State Mathematics standardized test scores 2013-2014 or school-level end-of-course final average	Quantitative Continuous measurement data: Interval-level data (RMARS) Continuous measurement data: Ratio-level data (State mathematics standardized test scores 2013-2014 or school-level end-of-course final average)	Descriptive statistics—frequencies and percentages Simple linear regression
RQ2: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.	Personal Mathematics Teaching Efficacy (PMTE): a subscale of the Mathematics Teaching Efficacy Belief Instruments (MTEBI). Questions 1-13. State mathematics standardized test scores 2013-2014 or school-level end-of-course final average	Quantitative Continuous measurement data: Interval level data (MTEBI) Continuous measurement data: Ratio-level data State mathematics standardized test scores 2013-2014 or school-level end-of-course final average	Descriptive—frequencies and percentages Simple linear regression
RQ3: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.	LMA, PMTE, & state mathematics standardized test scores 2013-2014 or school-level end-of-course final average	Quantitative Continuous measurement data: Interval-level data (RMARS, MTEBI, state mathematics standardized test scores 2013-2014 or school-level end-of-course final average)	Descriptive statistics—frequencies and percentages Multiple linear regression

Note. RQ1: Research Question 1 null hypothesis; RQ2: Research Question 2 null hypothesis; RQ3: Research Question 3 null hypothesis.

As indicated in Table 5 above, data for the study was collected in the following manner:

- RQ1 – What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?
- RQ2 – What is the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?
- RQ3 - What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve?

Data came from surveying mathematics inclusion teachers through the Revised Mathematics Rating Scale and the Mathematics Teaching Efficacy Beliefs Instrument. Data also came from gathering the scores of LD students on their state standardized mathematics exams and their end-of-course final average in Geometry, Trigonometry, Algebra I, and Algebra II.

Instrumentation and Material

The inclusion mathematics teachers who participated in this research was surveyed using the Revised Mathematics Anxiety Rating Scale (RMARS), which is described below and available in Appendix B, to gather data on situations where mathematics has made them apprehensive. They were also surveyed with the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI), which is also described below and available in Appendix A, to gather information on their efficacy in teaching

mathematics. Items in the RMARS survey addressed inclusion mathematics teachers' own trepidation towards teaching mathematics. Likewise, the MTEBI was used to collect information on how comfortable inclusion teachers are with their mathematics teaching. Participants answered each item in the survey by indicating the degree to which they agree or disagree with the item. The combination of the two surveys helped gather the proper data necessary to make appropriate determination regarding the research questions.

Revised Mathematics Anxiety Rating Scale (RMARS). The Revised Mathematics Anxiety Rating Scale (RMARS) is a modified 24-item version of the Mathematics Anxiety Rating Scale (MARS) which is a 98-item scale that was developed by Richardson and Suinn (1972) in order to measure the level of mathematics anxiety in adults (Plake & Parker, 1982). Since the MARS was a rather long survey to take, the revised version was designed by Plake and Parker (1982) to make the survey shorter and more efficient while maintaining its reliability and validity. The RMARS has an internal consistency reliability coefficient of .98. In addition, it has a .97 correlation with the original scale. However, Hopko's (2003) confirmatory analysis (n = 804) of the RMARS found that this scale is not as reliable when the sample size is very large. This scale is appropriate for this study because the sample size will be much less than 100 participants.

The RMARS is divided into 2 subscales: The Learning Mathematics Anxiety (LMA) subscale (16 items) and the Mathematics Evaluation Anxiety (MEA) subscale (8 items). Respondents rate items on a 5-point scale ranging from "*low anxiety*" to "*high anxiety*." "Reading and interpreting graph or charts" is one of the items taken from the LMA. The LMA measures the level of anxiety a person experienced while learning

mathematics. This is important to the study because it could help determine whether inclusion teachers had difficulty learning and therefore understanding mathematics. Vygotsky's Zone of Proximal Development theory posits that learning relies on the involvement of a more knowledgeable other (Tudge & Winterhoff, 1993). When the person who is supposed to be the more competent other is not, then the less knowledgeable person suffers.

Items taken from the MEA was not used in this study. The MEA measures the level of anxiety of the participant in taking mathematics tests. This subscale is not relevant in teaching mathematics. The scores on the RMARS range from 24 to 120. A score of 24 denotes a participant with the least level of math anxiety. A score of 120 in contrast represents a participant with the highest level of math anxiety. However, since only the LMA subscale was used for this study, the score only ranged from 16 representing a participant with the least level of anxiety in learning mathematics and 80 representing a participant with the highest level of anxiety in learning mathematics (Plake & Parker, 1982).

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI). According to Enochs et al. (2000), the Mathematics Teaching Efficacy Belief Instruments (MTEBI) is a survey that is divided into two parts. Respondents to the scale rate items on a 5-point scale ranging from "*strongly agree*" to "*strongly disagree*." One part has 13 items and focuses on teachers' beliefs in their individual capabilities to teach mathematics. It is called the Personal Mathematics Teaching Efficacy (PMTE) subscale. "I know how to teach mathematics concepts effectively" is one of the items taken from the PMTE. The other part has 8 items and focuses on teachers' beliefs that effective teaching of

mathematics can bring about student learning regardless of external factors. It is called the Mathematics Teaching Outcome Expectancy (MTOE) subscale. Riggs and Enochs (as cited in Swars et al., 2006, p. 312) held, "teaching outcome expectancy beliefs may be difficult to measure due to the myriad of variables entailed in this factor." Therefore the MTOE subscale was not used in this study.

Reliability analysis on the MTOE and the PMTE subscales produced respectively $\alpha = .75$ and $\alpha = .88$ (Enochs et al., 2000). Furthermore, a confirmatory analysis concluded that the two subscales were independent of each other; a feature of the two subscales that reinforces the construct validity of the MTEBI (Enochs et al., 2000). The scores on the MTEBI range from 73 to 53; where 73 signifies the score of a teacher with the highest mathematics teaching efficacy and 53 characterizes the score of a teacher with the lowest mathematics teaching efficacy level. Since only the PMTE was used for this study, the scores possibly ranged from 45 (lowest personal mathematics teaching efficacy) to 33 (highest personal mathematics teaching efficacy; Enochs et al., 2000).

Data Analyses

Once the surveys and the students' archived 2013-2014 test scores were in my possession, I used SPSS version 20.0 for Windows to perform additional screening and cleaning to make sure that the collected data was valid by using the Frequency tool, the Crosstabs tool, the Transform tool, and/or the Select Cases tool. In addition, Descriptive Statistics, Scatterplots, and Histograms under the Data Editor menu were used to detect errors. Then, I uploaded the data in SPSS in order to examine the research questions by performing statistical analyses on the collected data as described below.

Research Question 1

The first research question and applicable alternate hypotheses that guided the conduct of this study are:

RQ1 – What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve

H_1: There is a significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

In order to analyze Research Question 1, a simple linear regression was conducted to determine whether the independent variable mathematics anxiety in inclusion teachers is a predictor of the dependent variable average mathematics achievement of the students they serve. The correlation coefficient (r) was calculated to find out whether there is a positive or negative relationship between the independent and the dependent variable and the criterion for significance remained at $p < .05$. In addition, the coefficient of determination (R^2) was also calculated to determine the percentage of variance that the independent variable accounted for in the dependent variable (Field, 2009). In other words, this value told us how much the variability in the average score of the students is shared by the mathematics anxiety of their inclusion teachers.

Research Question 2

The second research question and applicable alternate hypotheses that guided the conduct of this study are:

RQ2 – What is the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

H_1: There is a significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

Research Question 2 was answered using the same statistical analysis as Research Question 1.The independent variable is inclusion mathematics teacher self-efficacy and the dependent variable is the average mathematics achievement of the students they serve. A simple linear regression was conducted in order to determine whether mathematics teacher self-efficacy in inclusion mathematics teachers could predict the average mathematics achievement of the students they serve. The correlation coefficient (r) as well as the coefficient of determination (R^2) was also explored to determine respectively the degree of association between the two variables and the amount of variance in the dependent variable that is associated with the independent variable.

Research Question 3

The third research question and applicable alternate hypotheses that guided the conduct of this study are:

RQ3 - What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics score of the LD students they serve?

H_0: There is no significant relationship between a group of inclusion mathematics teachers' anxiety and self-efficacy scores and the average mathematics score of the LD students they serve

H_1: There is a significant relationship between a group of inclusion mathematics teachers' anxiety and self-efficacy scores and the average mathematics score of the LD students they serve.

The data for Research Question 3 was examined using a multiple regression analysis to evaluate whether mathematics anxiety and mathematics teacher self-efficacy in inclusion mathematics teacher could predict the average score of the students they serve. The dependent variable was the average score of the students and the independent variables were mathematics anxiety and mathematics teacher self-efficacy in inclusion mathematics teachers. If the Pearson product-moment correlation between the two independent variables produced a value $r \geq .80$, there would not have been any reason to analyze Research Question 3. There would be too much multicollinearity between the two independent variables. The assumption of multicollinearity would be violated. Field (2009) concurred, "Multicollinearity between predictors makes it difficult to assess the individual importance of a predictor" (p. 224). However, since the Pearson product-moment correlation between the two independent variables produced a value $r = .427$, a value far less than $r = .80$, I performed a multiple regression analysis on the data. Using the hierarchical regression method, teacher self-efficacy will be the first independent variable entered followed by mathematics anxiety. The coefficient of determination (R^2) was calculated with teacher self-efficacy as the only independent variable and then with teacher self-efficacy and mathematics anxiety as the two independent variables. A comparison was made between the two resulting coefficients of determination. An increase in the coefficient of determination with the inclusion of the two independent variables showed the strength of the relationship.

Threats to Validity

The characteristics of survey research make the validity of this study vulnerable to internal and external threats. Internal validity threats are threats that make it difficult for researchers to conclude that changes in the independent variables are responsible for the changes that occur in the dependent variables. According to Frankfort-Nachmias and Nachmias (2008), internal validity "requires that the researcher rules out other factors as rival explanations of the observed association between variables under investigation" (p. 109). External validity threats are threats that make it difficult for researchers to replicate their study. External validity "requires that the findings of research be applicable to the natural settings and populations the researcher is investigating" (p. 109). In this study, an internal validity threat was history. Inclusion teachers in these districts have the possibility to know each other because they have participated together in countless workshops in the past. They may be familiar to each other to the point where they are colleagues, friends, and consequently are able to discuss the survey. Discussion of the survey between inclusion teachers could result in some teachers being influenced by the views of others. In the consent form, they were asked to not discuss the survey with other colleagues to minimize this threat.

In addition to the preceding threats, there is the selection bias threat (Frankfort-Nachmias & Nachmias, 2008). There was the possibility that most of the participants selected had either a great affinity for mathematics or were extremely fearful about mathematics. Likewise, a few selected participants furthering their math education through a college course or through a training program at the time of the survey could

influence the outcome of their responses in the surveys. The participants will be chosen through a random process to decrease the selection threat.

Lastly, participants may have run in some technical difficulties such as slow internet connection when accessing the survey. They were provided with ample time and directive to take the survey during their preparation periods, at the convenience of their home computer, or using their cell phones and tablets.

As pointed out above, there were also some external threats to the validity of this study. An external threat to the validity of this study was how representative the sample selected reflects the population of inclusion mathematics teachers in these districts. The lack of knowledge of the demographics of the inclusion mathematics teachers in these districts prevented a comparison with the sample of inclusion teachers participating in the study. Another external threat to this study was whether the sample selected was either too good in math or too poor in math. A random selection of the participants from all the districts was considered to likely minimize these two threats**.**

Ethical Procedures

In academic research, the IRB is the organization responsible to make sure that participants are aware and protected by federal guidelines. Informed consent was required before any inclusion mathematics teacher participates in the study to demonstrate understanding of their function and their agreement to take part in the study. Participants were informed that their involvement in the study would not have any influence on their future evaluations or assignments and they could drop out of the study at any time without penalty. Additionally, participants were treated justly and were made aware of the benefits and potential burden of the research. Participants were also treated with the

utmost respect to make sure that their autonomy was protected. My role was to protect every participant in the study. Any surveys will be kept safe before being destroyed after a period of 5 years. Moreover, participants were given my phone number as well as my e-mail address in case they wanted clarification or additional information on any concerns that may have arisen.

Summary

In this chapter, survey research was introduced as the research design that was used to carry out the study. The RMARS and the MTEBI were described as the instruments that were used to collect data for the study. Threats to the validity of the study were considered. The specific research questions that guided the study were discussed. The statistical approaches simple linear regression and multiple linear regression that were used to analyze the data were presented. In the next chapter, the findings of this cross-sectional survey research were examined and conclusions and recommendations were presented in Chapter 5.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to determine the strength of the relationship between inclusion teachers' mathematics anxiety and self-efficacy and the mathematics achievement of their LD students. Survey data from inclusion mathematics teachers were obtained using the Learning Mathematics Anxiety (LMA) subscale and the Personal Mathematics Teaching Efficacy (PMTE) subscale. Mathematics achievement of LD students was also obtained using 2013-2014 state standardized test data and the inclusion mathematics teachers' end-of-course final average classroom data. This chapter presents the research questions and hypotheses, research tools, description of the sample, and data analyses.

Research Questions and Hypotheses

The quantitative analyses of this study were made possible through the collection of data from inclusion teachers using the LMA and the PMTE and the collection of data from LD students using the 2013-2014 New Jersey High School Proficiency Assessment (HSPA) exam, the Fall 2013 New England Common Assessment Program (NECAP), and 2013-2014 end-of-course (Algebra I & II, Geometry, Trigonometry, Math Lab) final average classroom data. Based on the lack of individual available data on student achievement, adjustments had to be made to the research questions and hypotheses section. One variable was added to measure student achievement. Three more hypotheses were added to strengthen the analyses of the data. In the first three research questions, student achievement was measured using the school standardized test scores percentage passing rate. In Research Questions 4, 5, and 6, student achievement was measured using

end-of-course classroom final average. Therefore, data collection and analyses in the study were guided by the following research questions:

Student Achievement: School Standardized Test Scores Percentage Passing Rate

RQ1: What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

RQ2: What is the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

RQ3: What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

Student Achievement: End-of-Course Classroom Final Average

RQ4: What is the relationship between inclusion mathematics teachers' anxiety and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the end-of-course average mathematics achievement of the LD students they serve.

RQ5: What is the relationship between inclusion mathematics teachers' self-efficacy and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the end-of-course average mathematics achievement of the LD students they serve.

RQ6: What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the end-of-course average mathematics achievement of the LD students they serve.

Research Tools

The data were collected from inclusion teachers using the LMA subscale (Plake & Parker, 1982) to obtain the math anxiety score and the PMTE (Enochs et al., 2000) subscale to obtain the teacher efficacy score. The LMA subscale is a 16-item Likert-scale where participants rate items on a 5-point scale ranging from 1 = *low anxiety* to 5 = *high anxiety*. This subscale is designed to measure the level of anxiety a person is faced with when learning mathematics. The PMTE subscale is a 13-item Likert scale where respondents to the scale rate items on a 5-point scale ranging from 5 = *strongly agree* to 1= *strongly disagree*. This subscale is designed to evaluate teachers' beliefs in their individual capabilities to teach mathematics.

Description of the Sample

The population consisted of inclusion math teachers who volunteered to take a survey that I posted on my social media pages (Facebook, Twitter, LinkedIn, etc.) and the pages of my friends and colleagues. The data were gathered among eight high schools in three different urban school districts in New Jersey and Rhode Island. Of the 20 participants who took the survey, five were excluded because four were not inclusion math teachers and one did not complete the survey. Fifteen of 20 possible participants filled out the survey properly, which was divided into the Learning Mathematics Anxiety subscale, the Personal Mathematics Teaching Efficacy subscale, and the demographics questionnaire. As a result, 75% of the participants were involved in the results of the study. However, this sample size is relatively small and limits the significance of the results of the study. In addition, 2013-2014 archived Grade 11 school standardized data of the eight high schools were collected from the state websites. End-of-course final average classroom data of 275 LD students were obtained from the inclusion teachers in the Demographics questionnaire.

Data Analyses

The purpose of this quantitative study was to investigate the relationship between inclusion mathematics teachers' anxiety and efficacy and the mathematics achievement of LD students in a group of public school districts in the United States. The data collected from 15 inclusion teachers from eight public high schools were used to examine the six research questions and the associated six null hypotheses. IBM SPSS statistics version 21 was used to perform the analyses of the hypotheses. In order to determine relationships among the variables, RQ1, RQ2, RQ4, and RQ5 were analyzed using simple

linear regression. Multiple linear regression analyses were used in RQ3 and RQ6. As mentioned above, data were collected from a relatively small sample (n = 15) that limited the significance of the results of the study. An additional statistic was used in the report of the data analyses to enhance the substance and the significance of the results. According to Coe (2002), the p-value or the probability that the null hypothesis is correct (there is no effect in the population) depends essentially on the size of the effect and the size of the sample. Coe (2002) also suggested, "One would get a 'significant' result either if the effect were very big (despite having only a small sample) or if the sample were very big (even if the actual effect size were tiny)" (p. 8). Therefore, because this study's sample size was relatively small, in addition to the report on the null hypothesis testing, the effect size is presented to add strength to the statistical and practical significance of the results. According to Kotrlik et al. (2011), "An effect size measure for simple and multiple regression is the regression coefficient R^2" (p. 137). Cohen's (1988) convention stated that when R^2 = .0196, the effect size is small; R^2 = .1300, the effect size is medium; and R^2 = .2600, the effect size is large.

Research Question 1

RQ1: What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

The first research question determined the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they served using math anxiety as the independent variable and school

standardized test scores passing rate to evaluate student achievement as the dependent variable. To examine Research Question 1, a linear regression analysis was used to determine whether math anxiety significantly predicts student achievement. Using math anxiety as the only predictor, the results of the analysis indicated that there is not a significant correlation between inclusion teachers' math anxiety and student achievement ($r = .124$, $p > .05$). The analysis also showed that $R^2 = .015$, $F(1, 12) = .189$, $p > .05$. This means that inclusion teachers' math anxiety can account for 1.5% of the variance in student achievement. In addition, the analysis showed that $\beta = .124$, $t = .434$, $p > .05$. This means that inclusion teachers' math anxiety did not significantly predict student achievement measured by school standardized test scores passing rate. Furthermore, the effect size for this analysis ($R^2 = .015$) was found to be less than Cohen's (1988) convention for a small effect size ($R^2 = .0196$). This means that there was not any practical effect in the population. These results indicated that the null hypothesis was not rejected, as shown in Table 6.

Table 6

RQ1 Linear Regression Analysis

Model	Effect size R^2	Degrees of freedom	*F*	*B*	*t*	Level of significance
Regression	.015	1	.189	.124	.434	.672*
Residual		12				

Note. *$p > .05$.

Research Question 2

RQ2 – What is the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

The second research question determined the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve using teacher self-efficacy as the independent variable and school standardized test scores passing rate to evaluate student achievement as the dependent variable. To examine Research Question 2, a linear regression analysis was used to determine whether teacher self-efficacy significantly predicts student achievement. Using teacher self-efficacy as the only predictor, the results of the analysis indicated that there is not a significant correlation between inclusion teachers' self-efficacy and student achievement ($r = .181$, $p > .05$). The analysis also indicated that $R^2 = .033$, $F(1, 12) = .407$, $p > .05$. This means that inclusion teachers' self-efficacy can account for 3.3% of the variance in student achievement. In addition, the analysis showed that $\beta = .181$, $t = .638$, $p > .05$. This means that inclusion teachers' self-efficacy did not significantly predict student achievement measured by school standardized test scores passing rate. Furthermore, the effect size for this analysis ($R^2 = .033$) was found to exceed Cohen's (1988) convention for a small effect size ($R^2 = .0196$). This means that there was a small practical effect in the population. These results indicated that the null hypothesis was not rejected as shown in Table 7.

Table 7

RQ2 Linear Regression Analysis

Model	Effect size R^2	Degrees of freedom	F	β	t	Level of significance
Regression	.033	1	.407	.181	.638	.535*
Residual		12				

* $p > .05$.

Research Question 3

RQ3 - What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

The third research question determined the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve using teacher math anxiety and self-efficacy as the independent variables and school standardized test scores passing rate to evaluate student achievement as the dependent variable. To examine Research Question 3, a hierarchical regression method was used to determine whether the combination of inclusion teachers' math anxiety and self-efficacy significantly predict student achievement. The results showed that the Pearson product-moment correlation between the two independent variables produces a value $r = .427$ far less than .80. Therefore, a multiple regression analysis was performed on the data since the assumption of

multicollinearity was not violated (Field, 2009). Using inclusion teachers' self-efficacy in model 1, $R^2 = .033$. This means that inclusion teachers' self-efficacy can account for 3.3% of the variance in student achievement. However, when the second predictor (inclusion teachers' math anxiety) is included as well (model 2), this value increases slightly to .036 or 3.6% of the variance in student achievement. Therefore, if inclusion teachers' self-efficacy accounts for 3.3%, we can tell that their math anxiety only accounts for an additional .3%. As a result of these findings, the inclusion of math anxiety as a predictor has explained quite a small variation in student achievement. The results of the regression indicated that the predictors explained 3.6% of the variance ($R^2 = .036$, $F(2, 11) = .203$, $p > .05$). In addition, the analysis showed that inclusion teachers' self-efficacy ($\beta = .157$, $t = .478$, $p > .05$) and inclusion teachers' math anxiety ($\beta = .058$, $t = .176$, $p > .05$) did not significantly predict student achievement measured by school standardized test scores passing rate. Furthermore, the effect size for this analysis ($R^2 = .036$) was found to exceed Cohen's (1988) convention for a small effect size ($R^2 = .0196$). This means that there was a small practical effect in the population. These results indicated that the null hypothesis was not rejected as shown in Table 8.

Table 8

RQ3 Hierarchical Multiple Regression Analysis

Model	Effect size R^2	Degrees of freedom	F	β	t	Level of significance
Regression	.036	2	.203			.820*
Residual		11				
Teacher self-efficacy				.157	.478	.642*
Teacher math anxiety				.058	.176	.864*

* $p > .05$.

Research Question 4

RQ4 – What is the relationship between inclusion mathematics teachers' anxiety and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the end-of-course average mathematics achievement of the LD students they serve.

The fourth research question determined the relationship between inclusion mathematics teacher's anxiety and the end-of-course average mathematics achievement of the LD students they serve using math anxiety as the independent variable and end-of-course classroom final average to evaluate student achievement as the dependent variable. To examine Research Question 4, a linear regression analysis was used to determine whether math anxiety significantly predicts student achievement. Using math anxiety as the only predictor, the results of the analysis indicated that there is not a

significant correlation between inclusion teachers' math anxiety and student achievement (r = .123, p > .05). The analysis also indicated that R^2 = .015, $F(1, 13)$ = .201, p > .05. This means that inclusion teachers' math anxiety can account for 1.5% of the variance in student achievement. In addition, the analysis showed that β = .123, t = .448, p > .05. This means that inclusion teachers' math anxiety did not significantly predict student achievement measured by end-of-course classroom final average. Furthermore, the effect size for this analysis (R^2 = .015) was found to be less than Cohen's (1988) convention for a small effect size (R^2 = .0196), this means that there was not any practical effect in the population. These results indicated that the null hypothesis was not rejected as shown in Table 9.

Table 9

RQ4 Linear Regression Analysis

Model	Effect size R^2	Degrees of freedom	F	β	t	Level of significance
Regression	.015	1	.201	.123	.448	.662*
Residual		13				

*p > .05.

Research Question 5

RQ5 – What is the relationship between inclusion mathematics teachers' self-efficacy and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the end-of-course average mathematics achievement of the LD students they serve.

The fifth research question determined the relationship between inclusion mathematics teachers' self-efficacy and the end-of-course average mathematics achievement of the LD students they serve using teacher self-efficacy as the independent variable and end-of-course classroom final average to evaluate student achievement as the dependent variable. To examine Research Question 5, a linear regression analysis was used to determine whether teacher self-efficacy significantly predicts student achievement. Using teacher self-efficacy as the only predictor, the results of the analysis indicated that there is not a significant correlation between inclusion teachers' self-efficacy and student achievement ($r = .367$, $p > .05$). The analysis also indicated that $R^2 = .135$, $F(1, 13) = 2.026$, $p > .05$. This means that inclusion teachers' self-efficacy can account for 13.5% of the variance in student achievement. In addition, the analysis showed that $\beta = -.367$, $t = -1.423$, $p > .05$. This means that inclusion teachers' self-efficacy did not significantly predict student achievement measured by end-of-course classroom final average. Furthermore, the effect size for this analysis ($R^2 = .135$) was found to exceed Cohen's (1988) convention for a medium effect size ($R^2 = .1300$), this means that there was a practical medium effect in the population which is still shy of a large effect. These results indicated that the null hypothesis was not rejected as shown in Table 10.

Table 10

RQ5 Linear Regression Analysis

Model	Effect size R^2	Degrees of freedom	F	β	t	Level of significance
Regression	.135	1	2.026	-.367	-1.423	.178*
Residual		13				

*$p > .05$.

Research Question 6

RQ6 - What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the end-of-course average mathematics achievement of the LD students they serve.

The sixth research question determined the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the end-of-course average mathematics achievement of the LD students they serve using inclusion teachers' math anxiety and self-efficacy as the independent variables and end-of-course classroom final average to evaluate student achievement as the dependent variable. Just as in Research Question 3, to examine Research Question 6, a hierarchical regression method was used to determine whether the combination of inclusion teachers' math anxiety and self-efficacy significantly predict student achievement. The results showed that the Pearson product-moment correlation between the two independent variables produces a value $r = .427$ far less than .80. Therefore, a multiple regression analysis was performed on the data

since the assumption of multicollinearity was not violated (Field, 2009). Using inclusion teachers' self-efficacy in model 1, $R^2 = .135$. This means that inclusion teachers' self-efficacy can account for 13.5% of the variance in student achievement. However, when the second predictor (inclusion teachers' math anxiety) is included as well (model 2), this value increases to .231 or 23.1% of the variance in student achievement. Therefore, if inclusion teachers' self-efficacy accounts for 13.5%, we can tell that their math anxiety accounts for an additional 9.6%. Based on these findings, the combination of inclusion teachers' self-efficacy and math anxiety as predictors has explained a respectable variation in student achievement. The results of the regression indicated that these predictors explained 23.1% of the variance ($R^2 = .231$, $F(2, 12) = 1.801$, $p > .05$). Nevertheless, the analysis showed that inclusion teachers' self-efficacy ($\beta = -.514$, $t = -1.834$, $p > .05$) and inclusion teachers' math anxiety ($\beta = .343$, $t = 1.224$, $p > .05$) did not significantly predict student achievement measured by end-of-course classroom final average. Furthermore, the effect size for this analysis ($R^2 = .231$) was found to exceed Cohen's (1988) convention for a medium effect size ($R^2 = .1300$) but slightly below a large effect size ($R^2 = .2600$). This means that there was a practical medium effect in the population and there is a greater relationship between the predictors and the dependent variable. These results indicated that the null hypothesis was not rejected as shown in Table 11.

Table 11

RQ6 Hierarchical Multiple Regression Analysis

Model	E.S. R^2	Degrees of freedom	F	β	t	Level of significance
Regression	.231	2	1.801			.207*
Residual		12				
Teacher self-efficacy				-.514	-1.834	.092*
Teacher math anxiety				.343	1.224	.244*

Note. E.S. = effect size.
* $p > .05$.

Summary

The purpose of this study was to examine the strength of the relationship between inclusion teachers' mathematics anxiety and self-efficacy and the mathematics achievement of their LD students. Data from a three-part survey, schools standardized archived test scores, and end-of-course classrooms final average scores were used to analyze six research questions and six null hypotheses. Four of the questions were analyzed using simple regression analysis and the other two questions were analyzed using multiple regression analysis. The findings of this study showed that there were not any significant correlations between the independent variables (inclusion teachers' math anxiety, inclusion teachers' self-efficacy) and the dependent variable student achievement (school standardized test percentage passing rate, end-of-course classroom final average). In addition, the findings also demonstrated that both inclusion teachers' math anxiety and self-efficacy did not significantly predict student achievement. This chapter presented the

analyses of the study; Chapter 5 discussed the interpretation of the findings, implications, and recommendations from this study.

Chapter 5: Implications, Recommendations, and Conclusion

Introduction

Mathematics anxiety is a feeling of fear that interferes with someone's ability to perform mathematical operations (Whyte & Anthony, 2012). Teacher self-efficacy, according to Tschannen-Moran and Hoy (2001), is a teacher's "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). According to the literature, there are many definitions of student achievement. Some are short and specific; others are long and extensive. There are some broad definitions that describe student achievement as a series of specific goals that must be accomplished and other definitions that are centered on a single objective. Student achievement in this study is determined when learning disabled (LD) students pass their state standardized tests or obtain a passing grade in the following courses: Geometry, Trigonometry, or Algebra I or II. This quantitative study examined the strength of the relationship between inclusion teachers' math anxiety and self-efficacy and the mathematics achievement of their LD students. This chapter presents an overview of the research and provides discussion on the interpretation of findings, implications for social change, and recommendations for actions as well as further study.

Research Overview

A review of the literature has shown that math anxiety is detrimental to the academic achievement of non-LD students (Witt, 2012; Zakaria & Nordin, 2008) whereas teacher efficacy is instrumental to their academic achievement (Khan, 2011; Mojavezi & Tamiz, 2012). The purpose of this study was to determine the strength of the

relationship between inclusion teachers' math anxiety and self-efficacy and the academic achievement of their LD students. Of the 20 participants who took the survey, five were excluded because four were not inclusion math teachers and one did not complete the survey. Data were collected from 15 of 20 participating inclusion math teachers in eight high schools in three urban public school districts in the northeastern section of the country. The Learning Mathematics Anxiety subscale (Appendix A), the Personal Mathematics Teaching Efficacy subscale (Appendix B), and demographic items (Appendix C) were used to gather data from the 15 participating inclusion teachers. In addition, 2013-2014 school-level state standardized archived data and end-of-course classroom data of the 275 LD students of the 15 inclusion teachers surveyed were collected to measure student achievement. Simple regression and multiple regression analyses were conducted to assess the relationship between math anxiety, teacher efficacy, and student achievement.

The study attempted to answer the following research questions:

Student Achievement: School Standardized Test Scores Percentage Passing Rate

RQ1: What is the relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the average mathematics achievement of the LD students they serve.

RQ2: What is the relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the average mathematics achievement of the LD students they serve.

RQ3: What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the average mathematics achievement of the LD students they serve.

Student Achievement: End-of-Course Classroom Final Average

RQ4: What is the relationship between inclusion mathematics teachers' anxiety and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and the end-of-course average mathematics achievement of the LD students they serve

RQ5: What is the relationship between inclusion mathematics teachers' self-efficacy and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' self-efficacy and the end-of-course average mathematics achievement of the LD students they serve.

RQ6: What is the relationship between inclusion mathematics teachers' anxiety and self-efficacy and the end-of-course average mathematics achievement of the LD students they serve?

H_0: There is no significant relationship between inclusion mathematics teachers' anxiety and self-efficacy and the end-of-course average mathematics achievement of the LD students they serve.

The data from this study supported the following hypotheses:

1. There was no significant relationship between inclusion teachers' math anxiety and student achievement.
2. There was no significant relationship between inclusion teachers' self-efficacy and student achievement.
3. There was no significant relationship between inclusion teachers' math anxiety and self-efficacy and student achievement.

The results of the study showed that when used independently or combined, neither inclusion teachers' math anxiety nor self-efficacy predicted student achievement.

Interpretation of Findings

Simple linear regression analyses of RQ1 and RQ4 revealed that inclusion teachers' math anxiety accounted for 1.5% of the variance in student achievement when either school standardized test scores passing rate or end-of-course classroom final average was used to evaluate student achievement. Furthermore, participants in this study demonstrated that inclusion teachers' math anxiety did not affect the academic achievement of their LD students. These results are in disagreement with the literature that suggests that math anxiety has a significant negative effect on student achievement. According to Karimi and Venkatesen (2009) and Woodard (2004), students who were highly mathematically anxious tended to underperform in math.

Two additional simple linear regression analyses of RQ2 and RQ5 demonstrated that inclusion teachers' self-efficacy accounted for 3.3% of the variance in student achievement when school standardized test scores passing rate was used to evaluate student achievement and 13.5% of the variance when end-of-course classroom final average was used to evaluate student achievement. In both cases, the data collected from the participants revealed that teacher self-efficacy did not have a significant impact on student achievement. These results are also in disagreement with the literature that indicates that teacher self-efficacy has a significant positive effect on student achievement. Mojavezi and Tamiz (2012) found that teacher self-efficacy had a positive impact on student achievement. Likewise, Khan (2011) pointed out that teachers with a strong sense of self-efficacy believe that when they try hard, they can bring about positive influences on both the personal and the academic development of their students.

Two hierarchical multiple regression analyses were used to determine whether the combination of the variables of inclusion teachers' math anxiety and self-efficacy would predict student achievement. In the first hierarchical multiple regression analysis (RQ3), when student achievement was measured using school standardized test scores passing rate, the combination of the variables inclusion teachers' math anxiety and self-efficacy accounted for 3.6% of the variance in student achievement. In the second hierarchical multiple regression analysis (RQ6), when student achievement was measured using end-of-course classroom final average, the combination of the variables inclusion teachers' math anxiety and self-efficacy accounted for 23.1% of the variance. Although this combination of variables created a stronger model than the previous linear models in this study in predicting student achievement, the data analysis revealed that there was not a

significant correlation between the two independent variables, and their association did not have a significant impact on student achievement. These results are once again in disagreement with the literature that indicates that there is a negative correlation between teacher math anxiety and teacher efficacy. Gresham (2009) and Swars et al. (2006) showed in general that preservice teachers with the lowest degrees of math anxiety had the highest levels of mathematics teaching efficacy. There is a lack of research in the literature about the effect of the combination of these two variables on student achievement.

The results of this study are in contradiction with the literature and do not support the theoretical framework that covers math anxiety, teacher efficacy, and student achievement. According to the literature, math anxiety has negative effects that can hinder students' ability to progress in mathematics. Highly efficacious math teachers have the capacity to captivate, lead, and support their students. They also have the ability to draw out the best from their students and make math easier to them. Many factors impair student achievement in mathematics. Math anxiety has been shown to have strong debilitating effects, while teacher efficacy has been shown to have positive effects. Conflictingly, the results of this study indicate that inclusion teachers' math anxiety and self-efficacy do not affect student achievement.

The practical applications of the findings of this study demonstrate that the level of math anxiety and self-efficacy of the participating inclusion teachers does not seem to affect the academic achievement of their LD students. This outcome may be partially due to the fact that data analyses were performed on a relatively small sample size and individual student score was not available to measure student achievement.

Implications for Social Change

This study primarily helps create social change by filling a gap that existed in the literature. No other study has investigated the impact of the relationship between inclusion teachers' math anxiety and self-efficacy and the academic achievement of their learning disabled students. The reauthorization of the Individuals with Disabilities Education Improvement Act (IDEIA) Part B that was signed into law in 2004 guarantees that children and youth (ages 3-21) with disabilities throughout the nation receive special education and related services (US Department of Education, 2006). Under the official umbrella of IDEIA and NCLB, these special education and related services should in part be provided in classrooms across the state and throughout the country by highly qualified special education teachers in self-contained or inclusion environments (US Department of Education, 2006). LD students are part of the mainstream environment; they are expected to be taught by effective inclusion teachers. Instead of assigning inclusion teachers instructional duties according to the availability of the master schedule or their longevity on the job, other factors including their math anxiety and teaching efficacy must be considered. The findings of this study contradict previous research in the literature and revealed there was not any significant relationship between inclusion teachers' math anxiety and self-efficacy and student achievement. Based on the findings of the study, the implication for social change is that further research that includes variables other than teacher mathematics anxiety and teaching efficacy is needed to understand mathematics performance of learning disabled students.

Recommendations for Action

One of the main priorities of a school district is to ensure that all teachers are highly qualified in order for all students regardless of their learning ability to be academically successful. Based on the flexibility of the No Child Left Behind act, special education teachers in inclusion environments do not need to have a bachelor's degree in mathematics or be certified by passing a state exam, as long as there is a highly qualified general education mathematics teacher in the classroom (U.S. Department of Education, 2009). The strength of the inclusion model is based on the successful partnership between general education and inclusion teachers. The effectiveness of this partnership weakens when one of the teachers has to worry about teaching anxiety regarding the subject to be taught and a lack of efficacy in teaching ability. This study did not find any significant relationship between inclusion teachers' math anxiety and self-efficacy and the academic achievement of their LD students. I believe that, because of the limitations of this study, other research on this topic should continue to provide more dialogue and practical initiatives concerning the notion of math anxiety and teaching efficacy with regard to the assignment of special education teachers in mathematics classrooms.

The results of this study will be disseminated and explained to the mathematics and special education departments of the participating school districts in a PowerPoint presentation. This study could bring awareness to school officials about the proper assignment of special education teachers in inclusion environment. To begin, district officials and administrators could create a procedure to assign special education teachers to inclusion mathematics classrooms instead of relying on scheduling convenience. Every academic year, special education teachers who do not hold a bachelor's degree or a state

certificate in mathematics must be given the opportunity to show their competency in the subject matter prior to their inclusion assignments. A comprehensible test that covers all the standards to be taught in the course (Algebra I, Algebra II, Geometry, or Trigonometry, etc.) must be given annually at the end of the school year to any special education teacher who has the potential and/or scheduled to be placed in an inclusion mathematics classroom. Special education teachers must score in the 85th percentile on the test to be allowed to teach the corresponding course, suggesting that the greater their math knowledge, the greater their self-efficacy and the lower their anxiety. Those who failed to reach this score should be given the appropriate resources (i.e., seminars, workshops, college courses, etc.) to build on their strengths and correct their weaknesses during the summer months and throughout the school year before they are assigned to a mathematics classroom.

Recommendation for Further Study

Based on the sample size of this study and the data collected, there is still a need to further examine the relationship between inclusion teachers' math anxiety and self-efficacy and the academic achievement of their LD students.

Suggestions for future studies would include:

1. Further study should be conducted with a larger population of inclusion teachers.
2. Further study should use a simple random sampling method to create a sample highly representative of the population of inclusion math teachers.

3. Further study should be conducted with individual standardized archived data (i.e., PSAT, SAT, State Exams, etc.) from each LD student of participating inclusion math teachers.
4. Further study should investigate the impact of teacher anxiety and self-efficacy on achievement from the student's perspective.
5. Further study should investigate other subjects than mathematics. Other teaching anxiety regarding the subject to be taught (i.e., Chemistry, Physics, Biology, etc.) and a lack of efficacy in teaching ability could affect student achievement.

Conclusion

This quantitative study examined the strength of the relationship between inclusion teachers' math anxiety and self-efficacy and the academic achievement of their LD students in a group of public school districts in the United States. The data were collected among eight high schools in three different urban school districts in two northeastern states. Fifteen special education teachers who co-taught Algebra I, Geometry, Trigonometry, or Algebra II to LD students in an inclusion setting during the 2013-2014 school year took a three-part survey on mathematics anxiety, teaching efficacy, and demographics (Appendices A, B, & C). LD students archived Grade 11 school standardized data of the eight schools and their end-of-course final average classroom data were obtained respectively through state websites and their inclusion teachers' responses in the demographic questionnaire. Linear regression analyses were used to find out the impact inclusion teachers' math anxiety and teaching efficacy had on the achievement of their LD students.

The results of this study revealed that both inclusion teachers' math anxiety and teaching efficacy whether they acted independently or combined did not significantly predict student achievement of LD students. This is a direct contradiction to previous studies that have shown that math anxiety has been unfavorable to non-LD student achievement (Witt, 2012; Zakaria & Nordin, 2008) whereas teaching efficacy has been essential to non-LD student achievement (Khan, 2011; Mojavezi & Tamiz, 2012). Because of the limitations of this study, I believe that more studies are needed to address the concept of math anxiety and teaching efficacy with regard to the assignment of special education teachers in mathematics classrooms. LD students deserve to be assigned effective special education teachers who can make math easier to them. LD students have as much of a stake in society compare to their non-LD student counterparts. However, when they are deprived of a good mathematics education it is possible that they will less likely pursue academic fields related to science, technology, engineering, and mathematics thereby reducing their progress and status in society.

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Appendix A: Personal Mathematics Teaching Efficacy

A subscale of the
Mathematics Teaching Efficacy Beliefs Instrument

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

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. I will continually find better ways to teach mathematics.	5	4	3	2	1
2. Even if I try very hard, I will not teach mathematics as well as I will most subjects.	5	4	3	2	1
3. I know how to teach mathematics concepts effectively.	5	4	3	2	1
4. I will not be very effective in monitoring mathematics activities.	5	4	3	2	1
5. I will generally teach mathematics ineffectively.	5	4	3	2	1
6. I understand mathematics concepts well enough to be effective in teaching elementary mathematics.	5	4	3	2	1
7. I will find it difficult to use manipulatives to explain to students why mathematics works.	5	4	3	2	1

8. I will typically be able to answer students' questions.	5	4	3	2	1
9. I wonder if I will have the necessary skills to teach mathematics.	5	4	3	2	1
10. Given a choice, I will not invite the principal to evaluate my mathematics teaching.	5	4	3	2	1
11. When a student has difficulty understanding a mathematics concept, I will usually be at a loss as to how to help the student understand it better.	5	4	3	2	1
12. When teaching mathematics, I will usually welcome student questions.	5	4	3	2	1
13. I do not know what to	5	4	3	2	1

do to turn students on to mathematics.					

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Appendix B: Learning Mathematics Anxiety

A subscale of the
Revised Mathematics Anxiety Rating Scale

The items in this questionnaire refer to things and experiences that may cause fear or apprehension. Answer each item below to indicate how you feel today using the following code:

1 = Low anxiety
2 = Some anxiety
3 = Moderate anxiety
4 = Quite a bit of anxiety
5 = High anxiety

Work quickly and be sure to consider each item individually.

	Low anxiety	Some anxiety	Moderate anxiety	Quite a bit of anxiety	High anxiety
1. Watching a teacher work an algebraic equation on the blackboard.	1	2	3	4	5
2. Buying a math textbook.	1	2	3	4	5
3. Reading and interpreting graph or charts.	1	2	3	4	5
4. Signing up for a course in statistics.	1	2	3	4	5
5. Listening to another student explain a math formula.	1	2	3	4	5
6. Walking into a math class.	1	2	3	4	5
7. Looking through the pages on a math text.	1	2	3	4	5
8. Starting a new chapter in a math book.	1	2	3	4	5

9. Walking on a campus and thinking about a math course.	1	2	3	4	5
10. Picking up a math textbook to begin working on a homework assignment.	1	2	3	4	5
11. Reading the word "Statistics."	1	2	3	4	5
12. Working on an abstract mathematical problem, such as: "If x = outstanding bills, and y = total income, calculate how much you have left for recreational expenditures".	1	2	3	4	5
13. Reading a formula in chemistry.	1	2	3	4	5
14. Listening to a lecture in a math class.	1	2	3	4	5
15. Having to use tables in the back of a math book.	1	2	3	4	5
16. Being told how to interpret probability statements.	1	2	3	4	5

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Appendix C: Demographics

1. What is the name of your school district?		
2. What is the name of your high school?		
3. How many inclusion mathematics teachers are in the school?		
4. Which mathematics course(s) did you co-teach last year?		
5. How many learning disabled students did you co-teach last year in mathematics classrooms?		
6. Of those learning disabled students you co-taught, how many passed and how many failed the course?	# Passed	#Failed

Appendix D: Request to Use of MTEBI

Dr. Riggs and Dr. Enochs, November 8, 2013

My name is Vladimir Sylne and I am a doctoral student at Walden University. I am writing this letter to request your permission to use the MTEBI survey in my doctoral study. I am trying to analyze whether inclusion mathematics teachers' anxiety and teaching efficacy impact their students achievement in mathematics. I would like to have your permission to use the MTEBI survey to collect data from mathematics inclusion teachers in my study. I would appreciate your assistance in this process. Thank you very much for your time

Sincerely,

Vladimir Sylne
xxxxxxxx
xxxxxxxxxx@xxxxxxxx

Appendix E: Consent Form

CONSENT FORM

Purpose of the project:
You are invited to participate in a research study on the relationship between math anxiety and efficacy in high school inclusion mathematics teachers (special education teachers who co-teach in math classes with regular mathematics teachers) and the achievement of the learning disabled (LD) students they serve. This form is part of a process called "informed consent" to provide you information about the study before deciding whether to participate.

This study is being conducted by Vladimir Sylne who is a doctoral student in the Richard W. Riley College of Education at Walden University and a mathematics teacher in the Jersey City public school district.

Background information:
The purpose of this study is to examine the relationship between math anxiety and efficacy in high school inclusion mathematics teachers and the achievement of the LD students they serve. This study is trying to determine whether math anxiety in inclusion teachers and teacher efficacy of inclusion teachers affect the achievement of learning disabled students.

How the participants were selected:
You were chosen for the study because you are a high school inclusion teacher who taught Algebra I, Geometry, Trigonometry, or Algebra II to LD students during the 2013-14 school year. This consent form is made available to you and to any other inclusion math teachers in the United States who would like to participate in the study.

What information is being requested?
I am asking you to use the hyperlink provided to complete a 20-minute survey and to be as candid and honest as possible in your responses. The survey has three parts. The first part concerns mathematics anxiety; one of the sample questions is: Do you feel anxious when you are starting a new chapter in a math book? The second part concerns mathematics teaching efficacy; one of the sample questions is: When a student has difficulty understanding a mathematics concept, are you usually at a loss as to how to help the student understand it better? The third part concerns the demographic of the participant; one of the sample questions is: Which mathematics course(s) did you co-teach last year? The responses to the survey questions will be compiled and reported as frequencies. Your survey score will be compared to your LD student standardized mathematics test scores or their end-of-course final average scores in Geometry, Trigonometry, and Algebra I and II.

Benefits of being in the study:
Involvement in this study carries no special benefits for participants or their students. It is expected that the results of this study will be useful to school districts as they consider ways to improve the achievement of LD students in mathematics inclusion classrooms.

Possible risks of being in the study:
All information in the study will be kept confidential. There is very minimal risk to students and to you (teacher). Student test scores will be collected with no identifying information about any student. Teacher survey data will be collected with a hyperlink and kept confidential.

To whom the results will be made available and for what purpose:
The results of this study will be published in a doctoral dissertation through Walden University. An executive summary of the study will be made available to the participating inclusion teachers and school districts for information purposes only.

Voluntary nature of the study:
Your participation in this study is voluntary. This means that everyone will respect your decision should you choose not to participate. If you decide to join the study now, you can still change your mind during the study. You may inspect the survey before you decide to join the study. If you feel stressed during the study you may stop at any time and withdraw your consent.

Compensation:
There is no compensation for participating in this study.

Confidentiality:
Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study.

Contacts and questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher (Vladimir Sylne) via xxxxxxxxxx@xxxxxxx or (000) 000-0000. If you want to talk privately about your rights as a participant, you can call **Dr. Leilani Endicott**. She is the Walden University representative who can discuss this with you. Her phone number is **xxxxxxxxxx**. Walden University's approval number for this study is **06-25-14-0141746** and it expires on **June 24, 2015.**

The researcher will give you a copy of this form to keep.

Statement of consent:
I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By electronically filling and submitting the survey provided at the bottom of this consent form, I am agreeing to the terms described above.

Survey Link: http://bit.ly/AnxietyEfficacySurvey

Appendix F: Flyer

Math Teacher Seeks Help from Current Special Education Teachers

"Hi! I am a current PhD candidate and a high school mathematics teacher. Though familiar with **inclusive education**, it wasn't until a decade into my career as a mathematics teacher that I noticed an unintended impact on **learning disabled students**. For my dissertation, I am using a **survey** to assess math anxiety and teaching efficacy of **inclusion teachers** (special education teachers who co-teach in math classes with regular mathematics teachers). The goal is **NOT** to evaluate inclusion teachers. Instead, it is to determine if there are connections between math anxiety and teacher efficacy and student achievement in mathematics."

Would you (or a friend) like to participate in this study?

Who: Any High School Inclusion Teachers Who Co-Teach in the United States

What: Complete a 20 min survey

When: before June 25th

How: Read Consent Form and Click on the Link Provided at the Bottom of the Consent Form to Begin the Survey

Consent Form: http://bit.ly/ParticipantsConsentForm

Vladimir Sylne | Walden University | IRB **06-25-14-0141746** | xxxxxxxxxxxx@xxxxxxxxxx

Appendices D and E are adapted from:

Maguire, K. (2011). The role of teacher efficacy in student academic achievement in mathematics. (Order No. 3449809, Walden University). ProQuest Dissertations and Theses, , 128. Retrieved from http://search.proquest.com/docview/863675545?accountid=14872. (prod.academic_MSTAR_863675545).

Appendix F is adapted from:

Cain, J. M. ("n.d."). *Former teacher seeks help from current teachers*. [Brochure]. "n.c.": Jessie Montana Cain.