FACTORS INFLUENCING SPECIAL EDUCATION TEACHERS' MATHEMATICS TEACHING EFFICACY

by

Owen Edgar Martin

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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APPROVED BY:

Elizabeth Hillman, Ed.D., Committee Chair

Ann Colorado, Ed.D., Committee Member

David Gorman, Ed.D., Committee Member

ABSTRACT

This research examined the relationship between secondary special education teachers' mathematics teaching efficacy and the number of years of teaching experience, years of co-teaching experience, and number of math content coursework taken at the undergraduate level. Students with special needs continue to score significantly lower than their general education peers on Virginia's standards of learning mathematics tests. A quantitative, non-experimental correlational research design was used in this study. The targeted sample consisted of approximately 120 collaborating special education teachers in two school districts in southeastern Virginia. The Mathematics Teaching Efficacy Belief Instrument (MTEBI) was measure mathematics teaching efficacy and teacher mathematics content knowledge was measured by a survey of courses taken. A Spearman's rho correlation test was used to determine if a statistically significant relationship existed among the variables. The study found a positive relationship between mathematics teaching efficacy and years of mathematics co-teaching experience $r_s = .451$, $p = .01$ and a positive relationship between mathematics teaching efficacy and total math courses taken $r_s = .297$, $p = .014$. There was no relationship found between mathematics teaching efficacy and years of teaching experience. Results support increased efforts are needed to provide content specific education for special education teachers in the area of secondary mathematics.

Keywords: self-efficacy, student achievement, collaboration, special education teacher, mathematics, students with disabilities

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List of Abbreviations

American College Testing (ACT)

Americans with Disabilities Act (ADA)

Annual Yearly Progress (AYP)

Common Core State Standards (CCSS)

Elementary and Secondary Education Act (ESEA)

Every Student Succeeds Act (ESSA)

Free and Public Education (FAPE)

Individualized Education Plan (IEP)

Least Restrictive Environment (LRE)

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)

Mathematics Teaching Outcome Expectancy (MTOE)

National Assessment of Educational Progress (NAEP)

No Child Left Behind (NCLB)

Personal Mathematics Teaching Efficacy (PMTE)

Program for International Student Assessment (PISA)

Science Technology Engineering Mathematics (STEM)

Standards of Learning (SOL)

Virginia Department of Education (VDOE)

CHAPTER ONE: INTRODUCTION

Overview

Chapter One will discuss the background related to special education teachers' mathematics teaching efficacy. The problem statement will be discussed, including recommended research from previous studies. The purpose of this study will be discussed, as well as the significance of the current study. Finally, the research questions will be introduced, and definitions pertinent to this study will be given.

Background

French emperor, Napoleon Bonaparte, once said "the advancement and perfection of mathematics are intimately connected with the prosperity of the State." (Moritz, 1914, p. 42). Currently, educators place special emphasis on the ability of students to demonstrate proficiency in mathematics before they graduate high school and enter the community as productive citizens. The U.S. Bureau of Labor and Statistics projects that careers in the fields of science, technology, engineering, and math (STEM), will increase to nine million jobs by 2022 (Vilorio, 2014). Thus, preparing students for these challenging careers continues to be the nation's focus. Federal and state level accountability guidelines set minimum standards by which schools and school districts are assessed.

Despite the nation's focus on academic performance and achievement in math, the achievement of students with special needs continues to lag far behind their peers without disabilities in the area mathematics as, indicated by results from Virginia's Standards of Learning (SOL) test (Virginia Department of Education, 2016). The federal government has defined special education in the Code of Federal Regulations, Title 34 section 300.39 as "specifically designed instruction, at no cost to the parents, to meet the unique needs of a child with a disability" (Code of Federal Regulations, p.22, 2012). Accountability guidelines for educating students with disabilities were provided in the No Child Left Behind (NCLB) legislation, then recently defined by the replacement legislation Every Student Succeeds Act (ESSA), which is a reauthorization of the 1965 Elementary and Secondary Education Act (ESEA).

These accountability guidelines seek to level the playing field for students with identified disabilities, with the goal of helping them meet college and career ready standards and become productive citizens of the community. In 2015-2016, Virginia had just under 8% of the student population composed of students with various disabilities (Virginia Department of Education, 2016). Students with disabilities must continue to receive a free and appropriate education (FAPE) in their least restrictive environment (LRE) (Carson, 2015). Students with disabilities taking general education classes will be assessed on their attainment of general education standards through the state standardized assessment, or SOL tests. In order to meet the requirements of the ESSA, assessment results from the SOL's are reported annually for accountability at the state and federal levels (ESSA, 2015). The researcher will investigate factors that influence special education teachers' mathematics teaching efficacy and the relationship to the achievement of students with disabilities. The researcher sought to uncover ways to increase teaching efficacy of special education teachers and close the achievement gap between students with disabilities and their peers without disabilities.

Students with disabilities throughout the nation and in the state of Virginia, have disproportionately low levels of mathematics proficiency as compared to their non-disabled peers (King, Lemons, & Davidson, 2016; Schulte & Stevens, 2015). The National Assessment of Educational Progress (NAEP) assesses students throughout the nation in a variety of subjects, including mathematics. In 2015 there was a 43-point achievement gap between grade eight students with disabilities and their non-disabled peers (US Department of Education, 2016). In the state of Virginia, the gap is significant, although slightly smaller, at 38 points. Results from the 2015 NAEP mirror the trend from previous assessment years, in which the achievement gap between students with disabilities and their non-disabled peers remained steady with non-disabled students scoring higher each year (US Department of Education, 2016). In an analysis of the Standards of Learning (SOL) assessments in the state of Virginia, a similar trend was found. Students with disabilities scored lower on mathematics SOL tests than their non-disabled peers (Virgnia Department of Education, 2016). According to the Virginia Department of Educations's (VDOE) 2015-2016 Mathematics SOL data, 49% of students with disabilities passed these standardized assessments while 80% of their non-disabled counterparts passed. Elbaum, Myers, Rodriguez, & Sharpe (2014) indicated that mathematics is an area in which students with disabilities need additional support in order to meet yearly benchmarks and stay on track for graduation.

One factor that plays a significant role in determining the success of teachers in the classroom is self-efficacy. Bandura's social learning theory (1977), and later development of self-efficacy scales, provided the tools needed for researchers to confirm a correlation between teacher self-efficacy and student learning. Teachers in the classroom need to feel confident and capable about the content they teach. Swackhamer, Koellner, Basile, and Kimbrough (2009) confirmed this finding by exploring the relationship between teacher self-efficacy and the number of pre-service content courses taken. They found that there was a positive relationship between teacher self-efficacy and teacher content knowledge (Swackhamer et al., 2009). As teachers' coursework in their content area increased, so did their sense of self-efficacy, or belief that the work that they did, made a positive impact on students (Swackhamer et al., 2009). This research has assisted in identifying a key component to professional learning; content knowledge taught alongside effective pedagogy ensures the development of competent and confident teaching professionals (Swackhamer et al., 2009). Swackhamer et al., (2009) found that self-efficacy was positively correlated with content knowledge, which was confirmed in a later study by Gulten (2013).

Gulten (2013) found that math ability and math teacher self-efficacy are correlated. In his study, Gulten (2013) found that teachers with a higher ability in math felt more comfortable and confident in the mathematics classroom. Unfortunately, current Virginia licensure requirements for the special education endorsement titled, general curriculum K-12, do not include specific mathematics coursework or require a minimum mathematics proficiency assessment (8VAC20-22-540).

Another factor impacting special education teacher self-efficacy is role of the instructional delivery method. Co-teaching is an instructional delivery method that targets the needs of students with disabilities (Panscofar & Petroff, 2013). Co-teaching can be defined as a special education and general education teacher work together to provide direct instruction and support for all students in a general education setting (Panscofar & Petroff, 2013). In-service and targeted professional development has been shown to anecdotally increase the success of co-teaching relationships (Panscofar & Petroff, 2013). Pancsofar and Petroff (2013) found that professional development opportunities in co-teaching were positively related to improved attitudes, confidence, and interest in co-teaching. Teachers that were provided additional opportunities to learn and practice co-teaching were more likely to report higher confidence, positive attitudes, and an interest in the practice of co-teaching (Panscofar & Petroff, 2013).

Although targeted in-service training and professional development for teachers has been shown to yield higher levels of self-efficacy (Panscofar & Petroff, 2013), there is little evidence to suggest that special education teachers receive content specific instruction, particularly in the secondary level math courses, such as, pre-algebra, algebra, and geometry (Bottge, Toland, Gassaway, Butler, Choo, Griffen, & Ma, 2015). Furthermore, special education teachers typically have licenses which enable them to collaborate and teach in several different K-12 content areas even over the course of the same year (8VAC20-22-540). As a result, teaching assignments for special education teachers often change year to year. Becoming an expert in a content area is especially challenging for special education teachers who often switch between content areas such as math, science, history, and English. Due to the significant relationship between teacher self-efficacy and student achievement (Chang, 2015; Hines, 2008; Khan, 2012; Rashidi, & Moghadam, 2014), educational leaders have a responsibility to help build the self-efficacy of teachers. Improving self-efficacy in mathematics teachers is vital, since that is the area in which students with disabilities are experiencing difficulty (King, Lemons, & Davidson, 2016; Schulte & Stevens, 2015).

With the enactment of No Child Left Behind (2002) and the Individuals with Disabilities Education Act (2004), student services are now focused in the general education classroom instead of an alternate setting. Unfortunately, teacher training and the experience of veteran teachers has been focused on a more traditional pull-out and self-contained instructional model. Without proper training, many veteran teachers are left with a gap in knowledge and experience when working with students with special needs in the general education or co-taught setting (Panscofar & Petroff, 2013). A research study by Loreman, Sharma, and Forlin (2013) found that teacher self-efficacy for teaching in an inclusive classroom is positively correlated with high teacher confidence, training in special education, and experience working with students with special needs. Therefore, it would stand to reason that teacher education programs should provide teacher candidates with a variety of experiences working with students with special needs in the field, especially in the inclusive setting (Hamilton-Jones & Vail, 2014). Additionally, pre-service teachers should be given opportunities to work closely with their general education and special education teacher candidate peers to collaborate in lesson planning and instruction (Loreman et al., 2013).

Teacher preparation programs play a key role in ensuring teachers have the pedagogical and content skills they need to succeed in the classroom (Hamilton-Jones & Vail, 2014). Preparing special education teachers is a challenge due to the high, and various demands put on them by school districts (Harris, Pollingue, Hearrington, & Holmes, 2014). Special education teachers are responsible to co-teach, and also develop and implement an annual Individualized Education Plan (IEP) for approximately 16-20 students annually. Increased class sizes along with decreased time for professional growth and learning are factors that have contributed to high attrition rates for special education teachers (Lee, Patterson & Vega, 2011). Lee et al. (2011) found that teachers have higher levels of self-efficacy when they have a high perceived level of control over the factors that help them succeed. Administrators and district support personnel should take this into consideration when providing teacher support and professional development (Lee et al., 2011).

Problem Statement

Evidence of a positive relationship between teacher self-efficacy, student learning and achievement has been clearly established in a variety of academic contexts (Chang, 2015; Hines, 2008; Khan, 2012; Rashidi, & Moghadam, 2014). Additionally, evidence exists to support the positive relationships between teacher self-efficacy and level of teacher content knowledge (Gulten, 2013; Rosas & Campbell, 2010; Swackhamer et al., 2009; Hunt-Ruiz & Watson, 2015), and professional development (Park, Roberts, & Stodden, 2012; Stevens, Aguierre-Munoz, Harris, Higgins, & Liu, 2013). Thus, the current body of literature provides a foundation for understanding what self-efficacy is and a few of the factors by which it may be influenced. Despite the considerable research on this topic, there are still areas of exploration that can yield important information for educators. One area is the investigation of self-efficacy through various contextual lenses (Isiksal-Bostan, 2016). Important additions to this body of research include, understanding the contexts in which self-efficacy plays a role, understanding the development of self-efficacy through professional growth, and the factors that influence self-efficacy (Ji-Won, Seong Won, Chungseo, & Oh Nam, 2016). One such contextual lens, is the self-efficacy of the special education teacher serving students with disabilities in an inclusive mathematics classroom.

There is limited empirical evidence in the literature describing the relationship between special education teachers teaching efficacy and academic achievement in mathematics. Thus, a gap in the literature exists regarding the factors that are related to special education teachers' mathematics teaching efficacy. The present research will focus on the factors that may influence special education teachers' mathematics teaching efficacy, such as math content background, number of years co-teaching mathematics, and years of teaching experience.

Purpose Statement

The purpose of this study was to gain an understanding of how Virginia secondary special education teachers' mathematics teaching efficacy may be related to the number of years of teaching experience, years of co-teaching experience, and number of math content coursework taken at the undergraduate level. A quantitative correlational research design was used to study the relationship between mathematics teaching efficacy and teachers' mathematics background (Gall, Gall, & Borg, 2007). The criterion variable for this study is mathematics teaching efficacy, and the predictor variables for this study were, the number of years of teaching experience, years of co-teaching experience, and the number of math content coursework taken at the undergraduate level. Participants were currently employed, licensed special education teachers serving in public middle or high schools in southeastern Virginia. The researcher framed the research with educational theory and research questions. The theoretical framework guiding this study was Albert Bandura's self-efficacy theory, which was central to his social learning theory. Self-efficacy is defined as an individual's belief that he or she will accomplish a particular assignment (Bandura, 1997).

The researcher sought to answer questions regarding the relationship between mathematics content background, mathematics co-teaching experience, and teaching experience of special education teachers and their self-efficacy. The research suggests that as content background knowledge, years co-teaching, and total years teaching experience increase, mathematics teaching efficacy will increase. Math content coursework is defined as:

> courses taken at the undergraduate level (i.e., two-year or four-year institution) or at the graduate level that will not duplicate previous courses taken in the humanities, history and social sciences, the sciences, mathematics, health and physical education, and the fine arts. These courses are usually available through the college or department of arts or sciences." (Code of Virginia, 8VAC20-22-10, 2015)

In addition to investigating the relationship between content background knowledge and teacher self-efficacy, the author explored the relationship between years of experience with co-teaching and teacher self-efficacy. Years of co-teaching was defined as the number of years the special education teacher has participated in providing in-class instruction with a general education teacher, for students with and without disabilities in a regular education setting (Panscofar & Petroff, 2013). The third predictor variable in this study was the years of teaching experience. Total years of teaching experience included all years employed as a fully licensed educator. The three predictor variables content knowledge, years of co-teaching experience, and years of teaching experience were investigated in relationship to the criterion variable, mathematics teaching efficacy. Mathematics teaching efficacy was defined as "a judgment of his or her capabilities to bring desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Ryang, 2012, p. 45). This construct was measured by the Mathematics Teaching Efficacy Beliefs Instrument (Enochs, Smith, & Huinker,, 2000). Participants for the study included secondary special education teachers from two school districts in southeastern Virginia.

Significance of the Study

Mathematics achievement for students in the United States has increased when measured by national assessments (Kena, Hussar, McFarland, de Brey, & Musu-Gillette, 2016); however, achievement levels are still significantly behind international peers (Kelly, Nord, Jenkins, Chan, & Kastberg, 2013). Students with disabilities continue to underperform as compared to their non-disabled peers in multiple areas including mathematics, thus leading to significant concerns regarding the current instructional methods, pedagogy, and standards being utilized to provide services to students with disabilities (King et al., 2016). In Virginia, students with disabilities continue to score significantly lower in secondary mathematics courses than their general education peers on Virginia's SOL end of course assessments (Virginia Department of

Education, 2015b). Factors such as instructional methodology and teacher self-efficacy have been shown to improve the achievement of all students in the area of mathematics (Hinton & Strozier, & Flores, 2014; Lewis, 2016; Myers, Jun, Brownell, & Gagnon, 2015; Satsangi, Bouck, Taber-Doughty, Bofferding & Roberts, 2016; Kıvılcım, Toros, Miman, & Soyer, 2013; Lee et al., 2011; Wang, Zan, Liu, Liu, & Sharma, 2012). Researchers have uncovered factors that contribute to raising levels of teachers' self-efficacy (Jamil, 2012; Park et al., 2012).

This study may help assist pre-service teacher preparation programs and K-12 public school systems with understanding the importance of increasing self-efficacy of special education teachers through professional development and pre-service training. Teacher preparation programs play a key role in ensuring teachers have the pedagogical and content skills they need to succeed in the classroom (Swars & Dooley, 2010). Preparing special education teachers is a challenge due to the various demands put on them by school districts. Increased class sizes along with decreased time for professional growth and learning have led to high attrition rates. Understanding what increases the mathematics teaching efficacy of special education teachers, will benefit all involved in the training and hiring of teachers in this field.

Research Questions

The research questions for this study are:

RQ1: What is the relationship between the number of mathematics content courses taken and mathematics teaching efficacy of secondary special education teachers?

RQ2: What is the relationship between years of mathematics co-teaching experience and mathematics teaching efficacy of secondary special education teachers?

RQ3: What is the relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers?

Definitions

The following terms are used throughout the study within an educational context. The definitions below provide clarity and understanding as to how they should be understood in the study.

1. *Co-teaching* – special education teachers providing in-class instruction, alongside a general education teacher, for students with and without disabilities in a regular education setting (Panscofar & Petroff, 2013).
2. *Individualized education plan – "*a written statement for each child with a disability that is developed, reviewed, and revised in a meeting" (IDEA, 20 U.S.C. § 2004).
3. *Mathematics course content knowledge –* is defined as the number of math content coursework "taken at the undergraduate level (i.e., two-year or four-year institution) or at the graduate level" (Code of Virginia, 8VAC20-22-10, 2015).
4. *Mathematics teaching efficacy* – "a judgment of his or her capabilities to bring desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Ryang, 2012, p. 45).
5. *Self-efficacy* – an individual's belief or sureness that they will accomplish a particular assignment (Bandura, 1997).
6. *Special education* – "specifically designed instruction, at no cost to the parents, to meet the unique needs of a child with a disability" (IDEA, 2004, sec. 300.39).
7. *Special education teacher* – teachers licensed in area of special education to provide specially designed instruction for students with disabilities (Occupational Outlook Handbook, 2015).

8. *Years of co-teaching experience* – total number of years of full-time experience working in a collaborative classroom setting.
9. *Years of teaching experience* – total number of years of full-time teaching as a fully licensed teacher.

CHAPTER TWO: LITERATURE REVIEW

Overview

This review of the literature will explore themes within the current body of peer-reviewed literature related to mathematics teaching self-efficacy, mathematics content knowledge, years of co-teaching and teaching experience. The review explores topics such as teacher self-efficacy, special education, mathematics teaching and learning, as well as the measurement of mathematics teacher self-efficacy. The review will conclude with a summary of the existing literature and how it provides a firm foundation for the present study.

Since the enactment of No Child Left Behind (NCLB) in 2002, later reauthorized as the Every Student Succeeds Act (ESSA) in 2015, and the Individuals with Disabilities Education Act (IDEA) in 2004, special education teachers have had an increased role as a collaborator with the general education providing instruction in the general education setting. IDEA mandates that students with disabilities are served in their LRE. The LRE requirement seeks to meet the needs of all students by offering a range of placements from the general education classroom to more restrictive separate schools or hospitals (Carson, 2015).

Currently, in the Commonwealth of Virginia, special education teachers are certified in K-12 General Curriculum (Virginia Board of Education, 2013). This certification requires special education teachers to complete a program that includes a broad range of courses related to specializing the instruction of students with disabilities in the general education setting. This certification does not require teachers to complete courses in secondary mathematics or pass a mathematics skill assessment. Research suggests that mathematics is a highly recognized area of weakness for students with disabilities (Flores, Patterson, Shippen, Hinton, & Franklin, 2010; Schulte & Stevens, 2015). Studies have revealed that the average student with a disability is multiple grade levels behind their same age peers in the area of mathematics, even after individualized interventions and remediation throughout the secondary years (Flores et al., 2010; Schulte & Stevens, 2015).

Source Collection and Delimitation

An exhaustive review of research journals and databases was conducted on the topic using keywords and synonyms such as: self-efficacy, mathematics, mathematics skills, mathematics instruction, mathematics education, academic achievement, achievement gap, disabilities, learning disabilities, graduation rate, special education, and mathematics co-teaching. The literature centered on the following topics: teacher self-efficacy, special education teaching and learning, mathematics teaching and learning, and mathematics teaching self-efficacy. Each of these literature topics of the current research will be discussed, summarized, and strengths and weaknesses identified in an effort to provide an understanding of what variables serve as the best predictor of mathematics teaching self-efficacy. These variables will be used to determine if there is a relationship between mathematics teaching efficacy and mathematics content knowledge, years of co-teaching or teaching experience.

Chapter Organization

The research literature generally can be divided into a few primary areas that serve as the outline for this literature review. The review begins with a discussion of social learning theory and self-efficacy. Self-efficacy will serve as the theoretical framework for this study and foundation from which the researcher will develop the research questions and hypotheses. Next, special education and its core components related to student achievement in mathematics are discussed. These core components include the pedagogy of co-teaching, licensing and education requirements, special education teacher self-efficacy and how specialized instructional techniques help boost student achievement. The review will also examine the professional development and in-service training requirements of special education teachers and the impact this has on their self-efficacy and performance in the classroom.

Next, the review will explore the area of mathematics teaching and learning. Special emphasis will be placed on the national and international achievement of students in the area of mathematics and research-based strategies for improving instructional practices for students with disabilities. Finally, the review will focus on how mathematics teaching efficacy is specifically measured and what the literature reports about this topic. Overall, this review of the literature provides a synthesis of the existing literature regarding self-efficacy and guides in establishing the basis for why this study will make a meaningful contribution to the existing research.

Theoretical Framework

A theoretical framework sets the purpose and rationale for the study and helps underscore the reasoning by which the researcher has developed the area of research focus. In this section of the review of literature, a theoretical framework for the study is established. Social learning theory and self-efficacy will be explored as foundational concepts for understanding the impact of a teacher on a learner's achievement.

Albert Bandura, a Stanford University professor of psychology, focused his work on understanding a variety of aspects of human behavior. Bandura (1971) outlined a social learning theory, underscoring that "psychological functioning is best understood in terms of a continuous reciprocal interaction between behavior and its controlling conditions" (p. 2). Bandura (1971) emphasized that learning can be "acquired through direct experience or by observing the behavior of others" (p. 3), thus laying the foundation for his major social learning ideas; direct experience and modeling. Bandura proposesd that one-way humans learn new behaviors is through direct experience. Through this form of learning, people are able to try out several different methods or behaviors, then discard those that did not reach the desired outcome and keep those that did. The most effective behaviors with the most favorable outcomes will be those that are more likely to stay with the individual. An important key to the success of direct experience learning is the function of reinforcement (Bandura, 1971). Reinforcement comes as the effects of one's behavioral choices are experienced and come through the direct verbal and physical reinforcement of others around the learner (Bandura, 1971). As new behaviors are tried out and explored, feedback from the social interactions is used to train the behavior to stay, change, or go away.

In addition to direct experience, learning can also take place through modeling. Modeling is an essential tool for learning because not all behaviors are safe or appropriate to explore without consequence. Together, direct experience and modeling form the foundation of social learning theory. Bandura's (1971) research in the area of social learning theory has led to deeper understanding of reinforcement and efficacy in shaping student behavior.

Building on his previous work in the area of social learning, Bandura (1977) developed a more specific understanding of the influence of internal feedback, reinforcement, and efficacy on behaviors and outcomes. Bandura (1977) revealed that individual responses to the same stimuli vary "because people have met with different types and amounts of efficacy-altering experience" (p. 212). The theory of self-efficacy identifies personal expectations or beliefs in one's ability to produce the actions necessary to reach the desired outcomes as integral to changing behavior. Bandura (1977) noted that, "efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences" (p. 194).

Individuals with high self-efficacy will be more resilient in the face of adversity and tend to have better coping skills (Bandura, 1997).

Throughout the mid 1980's, Bandura's (1977) self-efficacy and social learning theories expanded beyond the field of psychology and into the field of education. Multiple researchers built upon Bandura's foundational ideas and began a series of research studies focused on the role of self-efficacy (Leary & Atherton, 1986, Kanfer & Zeiss, 1983; Pajares & Miller 1994; Zimmerman & Martinez-Pons, 1996). Kanfer and Zeiss (1983) studied depression and self-efficacy, Leary and Atherton (1986) investigated social anxiety and self-efficacy, Pajares and Miller (1994) explored self-concept and self-efficacy in mathematics, and Zimmerman and Martinez-Pons (1996) investigated self-efficacy's role in educational development. Hillman (1986) used Bandura's (1977) work as a springboard and went on to develop scales that can be used to measure teacher self-efficacy. These measures of self-efficacy have provided a wealth of data for researchers to explore and have been particularly helpful to educational researchers who have focused on understanding the impact of teacher self-efficacy on student achievement. Klassen and Tze (2014) conducted a meta-analysis analyzing 43 studies and 9, 216 participants, and revealed a significant, positive relationship between teacher self-efficacy and evaluated teacher performance. The findings from Klassen and Tze's (2014) meta-analysis confirmed the understanding that improved teacher self-efficacy is significantly correlated with more effective teaching.

In conclusion, Bandura's (1971) social learning theory set the stage to understanding how behaviors and skills are learned through complex social interactions. The social learning theory provided the foundation needed to further understand how humans make behavioral changes based on internal and external feedback cycles. Self-efficacy, as explored by Albert Bandura

(1977), helps to understand the complex set of expectations that drives an individual's confidence and actions in the teaching and learning cycle. The next section focuses on what the current literature states about how teacher self-efficacy is defined, the factors that influence teacher self-efficacy, its impact on student growth and achievement, and how teacher self-efficacy can be improved in pre-service and in-service teacher groups. In conclusion, the researcher will explore the impact of self-efficacy on special education student achievement and uncover the aspects of self-efficacy influencing mathematics achievement for students with disabilities.

Related Literature

Teacher Self-Efficacy

Teachers play a critical role in the teaching and learning cycle within the classroom. The teacher is the individual who is charged with the responsibility of delivering information so that students have the highest likelihood of succeeding (Scott, Cooper, & Hirn, 2015). Teacher self-efficacy is the belief a teacher holds in themselves that they can impact their students' learning outcomes (Kıvılcım et al., 2013; Lee et al., 2011; Wang et al., 2012). Bates, Latham, and Kim (2011) understood teacher self-efficacy as a belief of confidence regarding the performance of particular responsibilities. A considerable amount of research has been conducted regarding the positive relationship between in student achievement and teacher self-efficacy (Hines, 2008; Khan, 2012; Rashidi & Moghadam, 2014). In this section, the researcher will focus on what the current literature reveals about the role of teacher self-efficacy.

Teacher self-efficacy plays an important role in determining the success of teachers in the classroom (Khan, 2012). Teacher self-efficacy is composed of two expectations that include efficacy expectation and outcome expectation (Bandura, 1977). Efficacy expectation is the belief that "one can successfully execute the behavior required to produce the outcomes" (Bandura, 1977, p. 193). Therefore, teachers need to believe that they are capable of providing effective instruction for students. Outcome expectation is a "person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193). For teachers, this is the belief that their instruction will produce positive learning outcomes for their students (Bandura, Barbaranelli, Capara, & Pastorelli, 1996). These expectations guide thoughts and feelings, determine which instructional activities are chosen, the energy spent instructing, and the extent of perseverance through challenging times (Chang, 2015). Self-efficacy is measured by scales, such as the "self-efficacy scale for teachers" by Kıvılcım et al. (2013) that evaluate teacher opinions and attitudes toward their own effectiveness in the classroom. Bandura's (1977) social learning theory along with the later development of self-efficacy scales, have provided important data, which confirms a positive correlation between teacher self-efficacy and student learning.

Self-efficacy and student achievement. Significant research has found that teacher efficacy impacts students' learning (Chang, 2015; Hines, 2008; Ji-Won et al., 2016; Khan, 2012; Rashidi, & Moghadam, 2014). Chang (2015) concluded that math teaching efficacy is related to student achievement in mathematics, and this interaction is mediated by the students' belief in their own mathematical abilities. In addition to student self-efficacy, teacher self-efficacy has been shown to affect student achievement (Hines, 2008; Kıvılcım et al., 2013; Lee et al., 2011; Wang et al., 2012). Hines' (2008) revealed that students who were taught by teachers with higher levels of self-efficacy scored higher on benchmark tests than students who were taught by teachers with low levels of teaching self-efficacy. Findings in a recent study comparing the outcomes of eighth grade math students in Korea and the United States, researchers found a positive correlation between high teacher self-efficacy and student achievement in mathematics

(Ji-Won et al., 2016). Khan (2012) supported this finding as he found that both male and female teacher self-efficacy was significantly related to student academic achievement in both math and English. Rashidi and Moghadam's (2014) study revealed that teacher self-efficacy was significantly related to student satisfaction and achievement in an online course. Thus, supporting that teacher self-efficacy has a significant impact on student learning and outcomes in the classroom (Rashidi & Moghadam, 2014).

In addition to student learning and achievement, teacher self-efficacy can also change teacher behaviors that impact the classroom environment. Nurlu's (2015) qualitative investigation of mathematics teaching self-efficacy in pre-service elementary teachers revealed that teachers with higher self-efficacy levels were more likely to show "a higher level of effort and persistence with students" (p. 504). Teachers with higher self-efficacy were more willing to try new instructional strategies (Nurlu, 2015). Additionally, the teachers with higher levels of mathematics self-efficacy were more likely to feel responsible for their students' success (Nurlu, 2015). High levels of teacher self-efficacy have also been shown to translate into higher levels of job satisfaction, a critical component to building a positive classroom environment (Viel-Ruma, Houchins, Jolivette, & Benson, 2010). Research has shown that teachers with higher levels of self-efficacy are more likely to select instructional methods that focus on building both conceptual and procedural knowledge (Hinton, Flores, Burton, & Curtis, 2015). Hinton, et al's (2015) finding contributed to the overall understanding that high levels of teacher self-efficacy contributes to a powerful change in the learning environment due to its impact on student-teacher relationships, instructional planning, and teacher attitude (Hinton et al., 2015).

Teacher self-efficacy, or the belief a teacher holds in themselves that they are able to have an impact on their students' learning outcomes, plays an important role in the teaching and learning cycle (Kıvılcım et al., 2013; Lee et al., 2011; Wang et al., 2012). There is a significant influence that high and low levels of teacher self-efficacy can have on student achievement (Hines, 2008; Khan, 2012; Rashidi, & Moghadam, 2014). The research further shows that teacher self-efficacy influences not only the educational environment, but the pedagogical choices of teachers as well (Hinton et al., 2015). Therefore, the importance and effect of a teacher's self-efficacy on student achievement and educational environment is clear, however the question remains if a teacher's self-efficacy can be influenced or changed. As a result, improving teacher self-efficacy is the next area of this review's focus.

Improving teacher self-efficacy. Research clearly shows there are many factors that influence teacher self-efficacy, to include: amount of content knowledge, pre-service preparation for the teaching profession, and in-service professional development experiences (Gulten, 2013; Hunt-Ruiz & Watson, 2015; Park et al., 2012; Rosas & Campbell, 2010; Stevens et al., 2013; Swackhamer, et al, 2009). Although many factors have been found to affect self-efficacy, the research can be broken into three specific methods by which teaching self-efficacy can be improved. These are increased content knowledge, pre-service preparation, and in-service professional development.

Content knowledge. As leaders and guides in the classroom, teachers need to feel confident about the content they teach. Swackhamer et al. (2009) examined the relationship between teacher self-efficacy and the number of content knowledge courses taken. Teacher self-efficacy is directly related to content knowledge (Swackhamer, et al., 2009). As teachers' coursework in their content area increased, so did their sense of self-efficacy, or belief that the work that they did would make a positive impact on students. Gulten (2013) supports this tenant, as he found that math ability and math teacher self-efficacy were uniquely correlated. Teachers with a higher ability in math felt more comfortable and confident in the mathematics classroom. Hunt-Ruiz and Watson (2015) theorized that if a teacher struggles with efficacy in mathematics then less emphasis would be given to preparation and application. They further suggested that preservice teachers may not be willing to explore mathematical knowledge in a more conceptual way than they once learned "because of the belief that knowing a procedure without conceptual knowledge is, in fact, understanding" (p. 59). Tabancalı and Çelik (2013) found that academic self-efficacy beliefs of educator applicants had positive effects on their teacher's self-efficacy beliefs.

Likewise, Rosas and Campbell (2010) were interested if these findings applied to special education teachers. Rosas and Campbell (2010) noted that "teachers must have a deep understanding of the subject area they teach as well as the pedagogy to effectively deliver instruction" (p. 103). In Rosas and Campbell's (2010) study, they identified lack of mathematical content knowledge as a key barrier to success for special education teachers. They investigated the relationship between pre-service special education teachers' belief in their academic abilities and their sense of efficacy. Rosas and Campbell (2010) also found that academic self-efficacy was positively related to a special education teacher's personal self-efficacy, and led to higher levels of job satisfaction. Therefore, the role of content knowledge is an important key to self-efficacy not only in the pre-service preparation of special education teachers but also an individual's teaching years (Tabancalı & Çelik, 2013; Rosas & Campbell, 2010).

Bates et al. (2011) found that pre-service general education teacher mathematics self-efficacy was positively correlated to their performance on a skills test. Pre-service teachers who rated their self-efficacy as high scored significantly greater on the skills test than those who rated their mathematics self-efficacy low. Teachers who performed high on the skills test also rated their teaching efficacy higher than those in the low efficacy group. Thus, Hinton et al. (2015) found teachers must have a strong foundation of content knowledge that will directly impact the instruction given to the students. Maccini and Gagcon (2002) found that an abundance of special education teachers are not aware of the goals of the National Council of Teachers of Mathematic's (NCTM) Principles and Standards for School Mathematics (2000). Special education teachers must know and teach general education standards to students with disabilities in the general education setting (Panscofar & Petroff, 2013). Content knowledge is, however, only one factor when it comes to teaching mathematics. Similarly, Swackhamer et al. (2009) found that in service teachers' self-efficacy can be improved through gaining content knowledge. However, research from Swackhamer et al. (2009) provided a deeper explanation of self-efficacy as well as how to increase self-efficacy during the pre-service years through additional content coursework. The review will now turn to preservice training to prepare teachers for their role in the classroom.

Preservice Training. Teacher preparation programs also play a key role in ensuring teachers have the pedagogical and content skills they need to succeed in the classroom (Swackhamer, et al., 2009). Teacher preparation programs enable prospective teachers to build confidence in their content area as well as develop their own pedagogical teaching style. During preparatory coursework, particularly during field experience practicums and internships, a foundation is laid regarding teaching confidence or efficacy. Isikal-Bostan (2016) found that the foundation for teaching efficacy remains solid as pre-service teachers complete their field experiences and internships but may slowly declines by the end of the first year of teaching, as measured by the teachers' self-efficacy scores. Researchers have also explored the area of mathematics knowledge on teaching efficacy.

Brown (2012) studied non-traditional students in a Florida university who may choose to complete a teacher preparation program which includes a math methods course. Brown (2012) found that there was a significant positive correlation between levels of math courses on pre-service teachers' transcript and the teachers' math efficacy beliefs as measured by the Mathematics Teaching and Efficacy Beliefs Instrument (MTEBI) (2000). Brown (2012) further found that the grade earned on the math methods course had a significant correlation with the pre-service teachers' math efficacy beliefs.

However, Hinton, et al. (2015) stressed that special education teachers do not receive the same instruction as a pre-service teacher in the crucial areas of mathematical problem solving and reasoning. Hinton et al. (2015) further concluded that pre-service special education teachers had deficits in content knowledge and low self-efficacy. Bedel (2016) supported these findings by showing that academic self-efficacy in pre-service general education teachers had a medium to strong association with academic motivation. This finding illustrated the effect that positive attitudes and motivation to achieve can have on the belief in one's own effectiveness (Bedel, 2016). Increasing teacher self-efficacy has been the target of much recent research.

Pre-service general education courses that attempt to increase levels of self-concept may result in teachers with greater levels of efficacy in teaching mathematics (Isiksal, 2010). Isiksal (2010) further showed mathematical understanding and reflection as well as utilizing real life materials along with examples have been shown to increase levels of self-concept scores thus improving teaching efficacy. Isaksal (2010) theorized that discussion and development of conceptual understandings between math connections should be emphasized when creating teacher education coursework. Hands-on experience has also shown to improve teacher efficacy.

Pre-service training field experiences provide teachers with a practical way to practice and have real life experiences in what they have learned in the classroom. Rethlefsen and Park (2011) attained score levels of self-efficacy and outcome expectancy using the MTEBI on pre-service teachers before and after field experience. They found that increased levels of self-efficacy were obtained after hands-on and small group mathematics teaching experiences with students (Rethlefsen & Park, 2011). Additionally, they found that real life application and use of manipulatives also increased levels of self-efficacy (Rethlefsen & Park, 2011). Providing training to teachers during their pre-service program plays an important role in preparing them for work in the field but providing ongoing in-service training opportunities ensures their continued success.

In-service training. Teachers regularly undergo in-service training and professional development. There are many different forms and delivery methods of professional development for teachers. Oftentimes, school divisions require minimum levels of professional development for teachers to maintain and renew licensure. Many times, this in school professional development may include information that can influence teacher self-efficacy. Jamil (2012) conducted a study where professional development had statistically significant outcomes for increasing some facets of teacher self-efficacy. The professional development was a web-based consultancy program giving teachers the chance to view exemplar teaching and receive feedback on their own teaching experiences (Jamil, 2012). Participating teachers had higher scores of self-efficacy regarding instructional approaches than the control teachers.

Swackhamer et al. (2009) noted, as discussed above, that increasing in-service teacher content knowledge leads to high levels of teacher outcome expectancy. The study's participants had lower levels of personal efficacy due to lower level of content knowledge. In-service teachers who had taken more content courses to increase content knowledge had higher levels of outcome efficacy, than those who had taken fewer courses (Swackhamer et al., 2009). Similar results have been found in studies involving teacher professional development in specific teaching strategies. For example, Stevens et al.(2013) found increased levels of self-efficacy across domains for participants in a middle school mathematics training course. Shu Chien and Franklin (2011) also found increased levels of self-efficacy in teachers who received training in technology. Park et al, (2012) extended these finding by conducting a study where teachers received a three-day training in the summer focused upon improving attitudes, competence, and self-efficacy for students with special needs. A positive result of raised self-efficacy when working with students with disabilities was recognized the next school year following the summer institute training. In addition to short-term professional development sessions, increased self-efficacy has also been seen in longer-term sessions.

Powell-Moman and Brown-Schild (2011) found that increased scores of teachers' self-efficacy were seen from a two-year professional development program seeking to advance science, technology, engineering, and mathematics (STEM) instruction. Powell-Moman and Brown-Schild's (2011) findings also suggested that content knowledge and research skills gained from the novice teachers during in service programs increased levels of self-efficacy to that of more experienced teachers. Thus, as teachers' skills increased, their confidence in their own ability to effectively deliver instruction to their students, as measured by self-efficacy, also increased.

Self-Efficacy Summary

This review of the literature has revealed that teacher self-efficacy has a significant, positive relationship with student learning and achievement (Chang, 2015; Hines, 2008; Ji-Won et al., 2016; Khan, 2012; Rashidi, & Moghadam, 2014). Additionally, teacher self-efficacy can be influenced by the level of content knowledge (Gulten, 2013; Hunt-Ruiz & Watson, 2015; Rosas & Campbell, 2010; Swackhamer et al., 2009), pre-service preparation programs and in-service professional development, and teacher education programs (Park et al., 2012; Stevens et al., 2013).

Special Education

With the implementation of NCLB in 2002, later reauthorized as ESSA in 2015, and the demands of the Individuals with Disabilities Act (2004), co-teaching is a more common practice for special education teachers than teaching in self-contained settings (Garderen, Scheuermann, Jackson & Hampton, 2009). Teacher preparedness and confidence of effectiveness play key roles in helping students with special needs reach adequate progress (Hamilton-Jones & Vail, 2014). High stakes testing, and increased rigor of state standards continues to have implications on curriculum and instructional practices. Results factor into whether or not schools and school systems have made adequate yearly progress (AYP), which is tied to federal funding (Schulte & Stevens, 2015). In this section, the researcher will review what the literature says about the nature of special education, the role of the special education teacher, and influence of special education teacher self-efficacy on student achievement.

Special education students have traditionally scored lower when compared to their general education peers (Schulte & Stevens, 2015). Students with disabilities struggle in mathematics, even after years of remediation, and fall several grade levels behind their non-disabled peers (Schulte & Stevens, 2015). Additionally, students with disabilities tend to struggle in areas of mathematics related to fluency, reasoning, and procedural knowledge (Schulte & Stevens, 2015). Flores et al., (2010) proposed that achievement level of students with disabilities has not changed much in the last 20 years. Instructional methods and pedagogy should be scrutinized to see why this has been the norm.

Traditionally, math brings about a greater level of anxiety in students than other subjects even early on in elementary years (Tuner, 2016). Bates et al. (2011) found that when a student has a positive belief in his or her ability to do mathematics, they are more likely to put forth greater effort and persist at finishing the goal. This is a key relationship, particularly for students with special needs, since they are more likely to struggle academically throughout their years in school. Early intervention is necessary to help ensure those students, particularly with a math disability or anxiety, are supported to help increase levels of their self-efficacy and feelings towards math. Students who enroll in lower-level college mathematics courses have less mathematics self-efficacy than those enrolled in higher-level courses. Also, mathematics anxiety among college students has been shown to correlate with low self-efficacy (Bates et al., 2011).

Through legislative improvement, by way of ESSA (2015) and IDEA (2004), students with disabilities receive high quality, specialized instruction to meet their unique and individual learning needs (Hamilton-Jones & Vail, 2014). Teachers trained to provide this instruction have diverse educational backgrounds and deliver their instruction in a wide variety of settings (Scruggs, Mastropieri, & McDuffie, 2007). In this section, the review has explored the literature regarding students with disabilities' need for specialized instruction. In the next section, the researcher will outline how the models of instructional delivery have changed, and the impact of these changes on student achievement and teacher quality.

Changing models of instruction. Because of the enactment of No Child Left Behind (2002) and the Individuals with Disabilities Education Act (2004), students with disabilities are now being served in the general education classroom. Unfortunately, teacher training for veteran teachers whom are more familiar with the former model of self-contained classrooms has not caught up, and many are left with a gap in knowledge and experience when working with students with special needs (Panscofar & Petroff, 2013). There are new components to student access to curriculum, such as the co-teaching model(s) and the unique collaborative relationship between two teachers (Scruggs et al., 2007). The inclusion of students with disabilities now requires the special education teacher and general education teacher to work as a team to plan and develop lessons that ensure the success for all students (Tzivinikou, 2015). Loreman et al. (2013) found that teacher self-efficacy for teaching in an inclusive classroom is correlated with high teacher confidence, pre-service training in special education, and pre-service experience working with students with special needs. Teacher education programs should provide teacher candidates with a variety of experiences working with students with special needs in the field, especially in the inclusive setting (Hamilton-Jones & Vail, 2014). Additionally, they should be given opportunities to work closely with their general education and special education teacher peers to collaborate in lesson planning and instruction (Hamilton-Jones & Vail, 2014).

Traditionally, students with disabilities received direct instruction in a self-contained setting or resource classroom, more recently however, they are being instructed in the general education classroom with their non-disabled peers (Carson, 2015). Therefore, collaboration or co-teaching has become a common instructional method to meet the need for specialized instruction (Hamilton-Jones & Vail, 2014). The responsibility for instruction is then shared between the special education and general education teachers. Wang, et al. (2012) found that adequate funding, qualified teachers, and policy support were key factors in determining the quality of inclusive education. Highly qualified mathematics teachers are in demand because of the increase in rigor and changing mathematics curriculum. However, special education teachers tasked to provide inclusive or specialized instruction to students with disabilities have a limited mathematics background or lack licensure.

Co-teaching is pedagogical strategy in which teachers target the needs of students with disabilities. Co-teaching is when special education teachers provide in-class instruction, alongside a general education teacher, for students with and without disabilities in a regular education setting (Panscofar & Petroff, 2013). Special education and general education teachers work together to provide direct instruction and support for all students in an inclusive setting. Co-teaching has been found to improve the working relationship among co-workers, increase teacher confidence, improve understanding of student needs, and increase self-confidence of the students that participate (Prizeman, 2015). At the elementary level, co-teaching has been shown to increase the amount of positive feedback students receive and to increase the time students are involved in small-group or one-on-one instruction (Sweigart & Landrum, 2015). Having an additional adult in the classroom allows for the planning of parallel instruction, small group re-teaching, and allows for the use of a variety of instructional strategies that benefit both students with disabilities and their non-disabled peers (Prizeman, 2015).

Although there is positive evidence for the impact of co-teaching, the instructional model has its limitation and challenges. Prizeman (2015) revealed that co-teachers were challenged to find time for the planning and reflection required for effective co-teaching. Hamilton-Jones and Vail's (2014) qualitative study of co-teaching relationships revealed common challenges, such as power struggles among co-teaching pairs, difficulty understanding one's role in the one teach-one assist model, and lack of school-wide recognition of collaboration. General content teacher willingness and ability to adjust one's pedagogical strategies to meet the needs of students with disabilities plays a key role in their achievement (Wang et al., 2012). Bottge et al. (2015) found that despite efforts to remove barriers from the co-teaching relationship in math, “The main issues preventing special education teachers from fully participating in the instruction included inadequate resources, planning time, and training on how to teach the math skill or concept” (p. 173). At the secondary level, Sweigart and Landrum (2015) found little difference between co-taught and single teacher classrooms with regard to the amount of positive feedback and the amount of small-group and one-on-one instruction. This may be attributed to the tendency of secondary special education teachers to take on subordinate roles because of the need for specialized content knowledge at the secondary level (Scruggs et al., 2007; Sweigart & Landrum, 2015). Despite barriers to success, co-teaching continues to be the preferred instructional model to meet the needs of students with disabilities in their least restrictive instructional environment. Training and professional development is needed to help support teachers in their efforts to successfully implement this instructional method (Scruggs et al., 2007; Sweigart & Landrum, 2015).

In-service and targeted professional development has been shown to anecdotally increase the success of co-teaching relationships. Pancsofar and Petroff (2013) found that professional development opportunities in co-teaching is significantly correlated with teachers’ positive attitudes, confidence, and interest in co-teaching. Teachers that were provided more opportunities to learn and practice co-teaching were more likely to report higher confidence, have a positive attitude, and have an interest in the practice of co-teaching. The co-teaching method of instruction requires much support and training for effective implementation. Teachers must decide on common instructional methods that they will use to support all learners. Tzivinkou (2015) found that by providing specific training on the proposed instructional methods, the quality of co-teaching and depth of collaboration among teachers improved.

Sancar-Tokmak (2015) found that teacher training in specific pedagogical strategies improved their mathematics teaching efficacy.

Increased state and local curricular standards, and improved oversight by federal and state bodies, have led to an increase in the number of students being taught in the inclusive classroom (Carson, 2015). This has led to an increase in the amount of time special education teachers spend as co-teachers in the general education classroom (Prizeman, 2015). The instructional methodology of co-teaching has been shown to improve student achievement at the elementary level (Sweigart & Landrum, 2016), but it is not without challenges, especially at the secondary level (Bottge et al., 2015; Nurlu, 2015; Prizeman, 2015). Improving the quality of the co-teaching relationship and instructional methods used can be achieved through targeted professional development (Sancar-Tokmak, 2015; Tzivinkou, 2015). In this next section, the researcher will explore what the literature says about special education teacher self-efficacy and its role in improving instructional outcomes.

Special education teacher self-efficacy. Self-efficacy is a crucial factor that influences the level of student achievement in the collaborative classroom. Teacher attitudes toward students with disabilities in the general education classroom helps determine the student's achievement outcome. Lee et al. (2011) researched the role of teacher resources, backgrounds, training, and support on self-efficacy of special education teachers. They suggested additional qualitative research to determine how a teacher's experiences and perceptions impact their self-efficacy. Loreman et al. (2013) identified factors that impact self-efficacy in teachers of inclusive classrooms. They discovered that training in special education increases teacher self-efficacy. Secondary teachers had significantly lower self-efficacy than primary teachers (Loreman et al., 2013).

Flores et al. (2010) conducted a study to find the relationship between elementary special education teacher and general education teacher content knowledge proficiency and their perception of confidence. While both groups of teachers scored similarly in content knowledge, special education teachers had less confidence as the grade level they were teaching increased. Ongoing professional development may play a role in preparedness and feelings of self-efficacy over an individual's career (Harris et al., 2014). However, special education teachers tend to have professional development focusing on how to teach students with learning disabilities and instead of learning and mastering specific math content (Hinton et al., 2015). Rarely is professional development focused on improving teaching mathematics self-efficacy. This may be of greater significance as the level of mathematics increases at the secondary level. Pancsofar and Petroff (2013) believed that increased in-service occasions in co-teaching resulted in more positive attitudes and confidence in teaching ability. Harris et al. (2014) found improved teachers understanding of material when co-teaching pairs were provided direct in-service training on a targeted skill. The collaborative relationship between the special education teacher and general education teacher involves an ongoing professional growth process.

Special education teachers are tasked to co-teach in a variety of K-12 content areas. They typically follow students with various disabilities and levels into science, history, math, and English classrooms. Garderen et al. (2009) believed that the demand and expectation of special education teachers to be experts across content levels through grade levels is unrealistic. Special education teachers may or may not have math content class beyond their own high school math experience. Additionally, the pedagogy involved in developing strategies and specialized instruction for students with disabilities requires a depth and mastery of the content area. Rimpola (2011) found two factors contributing to special education teachers' low self-efficacy:

perceived level of mathematics content mastery and attitude towards not being the teacher of record for the math class. This is further evidence that special education teachers need to feel confident in the course content they are teaching in order to truly be effective at the work they do with students. Flores, Thornton, Franklin, Hinton, and Strozier (2014) noted that elementary pre-service mathematics and special education teacher had similar levels of math teaching self-efficacy. These teachers also had similar levels of mathematics content knowledge as measured by a computation and problems solving skill assessments. These results indicated that teacher self-efficacy can be improved through content knowledge preparation at the pre-service level (Flores et al., 2014).

The changing role of special education teachers has led to continued and even increased attrition and burnout rates. Special education teachers are tasked to be co-teachers and become masters of content without the formal training and background knowledge in content areas (Rimpola, 2011). This is especially troubling in the higher-level courses of middle school and high school mathematics. With low levels of formal training and coursework in mathematics and increased expectations to raise achievement of students with disabilities, special education teachers may now be experiencing more diminished feelings of self-efficacy compared to the past (Humphrey & Hourcade, 2009). Unlike their general education peers, special education teachers have a dual responsibility to teach in all curricular areas and meet the needs of students with disabilities who “are especially vulnerable to the impact of inadequate levels of teacher content knowledge and instructional skills” (Humphrey & Hourcade, 2009, p. 30).

Mathematics anxiety has been widely studied and researched (Gresham, 2009; Turner, 2016). “Research shows that a disproportionately large percentage of pre-service teachers experience significantly high levels of mathematics anxiety” (Gresham, 2009, p. 22). These findings may lead to lack of confidence or teaching efficacy among both general education and special education mathematics teachers (Gresham, 2009). Pancsofar and Petroff (2013) identified the type of professional development and factors that impact special education teacher self-efficacy. The results from their study indicated that additional training opportunities, higher levels of interest, and positive attitudes about co-teaching were associated with higher confidence. Conversely, Hinton et al., (2015), suggested that teachers with low teaching efficacy tend to lecture more, utilize worksheets, and deliver instruction by reading the text.

Briley (2012) studied the relationship between mathematics self-efficacy, mathematics teaching self-efficacy, and mathematics beliefs in pre-service elementary teachers. He determined that pre-service teachers with higher levels of self-efficacy in their ability to teach math were more confident and effective in solving math problems. However, just because a teacher may feel confident regarding their knowledge of mathematical content, does not necessarily translate into feelings of effective impact on student learning. Bates et al. (2011) found that high mathematics self-efficacy coupled with high teaching mathematics self-efficacy does not also improve a teachers' belief that their teaching will lead to higher student achievement. They believed that since the participants were pre-service teachers, their lack experience in what positively impacts student learning may be the cause (Bates et al., 2011). Special education teachers who emerge from pre-service educational programs with high levels of conceptual understanding of the content are more likely to exhibit higher levels of teacher self-efficacy and outcome expectancy (Hinton et al., 2015).

Viel-Ruma, et al. (2010) conducted a quantitative research study in a major southeastern metropolitan school district. One hundred special education teachers participated in the study from various levels and teaching assignments. The researchers found that increasing the self-efficacy of special education teachers led to improved levels of job satisfaction.

Preparing special education teachers is a challenge due to the high demands put on them by school districts. Increased class sizes along with decreased time for professional growth and learning have led to high attrition rates. Additional factors, which can help improve self-efficacy, include having smaller percentages of students with disabilities in each general education classroom and greater levels of parental support. Lee et al. (2011) found that teachers feel more comfortable teaching when they have a high perceived level of control over the factors that help them succeed. Administrators and district support personnel should take this into consideration when providing teacher support and professional development.

Instructional planning is a crucial aspect in the preparation and delivery of effective instruction (Prizeman, 2015). This is particularly important when two teachers come together to deliver instruction. Special education teachers may plan for a small group resource or study skills class as well as for collaborative classes. Common built-in planning in the schedules of both the content and special education teacher is often lacking (Prizeman, 2015). This may be difficult to accomplish due to a variety of factors. Individualized educational program and eligibility meetings usually take place during a planning block. Also, the special education teacher often needs to plan with multiple teachers across content areas. This perhaps leads to use of the *lead and assist method* of co-teaching and where actual co-teaching and specialized instruction is not evident (Rimpola, 2011). Administrators must take these needs into consideration when assigning co-teaching assignments and creating schedules.

Recent research on the effects of professional development for mathematics teachers on their self-efficacy has shown to result in more positive student outcomes (Stevens et al., 2013).

However, professional development should be centered on mathematic teaching self-efficacy, not increasing mathematical knowledge. Professional development programs in schools are changing in order to increase student achievement through increased teacher self-efficacy. Park et al. (2012), studied the effects of a summer professional development institute on the self-efficacy of faculty members teaching students with disabilities. They reported an increase in self- efficacy of faculty members, which was believed also to have a positive effect on the faculty's efforts and persistence when coming across difficulties (Park, et al., 2012). Stevens et al. (2013) also suggested that collaborative professional development programs result in less anxiety and pressure for teachers and may be a more conducive environment for building self-efficacy.

Special education teachers have many challenges to overcome in order to become high quality, effective co-teachers in the inclusive mathematics classroom. These challenges include relationships between general education teachers and special education teachers (Hamilton-Jones & Vail, 2014), gaining content knowledge (Humphrey & Hourcade, 2009), improving planning time (Prizeman, 2015; Rimpola, 2011), and pedagogical knowledge and experience (Parks et al., 2012; Stevens et al., 2013), all of these areas play key roles in determining the self-efficacy and effectiveness of a special education teacher. The current review of the literature reveals a strong core base of research in the area of understanding that special education teachers have a generally lower teaching efficacy than their general education peers, but a lack of research exists to pinpoint if this discrepancy exists in all contexts.

Mathematics Teaching and Learning

Since the enactment of No Child Left Behind (NCLB), greater emphasis has been placed on student accountability, specifically in the areas of reading and mathematics. At the national level, mathematics achievement has been improving (Kena et al., 2016). Student progress as measured by the National Assessment of Educational Progress (NAEP) has revealed improving scores for students in grades four and eight when compared to scores from the early 1990s (Kena et al., 2016). However, "in 2015, for the first time, the average mathematics scores for 4th and 8th grade students were lower than the average scores in the previous assessment year" (Kena et al., 2016, p. 150). Internationally, there is a different picture of student achievement. The Program for International Student Assessment (PISA) is an international project that allows researchers to compare student learning outcomes across a wide range of variables (Kelly et al., 2013). On the 2012 PISA assessment, nine percent of 15-year-old students in the United States scored "at proficiency level 5 or above" in the area of mathematics literacy "which was lower than the OECD average of 13 percent" (Kelly, et al., 2013, 2013, p. 9). In comparison, 55 percent of students in Shanghai-China scored at this level. These assessment results have given United States educators reason to pause and reflect on their educational practices, especially since there is such a strong link between mathematics achievement and post-secondary success. In response the United States' low performance on the PISA, more rigorous curricular standards have been put in place in states throughout the nation, typically the Common Core State Standards (CCSS) for mathematics. These standards emphasize conceptual understanding and problem solving (Turner, 2016). Improving mathematics achievement requires building conceptual understanding through targeted instruction in mathematical communication. This is evident in national (NAEP) and international (PISA) assessment scores, which show a general lack of conceptual understanding and ability to think abstractly about mathematical concepts (Turner, 2016).

Preparing the nation's youth for college and career is an essential component of secondary education. Tennant (2014) found that students who have a strong foundation in math when they leave high school are more likely to succeed in college. Students need these basic mathematical skills to be laid as a solid foundation in order to be successful in college. Student success beyond high school has been linked directly with achievement in mathematics (Brown, Halpin, & Halpin, 2015). Students who score higher on standardized math assessments, such as the math American College Testing (ACT), are more likely to have success in their post-secondary educational pursuits (2015). Continuous enrollment in mathematics courses in high school is another predictor of college success (Zelkowski, 2010). The mathematics course sequencing in the secondary years is another important predictor to success beyond high school graduation. Students who take algebra by eighth grade are able to complete four years of pre-college mathematics preparatory courses in high school and are more likely to be successful in their post-secondary pursuits (Howard, Scott, Romero & Saddler, 2015). Additionally, students who are successful in upper level mathematics courses in high school, such as trigonometry, pre-calculus, and calculus, are more likely to have success as they pursue STEM careers, such as, engineering (Brown et al., 2015; Cunningham, Hoyer & Sparks, 2015). The effects of more rigorous and specific course requirements, along with mandatory exit exams or course assessments, have been shown to improve the number of students who successfully transition to college (Daun-Barnett & St. John, 2012). Increased standards and graduation requirements have also reduced the number of students who successfully complete high school, an issue that states are working diligently to improve (Daun-Barnett & St. John, 2012). Overall, efforts to improve student success beyond high school require improving student access to, and achievement in, secondary mathematics courses.

Student achievement in mathematics is influenced by a multitude of factors, including the quality of education students receive in the classroom, and influence of teacher and parental education level and attitudes toward mathematics (Shoraka, Arnold, Sook Kim, Salinitri & Kromrey, 2015). Turner (2016) hypothesized that attitudes toward mathematics exist in a continuum, ranging from terror and avoidance to comfort and expertise. Turner (2016) further believed that math anxiety begins in the classroom where students are not given "enough experience thinking about, discussing, exploring, and experimenting with situations in their environment that might have mathematical content" (p. 80). Thus, the quality of educational experiences a study has and the attitude of the adult instructors in the students' life will have a significant impact on the students' likelihood of succeeding. Improving access to and achievement in mathematics courses should continue to be the goal of educators.

The nation's transition to the Common Core State Standards (CCSS) in mathematics have placed renewed emphasis on preparing all students, including those with disabilities, for college and career ready skills they will need to succeed in STEM careers. CCSS focuses on conceptual understanding and problem solving. Unfortunately, the increased expectations for mathematics achievement have not produced higher growth for students with disabilities. Students with disabilities have made little progress on the NAEP, with only 20% of students meeting proficiency targets (King et al., 2016). Students with disabilities continue to underperform their non-disabled peers in standardized assessments (Schulte & Stevens, 2015). The lack of progress can be generally tied to ineffective instruction, lack of teacher use of research-based practices, and lack of focus on conceptual understanding and problem solving (Myers et al., 2015). The implementation of research-based strategies, such as enhanced anchored instruction (the use of technology to engage students in problem solving), use of representations and manipulatives, and metacognitive strategies for solving word problems have been found to be the most reliable interventions for students with disabilities (Myers et al., 2015; Satsangi et al., 2016).

Students with specific learning disabilities in the area of mathematics often have difficulties understanding mathematical representations (Lewis, 2016). These difficulties are not necessarily the same as those students who would be considered low or underachieving. Often, the error patterns of students with a specific learning disability in the area of mathematics is unique and atypical, leading to difficulty for the educators who are trying to support the learning of the student (Lewis, 2016). Specific instructional strategies such as concrete-representational-abstract can be used to effectively improve the mathematical fluency of students with disabilities (Hinton, et al. 2014). Determining where students with disabilities will be taught, who will teach them, and what strategies will be used to teach them play an important role in achievement outcomes. Rather than teachers segregating them in separate classes, students with disabilities are increasingly included in the general education classroom. The benefits of inclusive education in the area of mathematics has mixed evidence. Barrocas and Cramer (2014) found that inclusive math education did not result in a significance difference in the achievement of students with disabilities. Cramer (2015) noted that it is important for school administrators to examine their practices for including students with disabilities in the regular education classroom, and provide training and support to educators whenever needed.

Mathematics teaching and learning play a critical role in the success of all students in meeting their educational goals. High school graduation, college entrance, post-secondary degree and career attainment are all tied to achievement in mathematics (Brown et al., 2015; Daun-Barnett & St. John, 2012; Howard et al., 2015; Zelkowski, 2010). Mathematics achievement for students in the United States has been improving when measured by national assessments (Kena et al., 2016), but their mathematics achievement still lags the mathematics achievement of their international peers (Kelly et al., 2013). Students with disabilities continue to underperform their non-disabled peers in the area of mathematics, leading to concern about the instructional methods and standards being used to support their success (King et al., 2016).

Measuring Mathematics Teaching Efficacy

A variety of instruments have been used to measure mathematics teaching efficacy, including the Math Literacy Self-Efficacy Scale (Gulten, 2013), the Academic Self-Efficacy Scale (Turgut, 2013), and most notably, the Mathematical Teaching Efficacy Beliefs Instrument (MTEBI) (Enochs et al., 2000). The MTEBI has been used in a wealth of research studies to explore the impact of a variety of factors on mathematics teaching efficacy (Bates et al., 2011; Briley, 2012; Brown, 2012; Gresham, 2009; Huntz-Ruiz & Watson, 2015; Isikal, 2010; Kieftenbeld, Natesan, & Eddy, 2011; Rethlefsen & Park, 2011). The MTEBI has been translated into other languages for use internationally, such as Thai (Matney, Jackson, & Panarach, 2016). Iris Riggs first developed the Science Teaching Efficacy Belief Instrument Form A in 1988 (Enoch & Riggs, 1990). It was then modified from an in-service to pre-service Form B orientation. It was made up of 23 items that consisted of 12 from the Personal Science Teaching Efficacy Scale and 10 on the Science Teaching Outcome Expectancy Scale. A t-test was conducted to determine if teachers responded differently; results indicated there was no significant difference in responses. Enochs and Riggs (1990) calculated that the Personal Science Teaching Efficacy Scale had a Cronbach's alpha coefficient of .90 and the Science Teaching Outcome Expectancy Scale had a reliability coefficient of .76.

Using this reliability data as the basis for the design, Enochs et al. (2000) then transformed the science instrument into a math instrument. Enochs et al. (2000) conducted a study to establish factor validity of the MTEBI. The instrument has 21 items consisting of 13 on the Personal Mathematics Teaching Efficacy subscale (PMTE) and eight items on the Mathematics Teaching Outcome Expectancy subscale (MTOE). Reliability analysis for this instrument produced an alpha coefficient of 0.88 for the PMTE scale and 0.77 for the MTOE scale.

Use of the MTEBI has revealed important findings that help shape current understanding of mathematics teaching self-efficacy. The MTEBI has been used to correlate mathematics teaching efficacy with a variety of factors including, mathematics performance (Bates et al., 2011), mathematics efficacy (Bates et al., 2011; Briley, 2012; Isikal, 2010), mathematical beliefs (Briley, 2012), grades earned in mathematics methods courses (Brown, 2012), targeted mathematical instruction (Rethlefsen & Park, 2011), and lower rates of mathematics anxiety (Gresham, 2009). This research provides a broad foundation from which the researcher has developed new research questions to target the mathematics self-efficacy of special education teachers.

Summary

This review of the literature explored the following four main themes: self-efficacy, special education, mathematics teaching and learning, and the measurement of mathematics teaching efficacy. The review began with an exploration of Bandura's social learning (1971) and self-efficacy theories (1977). Bandura's (1971, 1977) theories provided a foundation for understanding the role that teacher self-efficacy plays in improving student learning and achievement (Chang, 2015; Hines, 2008; Ji-Won et al., 2016; Khan, 2012; Rashidi, & Moghadam, 2014), and for uncovering methods for improving teacher self-efficacy through increasing teacher content knowledge (Gulten, 2013; Hunt-Ruiz & Watson, 2015; Rosas &

Campbell, 2010; Swackhamer et al, 2009;), pre-service preparation programs, and in-service professional development (Park et al., 2012; Stevens et al., 2013). The literature review also explored the area of special education, and uncovered specific challenges for meeting the growing demands of increased standards and accountability measures. The challenges facing special education teachers include building relationships between the general education teacher and special education teacher (Hamilton-Jones & Vail, 2014), gaining content knowledge (Humphrey & Hourcade, 2009), improving planning time (Prizeman, 2015; Rimpola, 2011), and increasing pedagogical knowledge and experience (Park et al., 2012; Stevens et al., 2013). Mathematics teaching and learning plays a critical role in ensuring students achieve their educational goals, such as high school graduation, college entrance, post-secondary degree and career attainment (Brown et al., 2015; Daun-Barnett & St. John, 2012; Howard et al., 2015; Zelkowski, 2010), and the difficulty students with disabilities have in obtaining conceptual understanding of mathematics skills (King et al., 2016).

This review of the literature further investigated how mathematics teaching self-efficacy might be measured to help researchers better understand how to help improve teacher confidence. The focus of the present study will be measuring the levels of mathematics teaching efficacy among teachers at the middle and high school levels to target the variables that affect self-efficacy of mathematics teachers. If researchers can understand reasons for low self-efficacy, then efforts can be made to improve teacher self-efficacy especially in the area of mathematics. Additional pre-service coursework and testing requirements for special education teachers may be warranted. Targeted and high quality professional development for special education teachers who teach secondary math may also provide for increased teaching efficacy.

Thus, the current research will add to the current body of literature and may lead to improvement in mathematics student achievement among students with special needs

CHAPTER THREE: METHODS

Overview

In the following chapter, the research design for this study is identified, discussed, and aligned with the purpose of the study. The researcher will describe the study's research design, along with how it will address the research questions and hypotheses of this study. Next, the participants and setting of the study are described. Additionally, a description of the sample and the sampling method is included. The instrument section will discuss reliability and validity statistics reported for the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI). A detailed description of the study's procedures to explain how the study will be completed is included. Finally, a description of the data analyses is discussed.

Design

A quantitative, correlational research design was used to analyze the relationship between secondary special education teachers' mathematics teaching efficacy and mathematics content knowledge, years of co-teaching experience, and years of teaching experience. The purpose of correlational research was to "discover relationships between variables through the use of correlational statistics" (Gall et al., 2007, p. 332). This research design has been commonly used in education research (Gall et al., 2007). Correlation research has also been used to describe a positive relationship between general education teachers' mathematics teaching efficacy and mathematics content knowledge (Bates et al., 2011; Briley, 2012; & Isikal, 2010).

The criterion variable for this study was mathematics teaching efficacy defined as "a judgment of his or her capabilities to bring desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Ryang, 2012, p. 45). Mathematics teaching efficacy was measured by Enochs et al.'s (2000) Mathematics Teaching

Efficacy Beliefs Instrument (see Appendix A). Predictor variables for this study included mathematics course content, years of mathematics co-teaching experience, and total years of teaching experience. Mathematics course content was defined as the number of math content courses "taken at the undergraduate level (i.e., two-year or four-year institution) or at the graduate level" (Code of Virginia, 8VAC20-22-10, 2015). The next predictor variable, co-teaching, was defined as the number of years the special education teacher has participated in providing in-class instruction, alongside a general education teacher, for students with and without disabilities in a regular education setting (Panscofar & Petroff, 2013). The final predictor variable, total years of teaching experience, included all years employed as a fully licensed educator.

Research Questions

The research questions for this study are:

RQ1: What is the relationship between the number of mathematics content courses taken and mathematics teaching efficacy of secondary special education teachers?

RQ2: What is the relationship between years of mathematics co-teaching experience and mathematics teaching efficacy of secondary special education teachers?

RQ3: What is the relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers?

Hypotheses

The null hypotheses for this study are:

$H_0$1: There is no statistically significant relationship between number of mathematics content courses taken and mathematics teaching efficacy of secondary special education teachers.

$H_0$2: There is no statistically significant relationship between years of mathematics co-teaching experience and mathematics teaching efficacy of secondary special education teachers.

$H_0$3: There is no statistically significant relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers.

Participants and Setting

The participants for the study were drawn from a convenience sample of middle and high school special education teachers employed in two southeastern Virginia public school districts during the fall semester of the 2017-2018 school year. The school districts were middle to upper-income mixed suburban and rural areas nestled between the major metropolitan areas of Richmond and Norfolk, Virginia.

The school districts used in this study were public school systems located in southeastern Virginia. School district one was located in a mixed suburban and rural community within driving distance from major cities. At the time of the study, the community had an estimated population of 73,147, of which comprised a student population of approximately 11,597 students (U.S. Census Bureau, 2015). Median household income for school district 1 was estimated at $75,710, with 7.1% of residents considered impoverished. The percentage of students eligible for free and reduced meals was calculated at 32.8%. School district one was composed of English language learners (4.7%) and students with disabilities (12.8%). The student population was Caucasian (61.8%), Black (17.7%), Hispanic (10.5%), two or more races (6.8%), Asian (2.7%), American Indian (.5%), and Native Hawaiian (.1%) (Virginia Department of Education, 2015a).

The second school district included in the study, school district two, had very similar characteristics to school district one. School district two was located in a mixed suburban and rural community that is within driving distance of a major city. The district had several military bases within its borders. At the time of the study, the community had an estimated population of 67,837, of which comprised a student population of approximately 12,699 students (U.S. Census Bureau, 2015). Median household income for school district two was estimated at $81,749 with 5.3% of residents considered impoverished. This is in contrast with the percentage of students eligible for free and reduced meals, which was calculated at 21.5%. School district two was comprised of English language learners (3.1%) and students with disabilities (10.1%). The student population was Caucasian (62.6%), Black (13.2%), Hispanic (9.3%), two or more races (8.7%), Asian (5.6%), American Indian (.3%) and Native American (.3%) (Virginia Department of Education, 2015a).

A sample size of 66 teachers was the required minimum for a medium effect size with statistical power of .7 at the .05 alpha level (Gall et al., 2007). The school districts employed a total of 114 secondary special education teachers. School district one employed 27 middle school special education teachers and 34 high school special education teachers. School district two employed 25 middle school special education teachers and 28 high school special education teachers. All secondary special education teachers in the districts were invited to participate in the study. All teachers were licensed Virginia special education teachers that provide specialized instruction to students with disabilities. These services were provided in a variety of settings, including collaborative general education classrooms and self-contained classrooms. Participant demographic information, including gender, race and highest degree attained were collected and provided at time of data analysis.

A group of 69 teachers participated in the study. One participant was removed due to lack of licensure for a total sample size of 68 participants. They classified themselves, with 60 being

Caucasian, five Black, one Hispanic, and two other ethnicities. There were a total of 12 males and 56 female participants (see Table 1). The volunteer participants included 68 licensed special education teachers. There were 18 teachers that held a bachelor's degree, 46 a master's degree, three with an educational specialist degree, and one with a doctorate degree. The average age of the participants was 42.49 years old. The average teaching experience was 13.47 years. Their mean age was 42.49 years, with a standard deviation of 11.00. Participants ranged in age from 26 years to 64 years old (see Table 2).

Table 1

Gender

	Frequency	Percent
Female	56	82.4
Male	12	17.6
Total	68	100.0

Table 2

Age and Years of Teaching Experience

	Frequency	Minimum	Maximum	Mean	Std. Deviation
Age	68	26	64	42.49	11.000
Years of Teaching	68	1	61	13.47	10.196

Instrumentation

An electronic survey was distributed using an online software tool called SurveyMonkey®. The survey was distributed with permission from the school districts to teachers through email. A follow-up email was also sent to encourage participation. The survey began with a demographics questionnaire, followed by the mathematics course checklist. Next, with permission from the author of the instrument, Dr. Huinker, the Mathematics Teaching Efficacy Belief Instrument (MTEBI) was used to collect mathematics teaching efficacy data (see Appendices A, B, and C for instrument, scoring instructions, and permission letter). In total, the survey took approximately 10-15 minutes for teachers to complete.

Demographics Questionnaire

A demographic questionnaire was used to collect self-reported data to describe the participants' age, gender, race, highest degree attained, number of years of teaching experience, and number of years of co-teaching experience. The questions can be found in Appendix D. Drop down menus were used whenever possible to ensure the data set remained consistent and reliable for disaggregation. A self-report of a yes or no question was present to verify each participant's endorsement as a special education teacher in the state of Virginia.

Mathematics Course Checklist

Mathematics content coursework knowledge was measured using a mathematics course questionnaire of college level mathematics courses. Participants were asked to select each of the college level mathematics course they have taken. Then, the total number of courses were calculated. The list of mathematics courses was developed by reviewing three major Virginia university mathematics teaching course requirements (see Appendix E). A list of required mathematics courses for secondary teaching licensures was obtained from each of the three major Virginia universities. The three lists were combined into one list and sorted to identify similarities. Common courses were grouped, and the most common or recognizable name for the course was selected for use in the mathematics course checklist (see Appendix F). A textbox was added to the end of the mathematics course checklist to provide participants the opportunity to list any additional courses they have taken that are not listed. The researcher assigned a value of one to each course taken, and then determined the total number of courses taken by adding them together.

Mathematics Teaching Efficacy Belief Instrument (MTEBI)

Teacher self-efficacy data was collected using a self-report instrument, MTEBI (see Appendix A). The selection of a valid and reliable self-efficacy survey was a critical component to the success of this research. The MTEBI (Enochs et al., 2000) was utilized to measure mathematics self-efficacy (see Appendix A for the complete instrument and Appendix B for the scoring instructions). Permission to use the instrument was requested and granted by Dr. DeAnn Huinker, professor in the Department of Curriculum and Instruction at the University of Wisconsin-Milwaukee (see Appendix F). Enochs et al.'s (2000) instrument was used in this study. This instrument was developed by Enochs et al. (2000) by modifying the Science

Teaching Efficacy Belief Instrument (STEBI) which was originally developed by Enochs and Riggs (1990). The MTEBI was published Enochs et al. (2000). Items were modified from future to present tense and the word “elementary” was removed from item 11 to allow the instrument to be used with secondary school teachers.

A range of educational researchers (Alsawaie & Alghazo, 2010; Bates et al., 2011; Brown, 2012; Rethlefsen & Park, 2011) have used the MTEBI to investigate a range of topics related to mathematics teaching efficacy. The MTEBI consists of 21 Likert scaled items consisting of two subscales, the Personal Mathematics Teaching Efficacy (PMTE) subscale, which measures a teacher’s belief about their ability to teach mathematics, and the Mathematics Teaching Outcome Expectancy (MTOE) subscale, which measures a teacher’s belief about the effectiveness of their mathematics teaching (Enoch, et al., 2000). Each item is measured on a five-point Likert scale consisting of 5 = strongly agree, 4 = agree, 3 = uncertain, 2 = disagree, and 1 = strongly disagree. Scores on the PMTE and MTOE subscales were added together for a total score of self-efficacy (Alsawaie & Alghazo, 2010; Bates et al., 2011; Brown, 2012; Rethlefsen, & Park, 2011). The possible range of scores for the PMTE is 13-65, and the possible range of scores for the MTOE range from 10 to 50 (see Appendix B).

Enoch et al. (2000) determined the reliability of the independent MTEBI subscales by calculating the Chronbach alpha. The PMTE subscale had an alpha coefficient of 0.88 and the MTOE subscale had an alpha coefficient of 0.77 (2000). Surveys with Cronbach alpha levels of 0.7 or higher are generally considered to contain good levels of internal consistency (DeVellis, 2003; Kline, 2005).

In addition to reliability assessments, the MTEBI has undergone rigorous factorial validity analysis, which has led to its continued wide range use as a self-efficacy tool in the field

(Enoch, et al., 2000). Confirmatory factor analysis (CFA) was conducted by Enochs et al. (2000) using three indexes of model fit. Confirmatory factor analysis of the MTEBI on the frequency items confirmed good model fit to each construct of PMTE and MTOE. The chi-square analysis demonstrated good model fit, χ^2 (184) = 346.70, $p < .01$. Akaike's Information Criteria (AIC) indicated good model fit with a value of 2.23, as did the Comparative Fit Index (CFI) of 9.19, in line with good fit standard values above .90 (Enochs et al., 2000). Thus, through rigorous reliability and construct validity assessments, the MTEBI has been shown to be internally consistent and to yield reliable results for researchers (Enochs et al., 2000).

Procedures

Permissions

The researcher began the process of seeking permission to conduct the research by contacting the local school divisions that were identified to participate. The researcher sent an email to each school division's research review representative (see Appendix G). After securing approvals from each participating school division, the researcher obtained Institutional Review Board (IRB) approval of the study through the university review board (see Appendix H and Appendix L). After securing approval from the university, the researcher obtained email addresses of each special education teacher in the division through the division websites, and send out a recruitment email to all special education teachers (see Appendix I). A follow-up recruitment email was sent after one and a half weeks (see Appendix J). Participants were notified that their participation was completely voluntary, and that their data would remain anonymous. Participants were provided a link to the electronic survey that directed them to an informed consent page where they read further information about the study before electing to participate (see Appendix K).

Data Collection

The MTEBI was converted to an electronic version using SurveyMonkey® to retrieve responses. Demographic questions and the mathematics content area course checklist were incorporated together to create one survey in SurveyMonkey®. Through an email message, prospective participants received a recruitment letter explaining the purpose of the study and requesting their voluntary participation (see Appendix I). The email contained an electronic link to the survey. Upon receiving the email, the participants were asked to open the link. The first page of the survey consisted of the informed consent that the participants reviewed and determined if they desired to continue (see Appendix K). The participants were asked a series of questions on the demographics survey followed by 21 Likert scaled items from the MTEBI, and the mathematics content course checklist. Teachers were given a three-week window in which to respond to the survey. A reminder email was sent after a week and a half (see Appendix J). An incentive for completing the survey was offered. All individuals that completed the survey were able to elect to submit their email address to receive a $10 Amazon gift card. Email addresses were maintained separately from the survey data in order to ensure anonymity. Data was then entered into the Statistics Program for the Social Sciences (SPSS) for data analysis.

Analysis

Data analysis for this study was conducted using the Statistics Program for the Social Sciences (SPSS). A comma delimited file of the data was downloaded from SurveyMonkey® and uploaded to SPSS to begin the analysis. Originally, the research planned to use a Pearson *r* as Gall et al. (2007) suggested, the Pearson *r* be used to analyze the strength and direction of a relationship between two continuous variables. The Pearson Product Moment correlation is considered a significant relationship at the 95% confidence level. The Pearson product-moment correlation coefficient is considered "the most stable technique [with] the smallest standard error" (Gall, et al, 2007, p. 348). This enabled the researcher to determine if the null hypothesis for each research question should be rejected or fail to be rejected. However, due to the assumption of bivariate normal distribution not being met, the researcher proceeded to test each hypothesis with a non-parametric measure of correlation, the Spearman's rank order coefficient. This test was a more appropriate measure than the Pearson product moment correlation coefficient because it does not rely on the assumption of bivariate normal distribution.

The researcher started the data analysis by reviewing the data for incomplete survey responses. Incomplete responses were removed prior to data analysis. Then, basic measures of central tendency for the demographic information were calculated, including total number of male and female participants, race, age distribution, years of teaching experience, and years of co-teaching experience. Next, items on the MTEBI were reverse coded as indicated in the scoring instructions (see Appendix B) and a total mathematics teaching efficacy score were calculated based on the participants' answers to each item. Finally, a total mathematics course content knowledge score was calculated by adding the points for each course selected on the Mathematics Course Checklist (see Appendix F).

After the data was prepared for analysis, the researcher completed assumption testing for each data set. The Pearson *r* assumed that data sets are linear, bivariate normally distributed and bivariate outliers (Laerd Statistics, 2015). Therefore, three specific assumptions were evaluated: assumption of bivariate outliers, assumption of linearity, and assumption of bivariate normal distribution. To test for bivariate outliers, a scatter plot between the predictor variables (x) and criterion variable (y) were developed and examined for extreme bivariate outliers. Then, to test for linearity, a scatter plot between the predictor variables (x) and criterion variable (y) was examined to determine if the data lies along a linear axis. However, as stated earlier, due to violation with bivariate normal distribution, the researcher proceeded to test each hypothesis with a non-parametric measure of correlation, the Spearman's rank order coefficient at the 95% confidence level. This test was a more appropriate measure than the Pearson product moment correlation coefficient because it did not rely on the assumption of bivariate normal distribution.

CHAPTER FOUR: FINDINGS

Overview

Throughout the next chapter, the researcher will provide a review of the findings from this study. A description of each statistical analysis used will be provided for the three research questions.

Research Questions

The research questions for this study are:

RQ1: What is the relationship between the number of mathematics content courses taken and mathematics teaching efficacy of secondary special education teachers?

RQ2: What is the relationship between years of mathematics co-teaching experience and mathematics teaching efficacy of secondary special education teachers?

RQ3: What is the relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers?

Null Hypotheses

The null hypotheses for this study are:

$H_0$1: There is no statistically significant relationship between number of mathematics content courses taken and mathematics teaching efficacy of secondary special education teachers.

$H_0$2: There is no statistically significant relationship between years of mathematics co-teaching experience and mathematics teaching efficacy of secondary special education teachers.

$H_0$3: There is no statistically significant relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers.

Descriptive Statistics

A sample of 114 special education teachers was recruited for this study. Out of the 114 participants, 72 responded to the survey. Three of the surveys were incomplete and not used in the analysis. Overall, there were 69 complete responses to the survey, which represents a 60.5% participation rate. Within the 69 complete responses, one respondent indicated that he or she does not hold a valid teaching license, so he or she were also removed from the study. This left 68 responses that were included in the analysis. The majority of respondents in the study were Caucasian, followed by Black or African American (see Table 3) and female (see Table 4).

Table 3

Ethnicity and Race

	Frequency	Percent
Multiracial	1	1.5
Asian	1	1.5
Black or African American	5	7.4
Hispanic/Latino	1	1.5
Caucasian	60	88.2
Total	68	100.0

Study participants were 82.4% female and 17.6% male (see Table 4). Their mean age was 42.49 years, with a standard deviation of 11.00. Participants ranged in age from 26 years to 64 years old (see Table 5).

Table 4

Gender

	Frequency	Percent
Female	56	82.4
Male	12	17.6
Total	68	100.0

Participants' average years of teaching experience was 13.47 years with a standard deviation of 10.19. Teaching experience ranged from one year to 61 years. The participants' years of math co-teaching experience was much smaller, with an average of 4.01 years, a standard deviation of 4.48, and a range of zero to 18 (see Table 5).

Table 5

Age and Years of Experience

	Frequency	*Min*	*Max*	*M*	*SD*
Age	68	26	64	42.49	11.000
Years of Teaching	68	1	61	13.47	10.196
Years of Math Co-teaching	68	0	18	4.01	4.484

Educational levels among participants were varied. The majority held master's degrees, followed by bachelor's degrees (see Table 6).

Table 6

Educational Level

	Frequency	Percent
Bachelor's	18	26.5
Master's	46	67.6
Educational Specialist	3	4.4
Doctorate	1	1.5
Total	68	100.0

The quantity of math content courses taken was measured using a checklist embedded in the survey. The most common math course taken by respondents was algebra (abstract, modern, or linear), followed by probability and statistics (see Table 7). Participants also had the opportunity to include courses not listed in the checklist. Courses entered manually included courses such as math for elementary school teachers, teaching mathematics, computer math, etc. The average number of course taken by participating teachers was 2.38 with a standard deviation of 1.57, with some teachers reporting no courses taken and a maximum of seven courses reported (see Table 8).

Table 7

Mathematics Course Checklist Responses

Course Name	Total Responses
Algebra – Abstract or Modern	28
Algebra - Linear	22
Calculus I	5
Calculus II	3
Calculus III	0
Calculus IV	0
Calculus - Multivariable	2
Differential Equations	4
Discovering Mathematics	4
Foundations of Math	24
Geometry	14
History of Mathematics	2
Number Theory	2
Math for Secondary Teachers	9
Discrete Mathematics	10
Probability and Statistics	34
None	7

Table 8

Mathematics Course Checklist: Descriptive Statistics

	Frequency	*Min*	*Max*	*M*	*SD*
Math Courses Total	68	0	7	2.38	1.574

Mathematics teaching efficacy was measured using the Mathematics Teaching Efficacy Belief Instrument (MTEBI). The instrument is made of two subscales, Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectancy (MTOE). Scores on the MTEBI had a mean of 50.96 and a standard deviation of 9.73 (see Table 9). The PMTE had a mean of 45.94 and a standard deviation of 8.95, and the MTOE had a mean of 29.10 and standard deviation of 3.21 (see Table 9).

Table 9

Mathematics Teaching Efficacy Belief Instrument: Descriptive Statistics

	Frequency	*Min*	*Max*	*M*	*SD*
PMTE	68	17	60	45.94	8.946
MTOE	68	21	36	29.10	3.214
MTEBI Total	68	46	95	75.04	9.733

Results

Assumption Testing

Data screening and assumption testing was completed prior to analyzing the data to ensure each data set met the requirements for using a Pearson correlation. The assumption testing included analysis of each data set for bivariate normal distribution, linearity, and for the presence of bivariate outliers. The researcher began by visually inspecting the data using a scatterplot to determine if the data meets the assumption of linearity (see Figures 1 – 3).

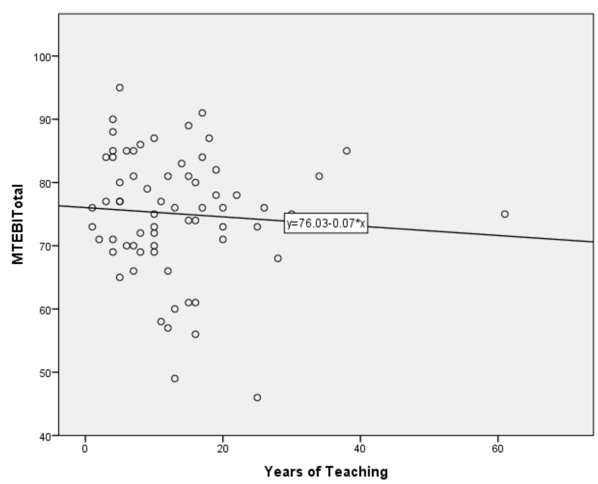

Figure 1. Scatterplot to determine the linearity of the MTEBI and years of teaching data sets.

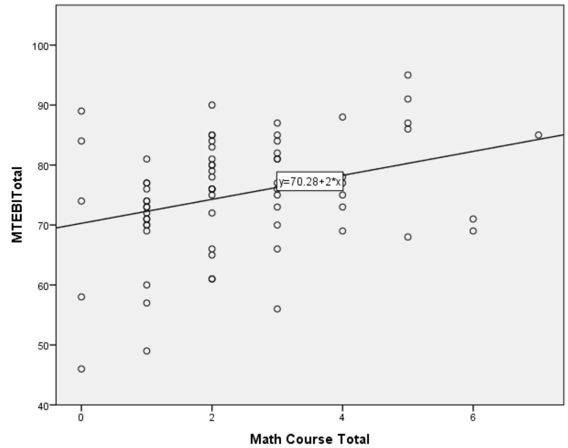

Figure 2. Scatterplot to determine the linearity of the MTEBI and the total math courses data sets.

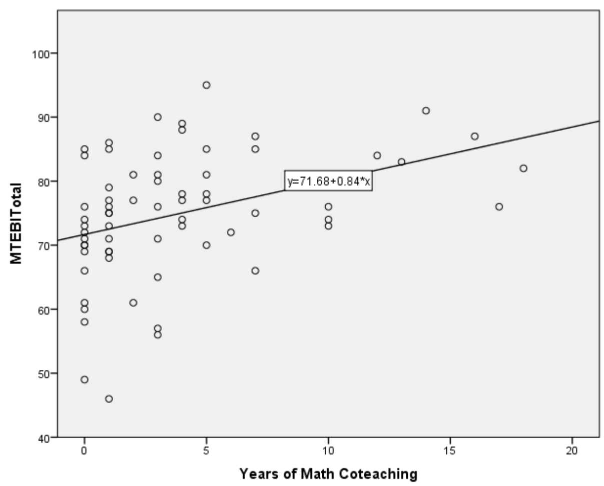

Figure 3. Scatterplot to determine the linearity of the MTEBI and the years of co-teaching experience data sets.

Through visual analysis of each scatterplot, the researcher determined that the assumption of linearity was tenable for years of experience, years of co-teaching, and the number of math courses. Years of math co-teaching and the MTEBI had the most tenable signs of a positive linear relationship, but the data is non-monotonic in nature.

Then the researcher began by visually inspecting the data using a scatterplot to determine if the data meets the assumption of bivariate normal distribution (see Figures 1-3). Through visual analysis of each scatterplot, the researcher determined that the assumption of bivariate normal distribution was not tenable for any of the plots.

To test for bivariate outliers, a scatter plot between the predictor variables (x) and criterion variable (y) was used (see Figures 1-3). The plots were inspected, and no outliers were identified. Because the assumption of bivariate normal distribution was not met for these data, the researcher proceeded to test each hypothesis with a non-parametric measure of correlation, the Spearman's rank order coefficient at the 95% confidence level. This test was a more appropriate measure than the Pearson product moment correlation coefficient because it does not rely on the assumptions of bivariate normal distribution.

Null Hypothesis One

Null hypothesis one compared the relationship between the number of mathematics content courses taken, and mathematics teaching efficacy of secondary special education teachers. The results indicated a weak, significant, positive relationship between total math courses taken and mathematics teaching efficacy as measured by the MTEBI, $r_s = .297$, $p = .014$ (see Table 10). Null hypothesis one was rejected.

Table 10

Relationship between Total Math Courses and Mathematics Teaching Efficacy

			Math Courses Total	MTEBI Total
Spearman's rho	Math Courses Total	Correlation Coefficient	1.000	.297*
		Sig. (2-tailed)		.014
		N	68	68
	MTEBI Total	Correlation Coefficient	.297*	1.000
		Sig. (2-tailed)	.014	
		N	68	68

*. *Correlation is significant at the 0.05 level (2-tailed).*

Null Hypothesis Two

To test the second null hypothesis, the researcher compared the relationship between years of mathematics co-teaching experience and mathematics teaching efficacy of secondary special education teachers. The Spearman's rho was calculated, and results indicated a statistically significant, positive relationship between years of mathematics co-teaching experience and mathematics teaching efficacy as measured by the MTEBI, $r_s = .451$, $p < .001$ (see Table 11). Null hypothesis two was rejected.

Table 11

Relationship between Years of Math Co-teaching and Mathematics Teaching Efficacy

			Years of Math Co-teaching	MTEBI Total
Spearman's rho	Years of Math Co-teaching	Correlation Coefficient	1.000	.451**
		Sig. (2-tailed)		.001
		N	68	68
	MTEBI Total	Correlation Coefficient	.451**	1.000
		Sig. (2-tailed)	.001	
		N	68	68

**. *Correlation is significant at the 0.01 level (2-tailed).*

Null Hypothesis Three

To test the third hypothesis the researcher compared the relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers. The Spearman rank order correlation coefficient was calculated, and the results indicated no statistically significant relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers $r_s = -.090$, $p = .464$ (see Table 12). The researcher failed to reject null hypothesis number three.

Table 12

Relationship between Years of Teaching Experience and Mathematics Teaching Efficacy

			Years of Teaching	MTEBI Total
Spearman's rho	Years of Teaching	Correlation Coefficient	1.000	-.090
		Sig. (2-tailed)		.464
		N	68	68
	MTEBI Total	Correlation Coefficient	-.090	1.000
		Sig. (2-tailed)	.464	
		N	68	68

CHAPTER FIVE: CONCLUSIONS

Overview

The purpose of this quantitative correlational study was to determine the relationship between Virginia secondary special education teachers' mathematics teaching efficacy and their number of years of teaching experience, years of co-teaching experience, and number of math content coursework taken at the undergraduate level. An extensive review of the literature was conducted to explore teacher self-efficacy, special education, mathematics teaching and learning, as well as the measurement of mathematics teacher self-efficacy. This review of the literature revealed a gap in research regarding the factors that are related to special education teachers' mathematics teaching efficacy. A volunteer sample of special education teachers in southeastern Virginia were surveyed for their demographic information, their mathematics course history, and their mathematics teaching efficacy using the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) (see Appendix A) (Enochs et al., 2000). Predictor variables for this study included mathematics course content, years of mathematics co-teaching experience, and total years of teaching experience. Surveys were distributed to 114 special education teachers employed by two public school districts in southeastern Virginia. Out of the 114 teachers, there were 69 complete responses, and one response was removed due to being from an unlicensed teacher. Assumption testing was conducted, and a Spearman's rho correlational analysis was completed. This chapter will review each research hypothesis and discuss the research findings. Limitations, implications and suggestions for further research will also be discussed.

Discussion

Research Question One

The first research question aimed to determine if there is a relationship between the number of mathematics courses taken by special education teachers and their mathematics teaching efficacy. A review of the literature revealed that there are many factors that influence teacher self-efficacy, including the amount of content knowledge, pre-service preparation for the teaching profession, and in-service professional development experiences (Gulten, 2013; Hunt-Park et al., 2012; Rosas & Campbell, 2010; Ruiz & Watson, 2015; Stevens et al., 2013; Swackhamer, et al, 2009). The researcher sought to determine if the same relationship existed between special education teachers' math content knowledge and their mathematics teaching efficacy, as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI). To answer this research question, data were analyzed using a Spearman's rank order correlation coefficient. The results indicated a weak significant, positive relationship between total math courses taken and mathematics teaching efficacy as measured by the MTEBI, $\rho = .297$, $p = .014$. This finding indicated that higher numbers of mathematics courses taken were related to higher levels of mathematics teaching efficacy. This finding aligns with prior research regarding efficacy and education of general education teachers (Gulten, 2013; Swackhammer et al., 2009).

The relationship between mathematics content knowledge and mathematics teaching efficacy is a complex one. Time between courses, alignment of the course content with the type of mathematics they currently teach, number of years of teaching experience since the course were taken, and other factors, may also be related and influencing the relationship between these variables. However, the relationship is clear that increased exposure to mathematical concepts and skills is positively related to higher levels of mathematics teaching efficacy.

Research Question Two

The second research question investigated the relationship between years of mathematics co-teaching experience and mathematics teaching efficacy of secondary special education teachers. Current literature about co-teaching reveals that it is the preferred method for providing specialized instruction for students with disabilities (Prizeman, 2015). Barriers to the success of co-teaching do exist and can include the willingness of the mathematics teacher to adjust one's pedagogical strategies to meet the needs of students with disabilities (Wang et al., 2012) along with "inadequate resources, planning time, and training on how to teach the math skill or concept" (Bottge et al., 2015, p. 173). Additionally, there is a tendency of secondary special education teachers to take on subordinate roles because of the need for specialized content knowledge at the secondary level (Scruggs et al., 2007; Sweigart & Landrum, 2015). To investigate this research question, a Spearman's rank order correlation coefficient was calculated between the variables of number of years of co-teaching experience and mathematics teaching efficacy. The results indicated a statistically significant, positive relationship between years of mathematics co-teaching experience and mathematics teaching efficacy as measured by the MTEBI, $r_s = .451$, $p = .01$. This positive correlation indicated that teachers that have more experience co-teaching in the mathematics classroom have more positive beliefs about their ability to teach math and achieve results for students with disabilities.

Special education teachers are expected to seamlessly provide specialized instruction within the general education setting to improve student outcomes (Hamilton-Jones & Vail, 2014). In order for this to be successful, their relationship with the mathematics content teachers must be strong, flexible, and constantly improving (Prizeman, 2015). The more experience that teachers have with co-teaching in the mathematics classroom, the more opportunity they have to develop strong, effective relationships with co-teachers.

Research Question Three

The third research question explored the relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers. It was hypothesized that with increased years of experience, teachers may develop more comfort and confidence in their ability to teach mathematics effectively to students with disabilities. The data were analyzed by calculating a Spearman rank order correlation coefficient to determine if there is a statistical relationship between years of teaching experience and mathematics teaching efficacy in the studied population. The results indicated no statistically significant relationship between years of teaching experience and mathematics teaching efficacy of secondary special education teachers $r_s = -.090$, $p = .464$. This meant that, in the population studied, more experienced teachers did not necessarily have a higher level of mathematics teaching efficacy than less experienced teachers. There is a gap in the literature in the area of special education mathematics teacher self-efficacy as it is related to years of teaching experience, but this finding may be explained through understanding the wide variety of factors that impacts special education teachers over time. Unlike most other educational professionals, secondary special education teachers change roles between self-contained and co-taught classrooms, switch among K-12 levels of teaching, may work in different public school settings, and may move between different content areas. These factors need further studies to determine their impact on secondary special education teachers' mathematics teaching efficacy.

Implications

The results of the present study had implications on current practices in the areas of special education teacher pre-service coursework, professional development, and achievement outcomes for students with disabilities. Teaching efficacy has been related in the research to improved student outcomes (Hines, 2008; Kıvılcım et al., 2013; Lee et al., 2011; Wang et al., 2012). Teachers who feel that they can and will make a difference in the achievement of students with disabilities through their use of specialized instructional strategies are more likely to experience high student achievement.

The present study proposed that mathematics teaching efficacy is related to higher levels of mathematics content knowledge. This research uncovered a weak, positive relationship between these variables. This implies that special education teachers need to feel comfortable and confident in the math content they teach (Rosas & Campbell, 2010), and they benefit from additional college level course work in mathematics. Encouraging content specific coursework for re-licensure and adding incentives for special education teachers to become dually licensed, are strategies for school policy leaders to consider. Additionally, professional development in mathematics co-teaching and the use of specialized instructional strategies for teaching mathematics to students with disabilities are important areas for skill building. This training should be supplemented with job embedded training in the implementation and alignment of math curriculum, instruction, and assessment. These may be the most effective pre-service and in-service strategies for improving mathematics teaching efficacy in the special education teacher population.

The research also proposed that years of co-teaching and teaching experience may be related to mathematics teaching efficacy. The research revealed a positive relationship between years of co-teaching experience and efficacy beliefs, and no relationship with years of teaching experience. Teachers that have more years of experience working in the math classroom and being exposed to the standards, curriculum, and instruction, are more likely to have higher levels of positive beliefs about their ability to teach student math content and skills successfully. Co-teaching relationships take time to develop and require time for planning, reflection, and development of a common understanding (Prizeman, 2015; Wang et al., 2012). Building administrators should consider how maintaining co-teaching pairs together from year to year and developing opportunities for common planning between co-teaching pairs may help foster the co-teaching relationship. Common planning is noted by Prizeman (2015) and Bottge, et al. (2015) as one of the most common struggles among co-teachers. School leaders may also want to consider sending co-teaching pairs to attend professional development together to improve their skills by providing specific training on co-teaching methods (Tzivinkou, 2015). School leaders may also incorporate modeling of the co-teaching relationship through faculty meetings, presentations, and professional development throughout the school year. Through these steps, co-teachers may begin to experience growth in their attitude and efficacy toward teaching students with disabilities.

Pre-service teaching program developers and school officials should pay close attention to the need for teachers to improve their teaching efficacy. The current research provides a broad review of literature related to mathematics teaching efficacy in special education teacher populations. Through improved co-teaching relationships, greater understanding of the use of specialized instructional strategies, and continuous, job-embedded training, special education teachers may gain higher levels of teaching efficacy and feel more prepared to provide the instructional services that students with disabilities need to be successful in the general education classroom setting (Hamilton-Jones & Vail, 2014; Loreman et al., 2013).

Limitations

The findings presented in the present research had key limitations, including the validity of the survey instrument and the applicability of the research to a wider group of special education teachers. Survey research using a volunteer sample relies on the respondents to be representative of the entire sample. Although the researcher achieved a satisfactory response rate to the survey of 60.5%, there was another 39.5% of the population that did not respond to the survey. A higher response rate or a larger sample size would yield a more valid outcome, and ensure that the measured outcomes could be applied to a broader population.

Additionally, the data gathered did not meet the assumption of bivariate normal distribution necessary to conduct a Pearson correlation coefficient. Thus, the researcher had to switch to a non-parametric form of correlational measurement, the Spearman's rank order correlation coefficient. Although this method also had merit in providing information on the relationship between two variables, the data became rearranged or ranked, rather than retaining its interval value. This limits the interpretation of the data and presents concern when applying the findings to broader populations.

Further limitations of the present research included the validity of the mathematics course checklist. The survey was designed to provide a simplified method for collecting information about each teachers' college mathematics experience. However, self-reporting errors may have led to inaccurate information collected within the survey. The researcher suggests that a larger sample size be used to collect more data in this manner to help determine if the trends are similar in a larger population. Future studies may also include inspection of college transcripts or the comparison of pre-service preparation programs that do and do not require additional math coursework as a means for understanding the impact of math coursework on teaching efficacy in special education teachers.

The limitations to this study included the sample size, response rate, lack of bivariate normal distribution and self-reporting errors on the survey. These limitations should be considered before drawing conclusions based on this research. Future researchers may benefit from focusing on reducing these limitations in their studies by increasing the population size.

Recommendations for Future Research

The present research study contributes to the body of knowledge regarding the various factors related to teaching efficacy. Future research is needed to uncover factors that are positively related to teaching efficacy, especially those that can be leveraged and improved, such as, professional development and length of co-teaching relationships. Additional correlational studies may help broaden the body of literature related to mathematics teaching efficacy, and help pre-service program developers and school administrators design improvement programs. The quantitative research can only uncover broad patterns in relationship, and cannot suggest causality and understanding special education teachers' efficacy requires intimate knowledge of the many complex facets of their background, motivation and areas of need. Therefore, qualitative analyses, such as, case studies and phenomenological studies may provide greater insight into these issues. Case studies are suggested to aid in the understanding of special education co-teaching relationships, mathematics teaching efficacy in special education teachers, and attitude regarding student outcome and achievement in mathematics. A phenomenological study to review the impact of the increased rigor in the mathematics standards in the state of

Virginia alongside the increased graduation requirements for students with disabilities may also be beneficial to the field.

Summary

The researcher used this quantitative correlational study to determine the relationship between Virginia secondary special education teachers' mathematics teaching efficacy and their number of years of teaching experience, years of co-teaching experience, and number of math content coursework taken at the undergraduate level. Significant, positive correlations were found between mathematics teaching efficacy and the years of mathematics co-teaching experience and the number of math content courses taken at the undergraduate level. These findings imply that special education teachers' mathematics teaching efficacy can be positively improved through increased experience in the math classroom, as well as, improving the teachers' mathematics knowledge through college level courses. Implications of this study include the need for improved licensure models for special education teachers which include content specific coursework, increased opportunities for professional development on building the co-teaching relationship, and planning by school leaders to purposefully foster their co-teaching pairs through common planning times, modeling, and professional learning opportunities.

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APPENDICES

Appendix A: Mathematics Teaching Efficacy Beliefs Instrument

Enochs, Smith, & Huinker, 2000, p. 200-201

Appendix B: MTEBI Scoring Instructions

Enochs, Smith, & Huinker, 2000, p. 200-201

Appendix C: Permission to Use Instrument

Re: Mathematics Teaching Efficacy Beliefs Instrument

DeAnn M Huinker <huinker@uwm.edu>

Sat 8/13/2016 3:44 PM

To: Martin, Owen <omartin@liberty.edu>;

Hi Owen,

Yes, you certainly have my permission to use the MTEBI instrument as you request.

Best to you in your research and professional work,
DeAnn Huinker

> On Aug 7, 2016, at 11:26 AM, Martin, Owen <omartin@liberty.edu> wrote:
>
> Dr. Huinker,
>
> My name is Owen Martin, and I am a doctoral candidate at Liberty University in Virginia. I am requesting permission to utilize the Mathematics Teaching Efficacy Beliefs Instrument published in the 2000 issue of the School Science and Mathematics journal. I am collecting data for a dissertation measuring the self-efficacy of special education teachers who co-teach mathematics. I plan to apply the instrument to currently practicing teachers and plan to change the items from future to present tense. I would also need to remove "elementary" from item 11 in order to apply the instrument to K-12 participants. If you have further questions regarding this study, please feel free to contact me or the chair of my dissertation committee, Dr. Elgen Hillman at ehillman2@liberty.edu.
>
> Sincerely,
>
> Owen E. Martin

Dr. DeAnn Huinker
Professor, Department of Curriculum and Instruction
[redacted]

Appendix D: Demographics Questionnaire

* 1. Are you a licensed teacher endorsed in special education in the state of Virginia?

* 2. What is your age?

* 3. What is your gender?

- Female
- Male

* 4. What is your race? (Select all that apply.)

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic/Latino
- Native Hawaiian or Other Pacific Islander
- White

* 5. What is your highest degree attained?

- Bachelor's
- Master's
- Education Specialist
- Doctorate

* 6. How many years have you been teaching as a certified teacher? (include the current year in total years of teaching.)

* 7. How many years of experience do you have with co-teaching in any mathematics course? (Co-teaching is providing in-class instruction alongside a general education teacher for students with and without disabilities in a regular education setting (Panscofar & Petroff, 2013).)

Appendix E: Mathematics Courses from Virginia Universities

Old Dominion University (2015)
Mathematics Teaching Licensure Courses

Calculus I
Calculus II
Ordinary Differential Equations
Abstract Algebra
Calculus III
Calculus IV
Advanced Concepts for Secondary Educators
Introduction to Linear Algebra
History of Mathematics
Fundamentals of Geometry
Number Theory and Discrete Mathematics
Intermediate Real Analysis

College of William and Mary (2016)
Mathematics Teaching Licensure Courses

Geometry
Introduction to Number Theory
Statistics
Calculus I
Calculus II
Multivariable Calculus
Linear Algebra
Abstract Algebra
Foundations of Math
Differential Equations and Operations
Research-Deterministic Models

Virginia Technical Institute (2016)
Mathematics Teaching Licensure Courses

Calculus of a Single Variable I
Discovering Mathematics I
Calculus of a Single Variable II
Discovering Mathematics II
Introduction to Linear Algebra
Introduction to Multivariable Calculus
Introduction to Differential Equations
Introduction to Proofs
Modern Algebra
College Geometry
Advanced Calculus
Linear Algebra I

Probability and Statistics
History of Math
Math for Secondary Teachers I
Math for Secondary Teachers II

Appendix F: Mathematics Course Questionnaire

8. Which college level mathematics courses have you taken? Select all college courses for which you have received credit.

Course names vary between colleges and universities, so please select the course that most closely matches. If you have taken courses not listed, please indicate the course name(s) in the box titled "other". If you have not taken college level mathematics courses, please select "none".

- ☐ Algebra – Abstract or Modern
- ☐ Algebra - Linear
- ☐ Calculus I
- ☐ Calculus II
- ☐ Calculus III
- ☐ Calculus IV
- ☐ Calculus - Multivariable
- ☐ Differential Equations
- ☐ Discovering Mathematics
- ☐ Foundations of Math
- ☐ Geometry
- ☐ History of Mathematics
- ☐ Number Theory
- ☐ Math for Secondary Teachers
- ☐ Discrete Mathematics
- ☐ Probability and Statistics
- ☐ None

Other (please specify course name(s))

[ ]

Appendix G: Request for Permission Email

Dear [Recipient]:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree in educational leadership. The title of my research project is "Factors Influencing Special Education Teachers' Mathematics Teaching Efficacy" and the purpose of my research is to gain an understanding of how Virginia secondary special education teachers' mathematics teaching efficacy may be related to mathematics content background knowledge, mathematics co-teaching experience and years of teaching experience.

I am writing to request your permission to contact employees of your school division to invite them to participate in my research study.

Participants will be asked to go to [webpage] and click on the link provided and complete the attached survey. Participants will be presented with informed consent information prior to participating. Taking part in this study is completely voluntary, and participants are welcome to discontinue participation at any time.

Thank you for considering my request. If you choose to grant permission, please provide a signed statement on approved letterhead indicating your approval.

Sincerely,

Owen E. Martin, Ed.S.

Appendix H: IRB Approval

LIBERTY UNIVERSITY
INSTITUTIONAL REVIEW BOARD

August 17, 2017

Owen Martin
IRB Exemption 2962.081717: Factors Influencing Special Education Teachers' Mathematics Teaching Efficacy

Dear Owen Martin,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under exemption category 46.101(b)(2), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:101(b):

> (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
> (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Please note that this exemption only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

[redacted]

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
The Graduate School

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Appendix I: Recruitment Email

Dear Teacher:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree in educational leadership. The purpose of my research is to gain an understanding of how Virginia secondary special education teachers' mathematics teaching efficacy may be related to mathematics content background knowledge, mathematics co-teaching experience and years of teaching experience, and I am writing to invite you to participate in my study. The deadline for participation is [Date].

If you are a special education teacher working at the middle or high school level, and are willing to participate, you may complete the survey at the link provided. It should take approximately 15-20 minutes for you to complete the survey. Your participation will be completely anonymous, and no personal, identifying information will be required.

To participate, go to [webpage] by clicking on the link provided. Please click on the survey link at the end of the consent information to indicate that you have read the consent information and would like to take part in the survey.

If you choose to participate, you will receive a $10 Amazon gift card via email. Once you have completed the survey, the completion screen will contain a link for you to use to enter your email address so that your gift card can be delivered. Email addresses used for the gift card will not be linked to participant survey responses.

Sincerely,

Owen E. Martin, Ed.S.

Appendix J: Follow-up Recruitment Email

Dear Teacher:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree in educational leadership. About a week and a half ago, an email was sent to you inviting you to participate in a research study. This follow-up email is being sent to remind you to complete the survey if you would like to participate and have not already done so. The deadline for participation is [Date].

If you choose to participate, you will be asked to complete an electronic survey. It should take approximately 15-20 minutes for you to complete the survey. Your participation will be completely anonymous, and no personal, identifying information will be required.

To participate, go to [webpage] and click on the link provided to complete the attached survey. Please click on the survey link at the end of the consent information to indicate that you have read the consent information and would like to take part in the survey.

If you choose to participate, you will receive a $10 Amazon gift card via email. Once you have completed the survey, the completion screen will contain a link for you to use to enter your email address so that your gift card can be delivered. Email addresses used for the gift card will not be linked to participant survey responses.

Sincerely,

Owen E. Martin, Ed.S.

Appendix K: Informed Consent

CONSENT FORM

Factors Influencing Special Education Teachers' Mathematics Teaching Efficacy
Owen E. Martin
Liberty University
School of Education

You are invited to be in a research study of teacher self-efficacy. You were selected as a possible participant because you are currently employed as a special education teacher. Please read this form and ask any questions you may have before agreeing to be in the study.

Owen Martin, a doctoral candidate in the School of Education at Liberty University, is conducting this study.

Background Information: The purpose of this study is to gain an understanding of how Virginia secondary special education teachers' mathematics teaching efficacy may be related to mathematics content background knowledge, mathematics co-teaching experience and years of teaching experience.

Procedures: If you agree to be in this study, I would ask you to complete an electronic survey that will take you approximately 15-20 minutes.

Risks and Benefits of Participation: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life. Participants should not expect to receive a direct benefit from taking part in this study. Benefits to society include contributing to ongoing educational research to improve professional development and training for teachers.

Compensation: Participants will be compensated for participating in this study. Participants may elect to submit their email address into a separate database at the end of the survey to receive a $10 Amazon gift card within 7 days of survey completion. Email addresses used for the gift card will not be linked to participant survey responses.

Confidentiality: The records of this study will be kept private. In report published will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records. All participants will remain anonymous. Data will be stored in a password protected file and password protected computer system.

Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University or your school division. If you decide to participate, you are free to not answer any question or withdraw at any time prior to submitting the survey without affecting those relationships.

Contacts and Questions: The researcher conducting this study is Owen Martin. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at omartin@liberty.edu. You may also contact the researcher's faculty advisor, Dr. Elizabeth Hillman at ehillman2@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 1887, Lynchburg, VA 24515 or email at irb@liberty.edu.

Please notify the researcher if you would like a copy of this information for your records.

Statement of Consent: I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study. Please click the link below to participate in the survey.

Appendix L: School Division Approvals

[redacted]

[redacted]

April 6, 2017

[redacted]

Dear Mr. Martin,

Thank you for submitting your formal written proposal to conduct educational/academic research in collaboration with the [redacted] I am pleased to inform you that based on the information that you submitted for consideration to our Review Committee, your project proposal [redacted] **#2017-003** has been approved for implementation and study.

Should there be any changes to your study, Factors Influencing Special Education Teachers' Mathematics Teaching Efficacy, please submit these changes to my office in writing for further consideration by the Review Committee.

Once your research has been completed, the Data Completion Notification Form must be submitted. [redacted] will require you to submit your findings in writing upon completion of the study. This information can assist us as we review our current instructional program.

Thank you for partnering with [redacted] Public Schools for your academic research proposal. We look forward to working with you. Please do not hesitate to contact my office with any concerns or questions regarding your study. We wish you the best of luck.

Sincerely,

[redacted]

Director for Accountability and Special Programs

[redacted]

[redacted]

March 29, 2017

Dear Mr. Owen:

Re: Request to Conduct Research

This letter authorizes you to contact building principals in order to proceed with your dissertation research, Factors Influencing Special Education Teachers' Mathematics Teaching Efficacy. Principals have the authority to determine how the research request will be presented to appropriate staff.

Please note that participation by any [redacted] employee and/or student in an outside study is completely voluntary. Parent permission must be received prior to any student involvement. Please share this letter with the building principal prior to proceeding with the research.

Sincerely,

[redacted]

Community and Public Relations Coordinator

[redacted]