SELF-EFFICACY SCORE DIFFERENCES BETWEEN SUPPORTED, UNSUPPORTED, DEPARTMENTALIZED AND NON-DEPARTMENTALIZED CLASSICAL CHRISTIAN ELEMENTARY MATHEMATICS TEACHERS

by

Cristina Marie Dube

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

Classical Christian schools have increased exponentially over the past 20 years. The main mission of a classical Christian education is to produce a student who is better equipped to think and apply the Christian worldview to every situation. Classical schools are based on the Greek Trivium which focuses on the tools of learning: grammar school, logic school, and rhetoric school. Classical tenets include integration of content, memorization of basic facts, and reliance on the Socratic Method. Utilizing the Socratic Method requires teachers to be confident in their understanding of mathematics. Because of the lower mathematics self-efficacy of elementary school teachers, they struggle with being able to utilize the Socratic Method. Mathematics specialists and coaches have been shown to produce positive results in increasing teachers' self-efficacy in schools. The purpose of this non-experimental, quantitative, causal-comparative research study was to determine if significant differences exist between self-efficacy scores of classical Christian grammar mathematics teachers with and without the presence of mathematics' specialists or coaches both within departmentalized and non-departmentalized classrooms. A total of 117 grammar school teachers at classical Christian schools across the country were sampled and data collection was conducted using the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI). The results were tabulated in SPSS. No statistically significant difference was found between the total MTEBI scores. Further research recommendations were made to study the quality of the elementary mathematics specialists and the spirituality of the teachers.

Keywords: Elementary mathematics specialists, math coaches, classical Christian grammar schools, self-efficacy, departmentalized, non-departmentalized

Dedication

I would like to dedicate this dissertation to my family: my wonderful husband, Eric and our two children, Aleksander Joseph (A.J.) and Nicholas Edward. My prayer is that you see that every day as a good day. I would also like to dedicate this to the mathematics students I have taught over the years who have provided so much joy in my life and inspired me to find more engaging ways to help reveal the beauty of mathematics.

Acknowledgement

First, I want to give praise to my Lord and Savior, Jesus Christ. Thank you, Jesus, for giving me the strength to complete a journey I started over 25 years ago. I thank you for giving me the persistence, focus, and resolve necessary to finish the race. I am blessed and highly favored and continue to trust in you to guide me.

Secondly, I would like to thank my family. Thank you to my husband, Eric, for supporting me, for letting me bounce ideas off you along the way, and for serving our great country in the United States Air Force. Thank you to A.J. for showing me what it means to work hard and accomplish goals. Your grit is admirable and inspiring. To Nick, I thank you for the smiles and hugs you provided in the early morning hours as my eyes were bleary. Your kindness is immeasurable. Thank you to my parents who always encouraged me to do my best in school and showed me that working hard is a worthy habit.

Lastly, thank you to Liberty University and Geneva School of Boerne for providing financial assistance via the military discount and continuing education discount. Specifically, thank you to Dr. Lunde and Dr. Cordes at Liberty University for supporting me and giving me the confidence to continue to pursue my degree. Your guidance and encouragement were invaluable to me.

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List of Abbreviations

Classroom Setting (CS)

Elementary Mathematics Specialist (EMS)

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)

Mathematics Teaching Outcome Expectancy (MTOE)

National Council of Teachers of Mathematics (NCTM)

Personal Mathematics Teaching Efficacy (PMTE)

Zone of Proximal Development (ZPD)

CHAPTER ONE: INTRODUCTION

Overview

This dissertation will specifically address the issue of underprepared grammar school mathematics teachers at classical Christian schools by studying the use of elementary mathematics specialists and coaches at these schools to determine their impact on teachers' self-efficacy. This chapter will first provide a brief background of classical Christian education. Next, it will delve into the problem statement of the dissertation. Following that, it will describe the purpose of the study and the significance of the study. Finally, the chapter will close by providing the research question and by defining necessary terms the reader will need that are relevant to the study.

Background

Classical Christian educators seek to cultivate a life-long love of learning in students by creating schools that produce students who know how and desire to think (Vaughn, 2018). Classical educators call for a return to education from over a century ago by fostering an advancement of critical and analytical faculties based in the study of the Bible, Latin and Greek languages, and classical books (Strachan, 2013). As the Greek author, Plutarch, stated almost 2,000 years ago, "The mind is not a vessel to be filled, but a fire to be kindled" (Nowlan, 2017). The goals of classical Christian education are to produce students with Biblical worldviews who desire a life-long love of learning and service to their community (Geneva School of Boerne, 2019).

Classical Christian education has been experiencing a dramatic increase in both numbers of students who attend and numbers of classical Christian schools in operation over the past 30 years (Zylstra, 2017). Because of the exponential growth of classical Christian schools, the past few decades, teachers at these schools are less experienced with classical tenets such as integration of subject matter, accountability of learned information, and the Socratic Method (Anderson, 2016). To better understand classical Christian education, teachers at these schools need specific training in these classical Christian tenets (Anderson, 2016). The question of how to teach lies in the variety of methodologies used at these schools. Perrin (2004), a leader of classical Christian education and Chief Executive Officer and publisher of Classical Academic Press, described classical Christian education as a long tradition of asking questions and digging up answers. The Socratic Method requires teachers to ask more open-ended questions and be comfortable enough with subject matter to allow for more freedom in responses (Anderson, 2016). Because this practice requires teachers to be more flexible, it also requires them to know their content well (Swars, Smith, Smith, Carothers & Myers, 2018). Sayers, (1947) in the seminal work on classical Christian education, asserted that thinking, arguing, and expressing ideas are all critical components of classical education. Unfortunately, grammar school mathematics teachers in classical Christian schools are coming from the same pool as educators at other schools and do not feel as comfortable with the content-specific subject of mathematics (Wu, Chao, Cheng, Tuan, & Guo, 2018). Grammar school mathematics teachers cannot assist students with these higher cognitive tasks required by the Socratic Method unless they have confidence in the subject area and specific training (Anderson, 2016). These teachers need further training to be able to teach at these schools. Elementary educators have been found to have a lower sense of self-efficacy in mathematics as well and, thus, are typically not as confident to help students who struggle in mathematics as they are with reading because they are generalists, not specialists (Gresham, 2018b; Martin, Polly, Mraz, & Algozzine, 2019; Qian & Youngs, 2016; Swars et al., 2018).

Classical Christian education was specifically designed to cultivate students who possess wisdom to make sensible choices and eloquence in their abilities to persuade both in public speeches and through writing their thoughts (Littlejohn & Evans, 2006). The goal of classical Christian educators is to produce a student who can think through problems by utilizing a Biblical worldview (Littlejohn & Evans, 2006). Christians, these educators maintain, must develop a view of the world that is based on Biblical truths and apply Biblical principles to every aspect of their lives to make better decisions (Council & Cooper, 2011).

Classical Christian educators and parents have firmly asserted that the philosophical changes in education which started back over a century ago from the publication of John Dewey's *Experience in Education* (1938) have eroded education into its current unsatisfactory state (Miller, 2011). One specific goal of classical Christian educators is to develop students who can perceive the world through a Biblical lens (House, 2009). Education in the early 20th century abandoned any Biblical truths and had at its heart, cultural relativism where every idea and viewpoint was accepted as true (Dow, 2013, Perrin, 2004). While the erosion of education this past century has been gradual, it is no less damning to classical Christian educators because it no longer rests on Biblical truths (Vaughn, 2018). C. S. Lewis (2001) wrote of the overall erosion of societal morals in *The Screwtape Letters,* and the application to education in America the last century has been just as concerning to these educators. Classical Christian educators posit the gradual attrition of education in America has left the country with an education that lacks any moral compass (Perrin, 2004; Vaughn, 2018). Seeking truth was no longer the goal of education, these classical Christian advocates claimed. Instead, the goal of education became more utilitarian and practical to meet the needs of society (Gutek, 2011).

The methods for creating a student with a Biblical worldview lean heavily on the classical ideals from the Greek Trivium of Grammar School, Logic School, and Rhetoric School (Sayers, 1947; Vaughn, 2018; Veith & Kern, 2001). The trivium aligns with the natural development of language in children (Clark & Jain, 2013; Veith & Kern, 2001). The grammar phase begins by focusing on acquiring information and holding students accountable for the information they are taught (Sayers, 1947; Vaughn, 2018). The acquisition of information rests heavily on memorization. Logic school then alters the focus to more logical thought and reasoning. In logic school, students are taught to employ reasoning techniques after they have mastered basic knowledge of topics (Perrin, 2004). Finally, the ability to apply this knowledge and reasoning and to clearly articulate thoughts becomes the focus in rhetoric school grades from ninth through twelfth (Circe Institute, 2018). This tool approach provides the emphasis in each school that is necessary to learn and think through any subject. This method also helps classical educators fulfill the purpose of these schools which is to teach students to reason, recognize, and defend truth, goodness, and beauty (Veith, 2012). It is important to note, however, that each school does not solely require the development of one tool. Students in grammar school are also taught how to logically interpret information and required to write and speak publicly (Perrin, 2004). The emphasis on acquiring basic knowledge in grammar school, however, is clearly articulated (Vaughn, 2018).

A key difference between grammar school at classical Christian schools and elementary school in all other schools is in the subject area of mathematics. The memorization of basic facts in mathematics is emphasized much more at classical Christian schools than at other schools (Perrin, 2004; Vaughn, 2018). In a recent survey of teachers who teach common core mathematics objectives, Bay-Williams (2016) discovered that 40% of teachers who teach in kindergarten through eighth grades say they have fewer students who memorize their basic facts. Quick retrieval of basic facts in mathematics is a key component of grammar-aged children at classical Christian schools, just as it was 100 years ago (Perrin, 2004). Classical Christian educators argue that all other schools have abandoned accountability of learned information in the 20th century and included in this accountability is the memorization of basic mathematics facts (Perrin, 2004; Vaughn, 2018; Veith & Kern, 2001). Ritchie, Sala, and McIntosh (2013) studied the importance of memorizing basic facts, a basic tenet of classical Christian mathematics education, and found it to be positively correlated to mathematics achievement. In addition, students who have memorized their facts in grammar school are more likely to succeed in algebra as well (Duncan et al., 2008). As Bauer and Wise stated in their book, *A Well-Trained Mind; A Guide to Classical Education at Home* (2016, p. 115), basic fact memorization in classical education lays the foundation for mathematics. The importance of the Trivium, the organizational structure, integration of content, and an emphasis on accountability discussed by Sayers (1947) continues to be referenced in classical education. Memorization of basic mathematics facts in schools that do not follow classical Christian tenets has been deemphasized the past two decades because of the publication of a book from the National Research Council and Mathematics Learning Study Committee (2001). Bay-Williams (2016), in a survey of teachers, corroborated this when they discovered that more attention was being paid to application of mathematics. In the book entitled, *adding it Up: Helping Children Learn Mathematics*, the National Research Council and Mathematics Learning Study Committee (2001) asserted that basic facts need not be memorized mechanically. This attention away from memorization of basic facts is in direct contrast to the objectives of teachers in classical Christian grammar schools (Perrin, 2004; Vaughn, 2018). Recently, however, a move back toward basic facts has been supported in research studies (Calderon-Tena & Caterino, 2016; Gersten et al., 2009). In a study by Calderon-Tena and Caterino (2016), a call for a return to basic facts instruction, especially requiring the memorization of basic facts, was reported in the *Journal of Science and Mathematics Education*. In it, the researchers discovered that long-term retrieval skills became a better predictor of both mathematics calculation and mathematics problem solving as age and grade increased. The current results are in line with a panel of educators who recommend that students need about 10 minutes of fact practice instruction each day to build quick retrieval of basic arithmetic facts through eighth grade (Gersten et al., 2009). Interestingly, a basic tenet of classical education, accountability for learned information and memorization in grammar school, has been the topic of a few studies the past few years (Anderson, 2016; Vaughn, 2018). How to help students who are struggling with basic facts, however, is ignored after initial strategy instruction in the lower elementary graders (Baroody, Purpura, Eiland, Reid, & Paliwal, 2016). The importance of understanding the impact reasoning has on basic fact memorization cannot be overstated. The ability to reason is a key component in fact retrieval because students need to be able to retrieve facts from long-term memory and transfer them into working memory (Gersten, Jordan, & Flojo, 2005). Baroody et al. (2016) found reasoning to be a significant factor in helping students derive an unknown fact from a known fact. However, teaching these strategies to primary mathematics teachers takes time. Teachers are less likely to use reasoning in classrooms because they are pressed for time (Wills & Sandholtz, 2009). Because of the emphasis on basic fact memorization at classical Christian schools, some teachers may be unwillingly increasing students' anxiety as well. Sorvo et al. (2017) reported that teachers who allow students to overutilize counting strategies to retrieve these facts may be increasing the stress-level on students and therefore increasing mathematics anxiety. Boaler

(2016) and Parker (2015) found similar results in their studies of math anxiety and math fact retrieval practices. Sorvo (2017) also discovered that students who rely on counting strategies have difficulty reaching automatic retrieval of basic facts and develop math anxiety more often. Teachers at classical Christian schools, as has been shown, emphasize the importance of memorization, but may not be trained in the stages of fact retrieval to help reduce anxiety.

One method for assisting elementary mathematics teachers in these areas is to use peer coaches or elementary mathematics specialists. The use of elementary mathematics specialists to help work with teachers has been shown to be a valuable resource to improve three main areas that elementary teachers struggle with: content knowledge, instructional practices, and self-efficacy (National Council of Teachers of Mathematics, 2018; Swars et al., 2018; Wu et al., 2018). Research has been conducted to determine how to improve teachers' mathematics understanding, instructional practices, and to build self-efficacy. In a recent study conducted by Spillane and Shirrell (2018), teachers' on-the-job interactions that included infrastructure changes in schools was predictive of changes in both the teacher's instructional practices and beliefs. Contrastingly, professional development alone did not change teachers' practices, but did change their beliefs. According to Spillane and Shirrell (2018), having an elementary mathematics specialist in place on a day-to-day basis profoundly impacted teachers, which in turn benefitted their students. Elementary mathematics specialists are increasingly being recommended to assist teachers in their content knowledge, instructional practices, and self-efficacy (NCTM, 2018).

Bandura and Wessels (1997) found that a person's self-efficacy can be domain-specific and Calderon-Tena and Caterino (2016) reported that elementary teachers, those who teach in grades kindergarten through fifth, have been shown to struggle with self-efficacy most in the content-specific domain of mathematics. Elementary teachers may struggle in their confidence in mathematics but feel stronger in other areas such as reading according to Calderon-Tena and Caterino (2016). Self-efficacy, or feelings about self, can alter a teacher's choice of instructional practices and reduce the desire to improve content knowledge (Boaler, 2016; Kahle, 2008; Pollock & Mindzak, 2018; Roettinger, 2014; Swars, 2005; Wilkins, 2008). For example, a teacher who is confident in her own mathematics ability will choose an instructional practice like discovery learning for her class over a direct teaching lesson because she will be more capable of handling unplanned questions or responses (Lee, Walkowiak, & Nietfeld, 2017). Vygotsky, creator of social development theory, hypothesized that interaction that occurs between experts and novices can aid understanding (Miller, 2011). This learning theory applies to the interactions between an expert elementary mathematics specialist and a novice teacher because the former would help develop teachers' content knowledge, instructional practices, and self-efficacy through positive interactions.

Research in schools has shown that having an elementary mathematics specialist on staff to clarify mathematics content, to improve teachers' instructional practices, and to increase elementary teachers' self-efficacy appears to be an appropriate way to improve the self-efficacy of these teachers (NCTM, 2018; Swars et al., 2018; Wu et al., 2018). However, very little research exists within the classical Christian school population (Council & Cooper, 2011; Splittgerber, 2010). Several researchers have shown that elementary mathematics educators benefit from the assistance of elementary mathematics specialists (NCTM, 2018; Swars et al., 2018; Wu et al., 2018). Therefore, this study will specifically focus on the self-efficacy of elementary mathematics teachers in classical Christian grammar schools with and without the assistance of elementary mathematics specialists to help improve self-efficacy beliefs in the domain-specific content area of mathematics.

Problem Statement

The research has begun to show the impact elementary mathematics specialists have on teacher content knowledge, instructional practices, and self-efficacy in a variety of schools (Boaler, 2016; Kahle, 2008; Pollock & Mindzak, 2018; Roettinger, 2014; Swars, 2005; Swars et al., 2018; Wilkins, 2008; Wu et al., 2018). The minimal research focused solely in classical Christian Schools includes examinations of administrator's job efficacy and self-efficacy of teachers within classical Christian schools compared to non-classical Christian schools (Anderson, 2016; Council & Cooper, 2011). Anderson (2016) found that there was no difference in the self-efficacy of teachers within the classical Christian environment and a traditional Christian environment. Council and Cooper (2011) discovered administrators at classical Christian schools reported greater job satisfaction based on their leadership qualities, relationship with the school governing body, and classical pedagogy. Classical Christian educators do require more training of classical Christian ideals, including pedagogy due to the lack of experience in these areas (Circe Institute, 2018; Veith & Kern, 2001). These ideals would include proper instructional practices such as utilizing the Socratic Method, integrating Biblical truths and their relation to mathematics, developing a sense of wonder in students, and finally, furthering an understanding of how to teach basic facts for memorization. Expert elementary mathematics specialists, it would follow, would help these teachers in these areas and build their confidence. Wu et al. (2018) discovered in their study of elementary mathematics teachers that these teachers lacked the appropriate content knowledge to teach mathematics with the precision required to clarify relationships. Without this precision of content knowledge, it is very difficult for any teacher to be able to make connections both within mathematics and among other content areas. Integration of learning is also area of emphasis in classical Christian schools (Perrin, 2004; Perrin, 2019; Sayers, 1947). The integration of the Bible specifically in mathematics helps students establish their *telos*, or purpose in life, for working through difficult problems. Research supports the importance of integrating mathematics with content areas. Polly (2016) found that the connections that students make within mathematics increased student achievement.

Anderson (2016) asserted that classical pedagogical strategies require more knowledge and understanding yet many teachers enter the classical arena ill prepared. The researcher added that this feeling of inadequacy influenced their efficacy to utilize instructional tools that increased engagement of students in the learning process. The problem is that while research points to elementary mathematics specialists having impact on teachers' self-efficacy, we still lack the ability to make a definitive statement about it. A research study that compares the impact they have in different settings would help validate these findings. This study will add to the body of evidence that is already in existence about elementary mathematics specialists' ability to impact self-efficacy and in turn will help make a definitive statement within the classical Christian school environment.

Purpose Statement

The purpose of this quantitative, causal-comparative study was to determine if elementary mathematics specialists had a statistically significant effect on classical Christian teachers' self-efficacy within departmentalized and/or non-departmentalized classrooms as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) (Huinker & Enochs, 1995). The study of this relationship fits within Vygotsky's social development theory and Bandura's social learning theory because experts work with novice teachers within a school environment to help develop teachers' self-efficacy in teaching mathematics in elementary school environments. The population was grammar school mathematics teachers within 60 classical Christian schools in the United States. The independent variables in this study were the support within a school of an elementary mathematics specialist or not and the setting of the classroom, either departmentalized or not. Departmentalized, for the purposes of this study, was defined as teaching more than one section of mathematics each day. The dependent variable in this study was the teachers' self-efficacy score using the Mathematics Teaching Efficacy Beliefs Instrument, MTEBI (Huinker & Enochs, 1995). Self-efficacy was defined as the conviction that one can successfully execute the behavior required to produce the outcome (Bandura & Wessels, 1997).

Significance of the Study

The study of the use of elementary mathematics specialists to interact on a day-to-day basis with grammar school mathematics teachers is imperative in classical Christian schools for a multitude of reasons. Firstly, because of the recent emergence of these schools, the study is needed to firmly establish the organization of the schools and to determine the practices that match the classical philosophies of accountability, inquiry-based instruction, and integration of subject matter. Secondly, because the impact elementary mathematics specialists have on teachers' self-efficacy is still being researched, it will help make a more definitive statement. Self-efficacy in mathematics can dramatically alter the instructional practices teachers choose to, or not to participate in (Boaler, 2016; Lee et al., 2017). In addition, Bandura's research on self-efficacy of teachers illustrated that teachers have different levels of self-efficacy based on the content they teach (Bandura, 1997). A recent study conducted by Wu et al. (2018) discovered significant differences in self-efficacy of pre-service teachers when they taught mathematics and science, as opposed to when they taught non-mathematics/science subjects. In addition, teachers who have lower self-efficacy in mathematics tend to teach with less inquiry-based instructional practices and make fewer connections (Wu et al., 2018). This is in direct conflict to the goals of a classical Christian education of inquiry-based instruction and integration. One main goal of classical Christian educators is to develop a life-long sense of learning in students. Teachers who chose to teach with direct teaching instructional practices are not developing a sense of wonder in their students and are not engaging their students with meaningful instructional practices (Perrin, 2004). In addition, teachers who do not have a strong sense of self-efficacy in teaching mathematics do not teach with discovery techniques because they don't feel comfortable when students ask questions outside the teachers' areas of expertise or that disrupt an algorithm being taught. Finally, teachers with a lower sense of mathematics self-efficacy cannot make connections both within mathematics and to other content areas because they do not have a strong understanding of content knowledge (Wu et al., 2018). Each of these areas could be dramatically improved by employing a qualified elementary mathematics specialist to work with elementary teachers.

This study provides more clarity of the impact elementary mathematics specialists have on teachers' self-efficacy in the classical Christian environment. The study provides leaders within classical Christian grammar schools with evidence to guide them in the training of classical Christian grammar school mathematics teachers. This research was needed to help establish how content will be taught and how these schools need to operate in order to meet their goals of creating life-long lovers of learning in students in all subject areas, including mathematics.

Research Question

The research question this study answered is:

RQ1: Is there a difference between the self-efficacy scores of classical Christian grammar school mathematics teachers who are supported by mathematics specialists and classical Christian grammar school mathematics teachers who are not supported by mathematics specialists within departmentalized and non-departmentalized classrooms as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)?

Definitions

The following definitions were used for the present study:

1. *Classical Christian Schools* - Classical Christian education is a combination of philosophy and methods that are age specific, time tested (the Trivium), Christ-centered, nurturing, and academically rigorous, as exemplified by schools associated through membership in the ACCS (Vaughn, 2018).
2. *Departmentalized Classrooms* – Departmentalized classrooms are those where one teacher is planning and delivering the core subject instruction for more than one group of students (Martin, Lee, & Trim, 2016).
3. *Greek Roman Trivium* – The Greek Roman Trivium is a methodology, or set of tools, that utilizes the Grammar, Logic, and Rhetoric phases (Vaughn, 2018).
4. *Non-departmentalized Classrooms* – Non-departmentalized classrooms are those where classroom organizational structures, where one regular education teacher teaches all required subject area content (other than perhaps music, art, and physical education) to a class of students all day for the entire school year (Nelson, 2014)

5. *Scaffolding* – Scaffolding is a temporary framework supplied by more skilled people to support a child's emerging skills (Miller, 2011).
6. *Self-efficacy* – Self-efficacy is the conviction that one can successfully execute the behavior required to produce the outcome (Bandura & Wessels, 1997).
7. *Telos* – Telos is the Greek word for purpose (Circe Institute, 2018).

CHAPTER TWO: LITERATURE REVIEW

Overview

The current literature review will center on the influence elementary mathematics specialists have on elementary teachers in school environments. The specific effects these elementary mathematics specialists have on teacher content knowledge, instructional practices (methodology), and self-efficacy will be reviewed. Next, an examination of the literature regarding classroom settings including the effects of departmentalization in schools will be presented. Finally, the review will include a brief synthesis of the sparse research available within the classical Christian school population. The purpose of this study is to review the research available on the impact elementary mathematics specialists have in schools, the research on non-departmentalized and departmentalized classrooms, and finally the research specifically based within the classical Christian population to determine if patterns can be found.

Theoretical Framework

The theoretical framework provided the support for the study. This study is based on two learning theories: Vygotsky's social development theory and Bandura's social learning theory. Both these theories emphasized the importance of environmental, nonbiological influences on behavior (Miller, 2011). These theories were chosen for the study because the significance of grammar school teachers interacting with qualified elementary mathematical specialists on a day-to-day basis will be one independent variable in this causal-comparative, self-efficacy study.

Social Development Theory

Social development theory originated in the early 20th century from a Russian psychologist named Vygotsky. The theory is based on the idea that learning precedes development, not the reverse as Piaget would assert in cognitive learning theory (learning-theories.com, 2018). A key tenet of social development theory is the idea of a zone of proximal development (ZPD). The ZPD is the "distance between a student's ability to perform a task under adult guidance and/or with peer collaboration and the student's ability to solve the problem independently" (learning-theories.com, 2018). The expert, the adult in this definition, assists the novice, the student, in learning unknown information from known information. In the present study, the expert will be the elementary mathematics specialist and the novice will be the classical Christian grammar school mathematics teacher. The elementary mathematics specialist will guide the teacher through intellectual conversations about mathematics and help them develop better content knowledge, more effective instructional practices, and improve the teachers' self-efficacy. Then, the teacher will be better equipped to act as the expert in the classroom who assists the novice student in learning mathematics.

Social development theory has been used as the theoretical framework for studies based on elementary mathematics specialists with promising results and is the predominant theory in teacher learning (Jaworski & Huang, 2014; Kutaka et al., 2017). In addition, collaboration between teachers and experts in the field is a ubiquitous framework for professional development research. However, Kutaka et al. (2017) emphasized that the collaboration took time for results to be significantly different. The building of connections between experts (elementary mathematics specialists) and novices (classroom teachers) in the school would require a time commitment as well. The employment of elementary mathematics specialists available on a day-to-day basis to help guide the teachers is a key variable of the present study.

Social Learning Theory

Social learning theory from Bandura was first based on Tinto's student engagement theory from 1975 (Shenkle, 2013). This theory emphasized the importance of student engagement in their college experience and how it contributes to their persistence in academics. In fact, student engagement was found to be the single greatest predictor in persistence in college (Shenkle, 2013). Astin's involvement theory furthered the development of social learning theory in 1977 by finding a direct positive correlation between a college student's involvement in institutional activities and the student's overall persistence (Shenkle, 2013). Bandura then developed social learning theory in 1977 and postulated that environmental intervention could be used to assist in academic-based non-completion issues. Bandura's work, a seminal work in social learning theory, was the springboard to the next 40 years of research on self-efficacy (Miller, 2011).

Self-efficacy is the conviction that one can successfully execute the behavior required to produce an outcome (Bandura & Wessels, 1997). Bandura argued that four types of information lead to a person's self-efficacy development. These four are the success or failure of previously similar attempts, the experience of observing others fail or succeed at similar tasks, verbal persuasion, and lastly, physiological and affective states such as arousal, anxiety, fatigue, and physical pain (Miller, 2011). Not surprisingly, the family is the main source of building self-efficacy in children. Later Bandura clarified his self-efficacy theory and posited self-efficacy can be domain specific. For example, people can have high self-efficacy beliefs in reading, but not in mathematics (Bandura & Wessels, 1997). Zee & Koomen (2016) pronounced that this moving away from overall self-efficacy to task-specific self-efficacy raised the predictive validity of scores on self-efficacy measurement scales.

Bandura further advanced social learning theory throughout his lifetime. Self-efficacy, as Bandura defined it, is the degree of one's feelings about one's ability to accomplish goals (Nilson, 2016). Schunk (1989) applied Bandura's self-efficacy to education by stating that it refers to perceived capabilities for learning or performing behaviors at designated levels. Self-efficacy, or beliefs about oneself, influenced activities people participate in (or not), the amount of effort they give to tasks, the persistence of effort, and the level of achievement reached (Boaler, 2016; Cerit, 2013). Self-efficacy is an area of study that needs to be further investigated in future teacher research, but specifically in the domain-specific content area of mathematics which is the focus of the present study.

Additional research on self-efficacy has been conducted by Dweck (2006). Dweck clearly showed the importance of teachers' and students' mindsets in the book, *Mindset*. Dweck (2006) illuminated the difference between people who have a fixed mindset and a growth mindset. Those with fixed mindsets believed they either have a specific talent, or do not. Those with growth mindsets believed if they work hard enough, they can learn anything. Boaler (2016) connected mindset research from Dweck to the domain of mathematics in the book, *Mathematical Mindsets*. Students who have growth mindsets scored higher on mathematics achievement tests than students with fixed mindsets (Boaler, 2016). Teachers, according to Boaler (2016), can further a growth mindset in their students in several ways. The praise that teachers direct towards students is extremely influential. Praise suggesting a student is smart furthers the fixed mindset whereas praise suggesting the student worked hard furthers a growth mindset. Those students with a growth mindset have higher self-efficacy beliefs as well. This connects with Bandura's third area of development, verbal persuasion offered by others, and is a key component in the development of a person's self-efficacy.

The research conducted by both Dweck (2006) and Boaler (2016) has direct application to the use of elementary mathematics specialists in schools. Specialists who praised their teachers for working hard at teaching and learning mathematics and not necessarily for being a "math person" helped develop a growth mindset and therefore positively impacted a teacher's self-efficacy (Boaler, 2016). Lischka, Barlow, Willingham, Hartland, and Stephens (2015) recently showed that professional development with elementary teachers only produced significant results in teaching changes when the teachers possessed a growth mindset. In addition, the National Council of Teaching Mathematics (2018) placed tremendous emphasis on developing growth mindsets in both teachers and children. Developing a growth mindset in children made a sizeable difference in what students were able to accomplish (NCTM, 2014). Clearly, mindset is an area that deserves further exploration and is a component of the present study. In addition, the relationship between self-efficacy and mindset needs to be further investigated.

Recent research directly connected mindset to self-efficacy of mathematics teachers as well (Boaler, 2016; Lin-Siegler, Dweck, & Cohen, 2016; Palazzolo, 2016; Pohl, 2017; Rissanen, Kuusisto, Tuominen, & Tirri, 2019; Stoehr, 2019; Willingham, 2016). Teachers who employed a growth mindset about mathematics had higher self-efficacy scores than teachers who employed a fixed mindset (Boaler, 2016). Ren, Green, and Smith (2016) used a mathematics attitude scale to determine the self-efficacy of elementary mathematics specialists. They found the scale to be a good predictor of self-efficacy and therefore useful in working with the elementary mathematics specialists to improve elementary teachers' mindsets. Research in this area is emerging and promising, but more research needs to be conducted on self-efficacy of teachers and the availability of elementary mathematics specialists to further investigate the relationship. Focusing on teachers' self-efficacy beliefs when elementary mathematics specialists are employed to help teachers learn through interactions with experts will help researchers better understand the role of the specialists.

The present study will extend Vygotsky's social development theory into the world of classical Christian schools by focusing on the development of grammar school teachers with elementary mathematics specialists' support within the zone of proximal development in these schools, and by comparing it to teachers in schools without elementary mathematics specialists in place. In addition, Bandura's social learning theory will be extended into the classical Christian school population by examining elementary mathematics teachers' self-efficacy differences with and without the assistance of an expert elementary mathematics specialist.

Related Literature

Elementary Mathematics Specialists

A significant shortage of students entering careers in science, technology, engineering, and mathematics (STEM) in the United States placed a greater emphasis on mathematics curriculum and instruction this century (Au, 2011; Rice, Barth, Guadagno, Smith, & McCallum, 2013). Even with this greater emphasis placed on mathematics, professional development experiences continued to be focused more on literacy than on mathematics (Martin et al., 2019). The use of elementary mathematics specialists is one way to combat this bias towards reading literacy in elementary schools. These mathematics specialists are employed in elementary schools to assist teachers in the day-to-day instruction to improve teachers' content knowledge, instruction practices, and self-efficacy (NCTM, 2018; Swars et al., 2018; Wu et al., 2018). Elementary mathematics specialists are required to be available for the questions that arise from teachers, to provide feedback to teachers, and to help make teachers make connections both between mathematics and other subjects and within mathematics.

The question of which areas these elementary mathematics specialists should be targeting with the teachers they assist has been the focus of several studies (Kutaka et al., 2017; Martin et al., 2019; Swars et al., 2018). In a recent study, Martin et al. (2019) discovered that over 18 billion dollars was spent on professional development for teachers in grades kindergarten through eight across the United States. Most of this professional development was aimed at improving teachers' content knowledge and instructional strategies (Martin et al., 2019). Kutaka et al. (2017) stated there were five main areas of professional development that needed to be targeted when working with elementary mathematics teachers: content knowledge development, active learning to observe peers or master teachers, development aligned with policy learning from the district, development that had long duration, and lastly, collective particpation in activities. However, the body of research was synthesized to include just three main areas that elementary mathematics specialists need to assist elementary mathematics teachers with: increasing elementary mathematics teachers' content knowledge, changing the instructional strategies employed by these teachers, and improving teachers' self-efficacy beliefs (NCTM, 2018; Swars et al., 2018; Wu et al., 2018). The National Council of Teachers of Mathematics (2018) released the Elementary Instructional Leader Math program components in 2010 with these three areas as well. In fact, they advocated that every elementary school in America should have access to an elementary mathematics specialist. Canada, too, has determined that the growing worry over low scores has made some leaders in mathematics education call for the placement of an elementary mathematics specialist in every school (Brown & Rushowy, 2013).

A recent study conducted by Swars et al. (2018) focused on three areas elementary mathematics specialists need to target: beliefs, content knowledge, and teaching practices. These researchers trained elementary mathematics specialists and found that changes in beliefs can be made quickly but changes in content knowledge and pedagogy take considerable time and effort. Other research studies have been conducted and have shown how to develop math teacher leaders, lead teachers, math coaches, or math specialists' content knowledge and pedagogical strategies (Green & Kent, 2016; Kutaka et al., 2017). Research in this area includes work done by Green and Kent (2016) that specifically targeted science and mathematics lead teachers through a technology initiative. The teachers were trained for one year and then returned to their home school to implement similar changes by coaching fellow teachers. The program was highly successful. Statistically significant change was reported in the achievement scores at these home schools after the leaders returned to teach their fellow teachers (Green & Kent, 2016). In fact, the changes equated to 28 extra days of schooling in mathematics compared to schools that did not have trained lead teachers to help them. This initiative involved no change in curricular standards, but rather changes in elementary science and mathematics specialists' content knowledge, instructional strategies, and self-efficacy; the three target areas. As has been shown, curriculum is not the same as instructional practices that are chosen by teachers on a day-to-day basis. As Parkay, Hass, and Anctil (2014) note, effective teachers plan both what is to be taught (the curriculum) and how it is to be taught (the instruction). Noticeably, the change in standards of mathematics in recent decades emphasizes the what but is insufficient. The research in the three target areas of content knowledge, instructional practices, and self-efficacy that has been shown to significantly impact teachers will be the focus of this portion of the literature review.

Content Knowledge

Elementary teachers' content knowledge has been divided into four different mathematics domains: number and operations, algebra and functions, geometry and measurement, and finally, data analysis and probability (NCTM, 2018). The body of research shows that elementary mathematics teachers' content knowledge is not at the level it should be (Polly et al., 2014; Schmidt, Burroughs, Cogan, & Houang, 2017; Taylor-Buckner, 2014; Tutak & Adams, 2017; Webel, Conner, Sheffel, Tarr, & Austin, 2017; Wu et al., 2018). Wu et al. (2018) argued that many elementary teachers lacked the knowledge to teach mathematics with coherence, precision, and reasoning. This lack of deep understanding of the subject, they asserted, has grave consequences because teachers with limited mathematics content knowledge teach in algorithmic ways and fail to make connections across content areas. Content knowledge of elementary math teachers has been an area of focus for considerable time (Taylor-Buckner, 2014). Content knowledge in mathematics is associated with richness of mathematical work, depth of teachers' interpretations of student work, varied instructional practices, and mathematics achievement (Monk, 1994; Ren & Smith, 2018). As these researchers have shown, mathematical content knowledge is vital for teachers to possess.

Wu et al (2018) argued teachers who teach at the elementary grade level typically teach all subject areas and most consider themselves to specialize in reading, not mathematics. Their mathematics content knowledge lagged their reading content knowledge because of this (Wu et al., 2018). The structure of elementary schools required teachers to become generalists, not specialists, because these teachers provide instruction in more than one content area (Gresham, 2018b). The structure of elementary schools requires these generalists to commit time preparing lessons for several academic subjects and reduces the remaining amount of time available to plan mathematics instruction. The remaining time left to develop mathematics teachers' content knowledge is insufficient because of the time commitment required to teach all subject areas.

Much effort has been made to improve the content knowledge of pre-service elementary school teachers in teacher training (Huang, Kulm, & Willson, 2014; Schmidt et al., 2017). Schmidt et al. (2017) discovered a statistically significant relationship between the coursework of teachers in teacher preparation programs and their self-reported experiences in mathematics. Teachers who felt good about mathematics sought out more mathematics courses. Those who disliked mathematics did not seek out these same courses. Schmidt et al. (2017) also suggested that the types of courses taken by these teachers was a key factor in teacher preparation. These researchers found that upper elementary teachers take fewer mathematics courses than lower-level middle school mathematics teachers who only teach a grade or two above them. Also, the research revealed elementary preservice teachers need to be taking more functions and probability content courses to improve their content knowledge of algebra, data, and probability. Huang et al. (2014) found that the total number of courses taken by pre-service teachers was positively correlated to teachers' performance in mathematics skills. Tutak & Adams (2017) discovered preservice elementary teachers have a limited understanding of geometry content knowledge and that they needed more coursework in the geometry strand. Finally, Depaepe et al. (2015) found that prospective elementary teachers had limited understanding of rational numbers and needed more coursework in the numbers and operation strand. Clearly, these researchers show prospective elementary mathematics teachers need to be taking more mathematics courses in their college preparatory education.

A common delivery method for broadening elementary mathematics teachers' content knowledge is through faculty in-services. Unfortunately, research in this area is contradictory (Campbell & Malkus, 2014). These researchers discovered in-service programs varied widely in quality and are focused more on reading than mathematical content. However, Willingham (2016) did show how to use faculty in-service programs effectively in a study of the mindset of participants. The researcher found that teachers who utilized short-term, mid-term, and long-term goal setting showed improvement in their growth mindsets. Copur-Gencturk, Plowman, and Bai (2019) too discovered that by using a variety of professional development, mathematical content knowledge of teachers could be increased. Polly et al. (2014) also observed significant positive results when employing a professional development program focused on increasing teachers' content knowledge. However, this same study presented no impact on student achievement scores until teachers also changed their instructional practices to become more student-centered and less teacher-centered. Qian & Youngs (2016) similarly addressed these issues by attempting to increase teachers' content knowledge and gave several reasons to explain why using professional development was an inadequate method for increasing teachers content knowledge. The authors suggested that further research might focus on how past experiences shape teacher content knowledge. Brown (2012) researched the quality of teachers and found that pre-service teachers' ages, lower division mathematics competency, and math methods course performance, had a significant correlation to their mathematics self-efficacy beliefs. This research underscores the fact that raising the content knowledge alone of teachers fails to consistently lead to gains in student performance on achievement tests.

Elementary teacher anxiety regarding mathematical content knowledge has also been an area of study. Stoehr (2019) provided specific guidelines for helping teachers decrease anxiety by improving content knowledge. First, Stoehr asserted, teachers must identify the roots of their anxiety. Next, teachers need to self-assess strong and weak areas of content they possess. Finally, a plan utilizing short, medium, and long-term goals can be put in place to help these teachers improve their content knowledge. In these ways, teachers learned to own and attack any weaknesses they have and develop a growth mindset. In a recent study by Gresham (2018b), teachers wanted to increase their content knowledge but were hesitant to do so because they feared it would reveal their lack of understanding.

The importance of content knowledge has been extended to elementary mathematics specialists as well. Swars et al. (2018) found that changes in content knowledge for elementary mathematics specialists took a considerable amount of time. Similar results were reported by Kutaka et al. (2017). These researchers conducted a program called Primarily Math that specifically trained teachers to become elementary mathematics specialists. By focusing on five areas which included increasing teachers' content knowledge, the participants in this program scored higher on number sense measures and on attitudes toward mathematics instruction. However, the time required for this change was key, as it took over a year to accomplish. Duration again was shown to be a significant factor in the success of developing both teachers and elementary mathematics specialists' content knowledge and attitudes.

Elementary mathematics specialists could help these teachers by reducing anxiety and explaining mathematical content more clearly. They could also help these teachers better engage students by increasing their mathematical content knowledge. This increase in content knowledge will reduce elementary mathematics teacher anxiety and make them more willing to vary their instructional practices as well. Much more research is needed at schools who include an elementary mathematics specialist as part of their organizational structure to conduct faculty in-services that could produce similar results and validate previous findings. These teacher leaders who can be there each day could help accommodate the needs of teachers both in professional growth opportunities and in lesson preparation and implementation. This research is necessary to determine specialists' impact on teacher content knowledge within Vygotsky's zone of proximal development.

Instructional Practices

The methodological approaches that teachers select to instruct their students impact students' achievement scores (Parkay et al., 2014). It should then follow that these approaches can be further broadened by effective elementary mathematics specialists. In fact, significant research has been conducted in the area of instructional practices of mathematics teachers (Boaler, 2016; Dougherty, Bryant, Bryant, Darrough, & Pfannenstiel, 2015; Kutaka, Smith, & Albano, 2018; Nilson, 2016; Shin & Bryant, 2015). Instructional practices such as discovery learning, deep discussion of topics, employing higher cognitive level tasks, integration of content, and implementing more visuals have all been researched.

The method of delivery elementary mathematics teachers employ has continued to be a topic of research of late (Boaler, 2016; Nilson, 2016; Parkay et al., 2014). Parkay et al. (2014) report inquiry learning, often called discovery learning, is a model of teaching that helps students acquire and manipulate information. This method based mostly on Jerome Bruner's structures of learning theory helps students discover that knowledge is connected and meaningful (Parkay et al., 2014). In mathematics practice, students are first presented with a problem-solving experience. Students then can use manipulatives to represent the problem, solve it, and discuss it with their partners (2014). Next, they use pictorials to represent and organize the information before they move to an abstract equation that represents the problem. Nilson (2016) stated people learn more when they are actively engaged than when they are passively listening to their instructors. Consequently, Nilson asserted, the discovery method should be implemented in classrooms as much as possible to actively engage students. As applied to mathematics, people learn more when they don't just focus on the algorithms, but rather when they have opportunities to discover and discuss concepts in problem-solving situations (Boaler, 2016). Students who discuss mathematics content can make connections not made by learning algorithms alone (2016). These connections can be made both within mathematics and between mathematics and other subject areas. These practices that promote discussion help students integrate mathematics to other subject areas. Kutaka et al., (2018) agreed with this statement and found that teachers' procedural beliefs were associated with lower content knowledge scores for students in mathematics. Learning rote algorithms in mathematics is necessary, but insufficient in helping students develop the reasoning required to apply mathematical concepts to the problems they encounter (2018).

Kutaka et al. (2017) asserted that discovery learning should be employed in elementary mathematics classes as much as possible. In their Primarily Math program the authors clearly stated that by having teachers work on mathematics problems with multiple solutions and varied representations and then communicating their reasoning to others, teachers learned methods they then featured in their own classrooms (Kutak et al., 2017). In this way, the instructors and teachers made use of one of Bandura's four components of social learning theory, modeling (Miller, 2011). By modeling these techniques to teachers, elementary mathematics specialists can further add to the variety of instructional practices implemented and, in addition, improve the self-efficacy of elementary mathematics teachers. Unfortunately, teachers who are not confident in mathematics often teach with direct teaching methods and are hesitant to integrate content, nor allow for deep discussion of topics (Gregory, 2004). Gregory (2004), from the book, *The Seven Laws of Teaching*, asserted that every lesson should connect with prior lessons and with the pupil's knowledge and experience. In addition, Gregory contended teachers should never direct teach students. Instead, they need to excite and stimulate the learner to discover concepts for themselves. By doing so, the teacher will help create a love of learning that will inspire the students to learn more on their own. In addition, the discovery method helps students learn how to think through problems. Rittle-Johnson and Schneider (2015) reported primary-aged children who solved unfamiliar problems before the lesson made greater gains in conceptual knowledge and comparable gains in procedural knowledge compared to children who solved the problems after the lesson. Teachers need to be willing to use the discovery method to allow students the time necessary to make connections both within mathematics and other content areas themselves.

The types of discussions that teachers encourage students to experience during mathematics classes has also been a recent topic of research (Dow, 2013; Kanar, 2014; Nilson, 2016). These discussions need to focus on student-to-student interactions that involve turning and talking about problems and reflecting on the learning that takes place. Garside (1996) found that these types of discussions improved problem-solving that required more higher-level cognitive thought. Dow (2013) illuminated the importance of reflection time in discussions by describing it as allowing the teacher to give students ownership in their learning and providing a sense of purpose to the lessons. Again, deep discussions are key components of developing *telos* in students, or, purpose for learning. Reflection, Nilson (2016) added, distinguishes knowledge from mere information. In addition, Nilson (2016) reported that students who took time to discuss and reflect on lessons and monitor their learning acquired new material faster. Furthermore, researchers stated that teachers who instruct with multiple modalities that involve instructional practices utilizing numerous senses help students make more connections and retain this information for longer periods of time (Kanar, 2014; Nilson, 2016). Each of these researchers has shown deep discussions in mathematics improved conceptual understanding.

An additional point of research has focused on the types of mistakes made *after* problems are presented to students (Boaler, 2016; Durkin & Rittle-Johnson, 2015; Nilson, 2016; Rittle-

Johnson & Schneider, 2015). Taking time to discuss misunderstandings and mistakes by turning and talking about the content of the mistakes, these authors asserted, enhanced learning. Rittle-Johnson & Schneider (2015) reported in their meta-analysis of instructional practices that promote mathematical conceptual and procedural understanding that students who compared correct and incorrect solutions had reduced misconceptions about mathematics. In addition, students who compared incorrect procedures to correct ones had higher fractional conceptual and procedural knowledge scores (Durkin & Rittle-Johnson, 2015). Boaler (2016) advanced the research in this area by offering new brain-based studies as evidence of the importance of employing these instructional practices. People only develop new synapses in the brain when they make and correct mistakes, Boaler asserted. Nilson (2016) added that teachers who persuaded their students to correct errors produced students who are more successful. Increasing the variety of mathematics instructional practices that involve great discussions between novices and experts fits into Vygotsky's social development theory of learning as well (Miller, 2011). Teachers who employ more instructional activities with a social component further student understanding of the mathematical content by increasing student engagement of tasks presented to them (Nilson, 2016). Instructional practices that include inquiry-based learning, student-to-student discussions, and active learning need to be taught to elementary mathematics specialists and teachers to increase both engagement and achievement of students.

Recent research indicated the instructional methods teachers use make a difference in a student's ability to recall information from long-term memory as well (Kanar, 2014). Kanar (2014) described the three types of memory students possess: sensory memory, short-term memory, and long-term memory. Information is processed for periods of time in short-term memory and if it is rich enough, it then gets transferred into long-term memory. The questions and tasks teachers present to their students matter in the ability to transfer this information. Scholars have linked teachers' use of mathematical tasks and questions to students' achievement in mathematics (Polly, 2016; Au et al., 2011). Specifically, Polly (2016) discovered the types of questions presented to the students changed throughout the year and produced varied results. Teachers in this study posed tasks in the final quarter of the year that were lower-level and required very little thought. These lower level thought questions are less engaging for students and therefore would be harder to summon up from long-term memory. Contrastingly, during the first three quarters, questions that were posed by the teachers had higher cognitive requirements. Polly (2016) suggested that these differences in questions might be because students take high stakes testing during the last quarter and that these tests influenced the types of tasks they encountered. An interesting discussion regarding a curriculum that focuses on high-stakes testing comes from Au et al. (2011). Au reports that education based on these high stakes testing standards resulted in an overemphasis on content covered on the test and factory production teaching. The irony is apparent; the assessments of the efficacy of these higher cognitive level standards are often based on high-stakes testing which ultimately results in more teachers teaching with direct-teaching methods. This also adds to the effectiveness of classical Christian schools where students are not required to take these high-stakes tests. Instructional practices in these schools, it would follow, would continue to be at higher cognitive levels throughout the year. Elementary mathematics specialists, embedded in the schools, would help remind teachers to continue to use varied instructional practices as well. Council and Cooper (2011) reported that classical Christian schools offer excellent alternative for parents and students because they nurture the whole child and equip them with the tools of learning to employ throughout life without having the goal of students passing standardized assessments. However, very little research has been conducted in classical Christian schools to help validate their assertion.

Recent research from Boaler (2016) also asserted that the instructional practices teachers employ must also include more visuals. Brain-based research has shown that students with higher achievement scores in mathematics are better at visualizing concepts (2016). The part of the brain that requires visualization, the hippocampus, grows when students are presented with complex tasks that require visualization and modeling of tasks. These visuals increase the engagement of students. Teachers who utilize more visuals, or who require students to create more visuals in their activities, help students better understand mathematics relationships. Visuals also reduce the cognitive load on working memory and help students identify these relationships. Using visuals to represent relationships in fractions has been shown to increase understanding in a multitude of research studies (Dougherty et al., 2015; Shin & Bryant, 2015; Usta, Yilmaz, Kartopu & Kadan, 2018). Recent research by Usta et al. (2018) uncovered that the use of visuals in problem-solving tasks increased fourth grade students' understanding of mathematical concepts. This research helps teachers assist with students who previously were thought to struggle in math, including special needs students (Boaler, 2016). Without question, the research is exciting and empowering for all teachers to have in their tool kit. However, the research is emerging and more studies on the instructional practices of teachers with visuals needs to be conducted to validate these assertions.

Effective elementary mathematics specialists require specific training in these types of instructional practices. They also need to model these instructional practices that require deep thought and then turn around and instruct teachers in the classroom with these same strategies. Cognitively demanding tasks have been shown to be effective practices for teachers and students

(Nilson, 2016). As applied to mathematics, memorization of procedures is a low cognitive demand activity and activities that require connections to made are high cognitively demanding activities (Polly, 2016). Teachers need to be able to try out these new instructional strategies with scaffolded instruction that would best be nurtured with the use of elementary mathematics specialists. Syverson (2018) compared the use of a mathematics curriculum coach to a general curriculum coach and found that quality mathematics specialists, coaches, and lead mathematics teachers significantly helped improve the instructional strategies employed by elementary mathematics teachers. Having expert mentors, the elementary mathematics specialists, available assisted these teachers and, ultimately, made them more willing to employ inquiry-based and higher cognitive level instructional strategies.

Each of these instructional practices-discovery learning, varied representations, open-ended problem-solving tasks, opportunities that enhance discussion, providing time for reflection, and using visuals to improve memory-can be facilitated with the employment of an elementary mathematics specialist. When teachers implemented just a few of these instructional practices, students attended classes at a higher rate, were more engaged, and learned significantly more than students who are taught solely with lower cognitive tasks (Nilson, 2016). Therefore, there is great promise that by adjusting the instructional practices teachers choose to employ, student achievement can increase.

Self-efficacy

Self-efficacy of teachers in part has been shown to determine the instructional behaviors, practices, and strategies teachers choose to employ in the classroom (Morris, Usher, & Chen, 2017; Schiefele & Schaffner, 2015; Thomson, DiFrancesca, Carrier & Lee, 2017). Self-efficacy of teachers has been shown to dramatically impact the cognitive support offered to students as well (Boaler, 2016). The role of self-efficacy cannot be overemphasized in teaching. In a review of the literature on self-efficacy, Morris et al. (2017) synthesized the results from 82 empirical studies to identify trends. From this meta-analysis, the researchers revealed that teachers with a strong sense of efficacy employed more effective instructional strategies, were less susceptible to burnout, and were more committed to the profession than those with a weak sense of efficacy. Most importantly, these researchers found that teachers' self-efficacy produced positive outcomes in student achievement. As applied to mathematics, improving the self-efficacy of teachers in turn increased the mediocre mathematics achievement scores that are currently found in standardized tests (Lee et al., 2017). Teachers' self-efficacy in mathematics has broad reaching outcomes. Students as young as five are impacted by their teachers' self-efficacy in mathematics. Jung, Brown, and Karp (2014) discovered kindergarten teachers' mathematics self-efficacy was positively correlated to achievement scores of their students. Chang (2015) extended the results from kindergarten by discovering teachers' self-efficacy significantly impacted both student self-efficacy and achievement in fifth graders. In a recent study conducted within a ninth-grade mathematics teacher population and with students, a correlation between teacher anxiety and lower achievement in students was found (Ramirez, Hooper, Kersting, Ferguson, & Yeager, 2018). In summary, teachers with high self-efficacy in mathematics developed students who have greater math competence throughout the elementary grade school age range and beyond (Boaler, 2016).

Self-efficacy improvement of teachers had a positive impact both on the teacher's choice of instructional practices and mathematics content knowledge as well. Carney, Brendefur, Thiede, Hughes, and Sutton (2016) did a large-scale professional development study with teachers and found that self-efficacy had a significantly positive impact on teacher content knowledge and instructional practices. Boaler (2016) specifically connected the self-efficacy of teachers and their mindsets to student achievement scores. Unfortunately, Boaler discovered that 40% of children held damaging fixed mindsets about mathematics. The students believed that intelligence in mathematics as a gift that is possessed or isn't possessed. Boaler (2016) also discovered teachers with negative emotions in mathematics in elementary schools produced female students with lower achievement scores. Clearly, self-efficacy of teachers has been shown to have both positive and negative impact on students' achievement. Lee et al. (2017) furthered the research in this area by uncovering that teachers develop beliefs about their own ability to teach because of the feedback they receive from their mentors. Again, as Bandura noted in social learning theory, feedback is one of the four components that help establish a person's self-efficacy (Miller, 2011). Positive feedback builds self-efficacy in people; negative feedback extinguishes self-efficacy.

Teachers with positive self-efficacy in mathematics are less likely to suffer from stress, burnout, and emotional exhaustion. In addition, they are more likely to have high levels of commitment and job satisfaction (Zee & Koomen, 2016). Skaalvik and Skaalvik (2016) asserted that a lack of supervisory support for teachers added to the stress of teachers and reduced self-efficacy. The supervisory feedback and evaluations teachers receive had significant impact on their self-efficacy (Klassen & Tze, 2014). The support of mathematics specialists dramatically reduced early-career teacher turnover as well (De Jong & Campoli, 2018). Teacher turnover is still an issue in education. Sawchuk (2015) informed that 30% of teachers leave the profession within the first five years of employment. Teachers who have the support of supervisors, it would then follow, would remain in the profession and grow in their self-efficacy.

Mathematics achievement score differences among schools were directly predicted by collective teacher efficacy beliefs and indirectly predicted by instructional leadership and the quantity and quality of teacher collaboration (Goddard, Goddard, Sook Kim, & Miller, 2015). Building self-efficacy in teachers with supervisory support of elementary mathematics specialists has been shown to help teachers become more confident in their teaching abilities, improve their instructional practices, increase students' mathematics achievement scores, and reduce teacher turnover. In summary, these researchers have shown that elementary mathematics specialists available on a continuous basis can help build the self-efficacy of teachers.

Combinations of the Three Goals

The interplay between teacher content knowledge, instructional practices, and teacher self-efficacy is ambiguous and demands further attention. The body of research does show that teachers who have strong sense of self-efficacy in mathematics appear to have more content area knowledge and they utilize a greater variety of instructional strategies (Kahle, 2008; Pollock & Mindzak, 2018; Roettinger, 2014; Swars, 2005; Wilkins, 2008). However, researchers have also determined that teachers are more apt to want to widen the variety of instructional practices they use than increase their mathematics content knowledge (Mishal & Patkin, 2016). Research has been conducted to determine if an increase in content knowledge does impact instructional practices and self-efficacy. Matthews and Seaman (2007) discovered prospective teachers who participated in a semester-long mathematical content course focused on the number system and place value had increased self-efficacy in mathematics in comparison with their peers who did not participate in the course. In addition, the better a teacher understands calculus and statistics, the higher their math teaching self-efficacy, or belief in their ability to teach math (Enochs, Smith, & Huinker, 2000; Epstein & Miller, 2011). This deserves further exploration, but the interplay between the three areas has not been firmly established.

A few studies have been undertaken to show the results of implementing changes in both elementary mathematics specialists and teachers in these three areas. Carney et al. (2016) examined the findings of a statewide professional development course on teachers' content knowledge, self-efficacy, and instructional practices. About 4,000 teachers took part in the year-long training in Idaho. The results were clear, significant increases in content knowledge were created along with changes in both self-efficacy and instructional practices in teachers who completed the course (2016). Carney et al.'s study conflicted with previous studies, however, as it established a change in all three target goals.

Recent research shows that a teachers' self-efficacy does alter the instructional practices that are chosen in the classroom. Lee et al. (2017) reported prospective teachers with higher levels of mathematics teaching efficacy taught lessons having higher cognitive demand. These same teachers extended student explanations, increased student-to-student discourse, and created more explicit connections between representations. In other words, to improve instructional practices, it is imperative that we increase self-efficacy of teachers. Cerit (2013), too, discovered teacher's self-efficacy can influence their willingness to implement the higher standards of education that are in existence today. Kutaka et al. (2017) asserted the three target teacher outcomes—knowledge, attitudes, and beliefs as highly interconnected psychological constructs. A program for the development of elementary mathematics specialists needs to include feedback that specifically targets mathematics teachers' self-efficacy improvement, instructional practices, and content knowledge. Lee et al. (2017) emphasized the importance of providing feedback in their study of prospective teachers as well. To produce significant changes in the three areas, it is imperative that self-efficacy be targeted. Zee and Koomen (2016) reported self-efficacy influences classrooms in complex ways that deserve further investigation. One study from Cahill (2018) did demonstrate that teacher self-efficacy was not influenced by peer coaching but was increased by student engagement, instructional strategies, and classroom management changes. Perhaps Ren and Smith (2018) put it best when they said that too little information is known about how teachers' mathematical beliefs and attitudes interact with each other and the resulting effect these beliefs have on instructional practices. Much more research is needed to further clarify and understand how self-efficacy impacts instructional strategies and teacher content knowledge. In addition, research is needed to better understand how elementary mathematics specialists' impact the teachers they work with. This research will also help provide guidance to school leaders to determine whether they need to implement organizational changes that utilize elementary mathematics specialists.

Classroom Organizational Settings

The organizational structures of elementary schools have been topics of heated debate and continue to be a topic of mathematics research studies with conflicting results. As early as 1931 studies were conducted comparing classrooms who had departmentalization to classrooms that were non-departmentalized (Webel et al., 2017). Departmentalized classrooms are those that have more than one teacher planning and delivering the core subject instruction for groups of students (Martin et al., 2016). In 1931, 37% of elementary schools had some form of departmentalization in upper elementary classrooms. Today, the number approaches 62.5% of 5^{th} grade teachers who participate in departmentalized classrooms (Taylor-Buckner, 2014). Several research studies suggested departmentalization in upper elementary has positive impact on achievement scores while others suggested remaining non-departmentalized improved student achievement scores (Baroody, 2017; Chan & Jarman, 2004; DelViscio & Muffs, 2007; Nelson, 2014). The benefits of departmentalization include having experts in mathematics available to teach more children, increased planning time for teachers, and preparing students for middle school by having them move classes (Chan & Jarman, 2004; DelViscio & Muffs, 2007). A main objection to non-departmentalized classrooms is that classes become more subject-centered, and less child-centered (Taylor-Buckner, 2014). Teachers who are not specialized do not know the content from other areas and therefore are unable to assist students in making connections between content areas. Elementary mathematics specialists could help teachers make these connections both within mathematics and between mathematics and other subject areas. When students make these connections within mathematics and to other content areas, they demonstrate a deeper understanding of the subject (Polly et al., 2014). The classroom setting, whether it is non-departmentalized or departmentalized, matters in the ability to make connections both within mathematics and with other content areas. Teachers within a non-departmentalized are familiar with the daily lessons in all subject areas whereas teachers within a departmentalized setting may not be.

Research on achievement scores and self-efficacy of teachers in these classrooms is contradictory. Lau, Kitsantas, Miller, and Rodgers (2018) specifically studied the impact on teachers' self-efficacy based on the grade-levels they taught and found that fifth grade mathematics teachers had higher levels of self-efficacy than third grade teachers. Fifth grade classrooms are departmentalized more often than third grade classrooms (Isenberg, Teh, & Walsh, 2015). However, Lee, Martin, & Trim (2016) studied the impact departmentalization had on public schools in Tennessee in grades three through five and found no impact on achievement scores in the different classrooms settings. They found an impact on teacher efficacy when the teachers were surrounded by professional learning communities which included elementary mathematics specialists. Nelson (2014) reported higher mathematics scores of fifth grade students when they were in departmentalized settings. However, Baroody (2017) explored the contribution of classroom formats on teaching effectiveness and achievement in upper elementary classrooms and found that departmentalization had just a small positive association with higher achievement in language arts classes, but not in mathematics. Baroody's study did not investigate the self-efficacy of the teachers, however. McGrath and Rust (2002) reported that science, language arts, and total achievement scores of 5th and 6th graders decreased when students were in departmentalized settings. Recent research from Bastian and Fortner (2018) adds to the uncertainty of classroom settings impact. They discovered 25% of fourth grade students and 37% of fifth grade students in a sample were in departmentalized settings. In addition, they revealed school-level achievement in mathematics and reading did not improve when more specialization occurred. The impact of elementary specialists may make a difference in these settings. Epps (2018) discovered elementary mathematics teachers' self-efficacy improved in departmentalized settings only when they had the support of a peer coach or mathematics specialist. The impact departmentalization has on content knowledge, instructional practices, and self-efficacy is contradictory in mathematics and deserves much further study.

Classical Christian Schools

Research in classical Christian schools is scarce for several reasons. First, very few schools are currently in existence in the United States (Council & Cooper, 2011). In addition, Council and Cooper report that the schools have not been around very long, just 34 years (2011). Sherfinski (2014) states that there are only a little over 200 classical Christian schools nationally but that the classical Christian curriculum is the most commonly used curriculum by home schoolers. Only a few research studies on self-efficacy were found that are based within the classical Christian population. In 2016, Anderson found that the self-efficacy of teachers in classical Christian schools was not statistically different than the self-efficacy of teachers in Lutheran schools. In 2011, Council and Cooper reported that headmasters in classical Christian schools had a high degree of job satisfaction and job efficacy. In the study, the researchers also recommended further study of self-efficacy of faculty members, which is a primary component of the present study. Dernlan (2013) explored the spirituality of students who attend classical Christian schools and compared it to students who attend schools that were not classical Christian. Dernlan (2013) also observed that the classical Christian schools produce students with a higher level of Christian faith formation than all other schools. Another study conducted by Vaughn (2018) focused on achievement within the classical Christian school population. Classical Christian schools produced students who had significantly higher PSAT scores in mathematics than students at other schools. Splittgerber (2010) compared student achievement at classical Lutheran schools to achievement at non-classical Lutheran schools and found that school-wide achievement scores were significantly higher in language, mathematics, and reading at the classical Lutheran schools.

A key component of classical Christian education is the integration of all subjects and was advocated by several leading proponents (Bauer & Wise; 2016; Perrin, 2004; Perrin, 2019; Sayers, 1947; Vaughn, 2018; Wilson, 2003). Obtaining a Biblical worldview starts with the words from the Bible. Colossians 1:17 reminds us, “And He is before all things, and in him all things hold together” (English Standard Version). By allowing every purpose to flow from the Bible, educators develop the *telos* of students and students then learn to lead a more purposeful life (Knetter, 2019). Classical Christian educators argue that curriculum that is disjointed and fragmented fails because it does not flow from the Bible (Littlejohn & Evans, 2006; Sayers, 1947). The transformation of worldview, classical Christian educators maintain, is made much easier because of the Trivium at classical Christian schools (Bauer & Wise, 2016; Perrin, 2004; Sayers, 1947). The initial focus on Latin and Greek also includes an integration of rich stories from myths, classic literature, and history (Kopff, 2014). The integration of these stories of good versus evil is more memorable and allows students to live their lives in productive and meaningful ways Kopff asserted.

Recent research not based schools specifically within classical Christian schools supports integration across subjects. Yoon, Dyehouse, Lucietto, Diefes-Dux and Capobianco (2014) discovered significant results in mathematics content knowledge when second and fourth graders were exposed to an integrated curriculum that included engineering, science and mathematics. It is important to note that this study, however, did not flow from a Biblical Worldview. No studies on integration of content were located that included integrated content from this worldview based solely in classical Christian schools. Also, no research based within these schools was discovered that involved non-departmentalized classrooms versus departmentalized classrooms.

New research on the use of elementary mathematics specialists to increase content knowledge, instructional practices, and self-efficacy of teachers exists (Kutaka et al., 2017; Martin et al., 2019; Swars et al., 2018). Elementary mathematics specialists have been shown to have a positive impact on teachers in all three of these target areas. However, no research on the impact of elementary mathematics specialists on self-efficacy of teachers within the classical Christian schools was discovered. Clearly, with fewer than 10 total studies based within this population, more research is needed to explore the effectiveness of these schools. As shown from the research, the relationship elementary mathematics specialists have on teachers' self-efficacy is emerging and in need of more study. The primary purpose of this research is to determine if elementary mathematics specialists have a positive impact on a teachers' self-efficacy as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) both within departmentalized and non-departmentalized classrooms at classical Christian grammar schools.

Summary

Mathematics education in the United States continues to be the focus of numerous research studies with conflicting results as has been demonstrated in this literature review. Educators have been on an uphill journey for decades trying to combat students' lower mathematics achievement scores. As a response to these lower scores, standards have been drastically changed to increase expectations of students. The teachers within the United States have had to implement very high standards in mathematics since 1989 (National Council of Teachers of Mathematics). Specifically, the standards have been altered in mathematics problem solving. The scores, however, are not improving at the same rate as other countries' achievement scores with similar standards (Lim & Sireci, 2017). Raising mathematical content standards alone is not enough to prepare teachers in schools. We need well-prepared elementary mathematics specialists who can scaffold instruction to teachers at the local level to make real change in mathematics education in both public and private school settings by increasing teachers' content knowledge, modeling effective instructional practices, and by improving self-efficacy (NCTM, 2018).

The National Research Council (2011) reports that teachers and teaching are at the center of mathematics education reform. Recent research on the use of elementary mathematics specialists supports this claim (Kutaka et al., 2017; Martin et al., 2019; Swars et al., 2018). In an important study conducted in 2018, Harbour, Adelson, Pittard, and Karp discovered a link between the use of full-time mathematics specialists and higher overall student achievement scores. The study utilized over 7,000 schools' data and included over 190,000 fourth grade students. Qualified elementary mathematics specialists can have profound impact in schools. Research also points to the importance of utilizing mathematics specialists to develop elementary teachers' self-efficacy in mathematics. Significant results were reported by researchers when self-efficacy was targeted by elementary mathematics specialists (Campbell & Malkus, 2010). Specifically, these researchers found that elementary mathematics specialists who were highly engaged with teachers produced significant impact on teachers' beliefs about their ability to effectively teach mathematics.

The present study will add to the body of research in existence in elementary schools to help make a definitive statement about elementary mathematics specialists' impact on teachers' self-efficacy. Specifically, the impact of elementary mathematics specialists who have mastered mathematical content and instructional strategies that can alter teachers' self-efficacy in classical Christian schools will be studied. These strategies need to be measured using research, however. The best techniques need to be identified and replicated. Peer coaching of elementary mathematics teachers in a recent study by Cahill (2018) did not increase overall self-efficacy of teachers but did show positive results in teacher efficacy specifically by changing instructional strategies and classroom management. Conflicting research exists in these studies.

Parents are increasingly turning to classical Christian schools as an alternative option for educating their children. These classical Christian schools have at their core, a Christ-centered curriculum based on Biblical Truths. From this core, the advocates of this educational philosophy assert, students learn truth, beauty and goodness all flow from the Bible (Perrin, 2004; Sayers, 1947; Vaughn, 2018; Wilson, 2003). Most importantly, these students learn to love learning and pursue that which interests them both curiously and tenaciously (Christal, 2018). These traits: curiosity and tenacity are both virtuous traits that develop virtuous minds in students (Dow, 2013).

Classical Christian schools utilize a well-rounded, integrated curriculum that includes study based within the liberal arts (Perrin, 2019). The integration of liberal arts with core subject areas, according to classical Christian advocates, better prepares students for their chosen vocation. This integration helps these students develop the skills that help them think rationally, solve problems, make decisions, speak, and persuade others (Perrin, 2019; Ryden, 2018). And, most importantly, the integration of the Bible into every subject area helps these students lead a purposeful life (Littlejohn & Evans, 2006). Teachers at these schools aim to help these students make connections between subjects and within subjects all stemming from the Bible (Geneva School of Boerne, 2018; Perrin, 2019).

Classical Christian schools, however, have had very few research-based studies to determine their efficacy. Specifically, the gaps in the literature show a need for further study of grammar school mathematics teachers' self-efficacy within classical Christian settings when teachers are surrounded by mathematics specialists to improve teacher content knowledge, open discussions about effective teaching practices, and increase teachers' self-efficacy in mathematics. In addition, further research within these schools needs to be conducted to determine the age at which departmentalization needs to be established. The present study will utilize the conflicting research already in existence in all schools and specifically focus on the classical Christian population.

CHAPTER THREE: METHODS

Overview

This chapter includes salient information about the research design, participants, setting, instrumentation, procedures, and data analysis that will be used for the study. Literature from previous studies will be included to provide rationale for the use of causal-comparative research and its appropriateness for the study. In addition, the suitability of the theoretical background in the study will be provided. The present study examined self-efficacy factors to identify self-efficacy score differences of two separate populations of elementary mathematics teachers at classical Christian schools: those who receive support from elementary mathematics specialists and those who do not along with those within departmentalized or non-departmentalized classroom settings.

Design

The study employed a non-experimental, quantitative, causal-comparative research design. Causal-comparative research is a type of ex-post facto research because it operates retroactively (Gall, Gall, & Borg, 2007). Causal-comparative research designs are the best choice when researchers aim to determine the causes of dependent variable differences between two or more groups. A non-experimental design was chosen because the independent variables will not be manipulated. Instead, they were naturally occurring (Gall et al., 2007). In this study, the cause, the presence or absence of an elementary mathematics specialist in the school, was presumed to affect the differences in self-efficacy scores amongst the separate groups of individuals. The purpose of a causal-comparative research design is to determine possible relationships between independent and dependent variables after an event occurs. The independent variables in this study, support from elementary mathematics specialists and classroom settings, were both measured in the form of categories, a key component of causal-comparative studies (Gall et al., 2007). The present study sought to determine the existence of causes the presence of elementary mathematics specialists and classroom settings have on teacher self-efficacy within the classical Christian school population. The use of mathematics specialists in prior studies not solely based in classical Christian schools has been shown to improve teachers' self-efficacy (Goddard et al., 2015; Kutaka et al., 2017; Skaalvik & Skaalvik, 2016). The use of mathematics specialists to assist in these areas is supported by both social learning theory that develops self-efficacy, and social development theory that utilizes experts and novices in social environments (David, 2018).

The independent variables in this study were the support within a school of an elementary mathematics specialist or not and the setting of the classroom, either departmentalized or non-departmentalized. Departmentalized classrooms were defined as those where one teacher is planning and delivering the core subject instruction for more than one group of students whereas non-departmentalized are those where one teacher is planning and delivering all of the core subject instruction for just one group of students (Martin et al., 2016). Elementary mathematics specialist support is defined as the use of a mathematics expert to support the development of teachers' content knowledge, instructional practices, and/or self-efficacy. These three areas have been shown to be the main themes effective elementary mathematics specialists target (Swars et al., 2018; Wu et al., 2018). Departmentalized, for the purposes of this study, is defined as teaching more than one section of mathematics each day. The dependent variable in this study will be teachers' self-efficacy scores using the Mathematics Teaching Efficacy Beliefs Instrument, MTEBI, and the sub scores on it (MTOE and PMTE) (Huinker & Enochs, 1995). Self-efficacy is defined as the conviction that one can successfully execute the behavior required to produce the outcome (Bandura & Wessels, 1997). Because prior research was done on the choices of variables to study, the likelihood of finding a significant relationship was greater (Gall et al., 2007). A causal-comparative research study is appropriate in this study because of its application to naturally occurring, independent groups and its continued presence in educational research. In this study, the naturally occurring groups will be the mathematics teachers at classical Christian grammar schools. Some of these grammar schools employ mathematics specialists and some do not therefore naturally establish different groups of study. In addition, some of the teachers at these schools teach all content areas and some teach mathematics alone.

Research Question

The research question for this study is:

RQ1: Is there a difference between the self-efficacy scores of classical Christian grammar school mathematics teachers who are supported by mathematics specialists and classical Christian grammar school mathematics teachers who are not supported by mathematics specialists within departmentalized and non-departmentalized classrooms as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)?

Hypotheses

The hypotheses for this study in the null form are as follows:

H01: There is no significant difference between the self-efficacy scores of classical Christian grammar school teachers when supported by an elementary mathematics specialist and classical Christian grammar school teachers when not supported by an elementary mathematics specialist as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

H02: There is no significant difference between the self-efficacy scores of classical Christian grammar school teachers in departmentalized settings and classical Christian grammar school teachers in non-departmentalized settings as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

H03: There is no significant interaction between the self-efficacy scores of departmentalized and non-departmentalized classical Christian grammar school teachers supported by elementary mathematics specialists and departmentalized and non-departmentalized classical Christian grammar school teachers without elementary mathematics specialist support as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

Participants and Setting

The participants in this study constituted a convenience sample of all classical Christian teachers across the United States teaching mathematics in grammar schools (K- 6). The teachers who were given the survey were employed at schools which were members of the ACCS (Association of Classical Christian Schools). The director of the ACCS was emailed to obtain the email addresses of heads of school at these grammar schools. The use of a convenience sample was necessary because the participants were solicited online, and the responses were not mandatory. The results are not generalizable to all classical Christian teachers (Gall et al., 2007). The setting in the study was virtual; emails were sent to participants at schools throughout the country. Only classical Christian teachers who teach mathematics at the grammar school level were included in the study. The teachers at these schools came from a total of 247 classical Christian schools employing approximately 2,000 grammar school teachers. The minimal sample of teachers desired was 100 and was well above the medium effect size minimum of 52 as established by Gall et al. (2007) with a statistical power of 0.7 at the .05 alpha level. The data from all participants who completed each question from the study were used in the data collection phase. Council and Cooper (2011) reported very little information is available about classical Christian teachers across the United States. What has been reported from a sample of teachers in a recent study is that 70% of these teachers were female and 40.4% had taught between 4 and 10 years, and 29.8% had taught between 10 and 20 years (Anderson, 2016). The demographic research of all elementary educators, however, shows that women represent 81.7% of the population (Larisa, 2012). This study added to the limited body of research that does exist by collecting data on the demographics of classical Christian grammar school teachers in the survey. The groups are identified as grammar school teachers who teach in non-departmentalized classrooms without elementary mathematics specialist support (NDEP without support) grammar school teachers who teach in non-departmentalized classrooms with elementary mathematics specialist support (NDEP with support), grammar school teachers who teach in departmentalized classrooms without elementary mathematics specialist support (DEP without support), and finally, grammar school teachers who teach in departmentalized classrooms with elementary specialist support (DEP with support). These groups were naturally occurring across the country in classical-Christian schools. The total sample of 117 teachers consisted of 4 males and 113 females. The ethnicity of the teachers was 98.3% Caucasian, 1.7% African American, 0.9% Asian, and 1.7% other. A total of 91 teachers did not receive elementary mathematics support whereas 26 did receive support. In addition, 37 of the teachers were in departmentalized settings and 80 were in non-departmentalized settings. 64 teachers were in group NDEP without support, 16 teachers were in NDEP with support, 27 teachers were in DEP without support, and 10 teachers were in DEP with support. Group NDEP without support consisted of 2 males and 62 females. The ethnicity of the NDEP without group was 100% Caucasian, 0% African American, 0% Asian, and 0% Other. Group NDEP with support consisted of 0 males and 16 females. The ethnicity of the NDEP with group was 93.7% Caucasian, 0% African American, 6.3% Asian, and 0% Other. Group DEP without support consisted of 0 males and 27 females. The ethnicity of the DEP without group was 92.6% Caucasian, 0% African American, 00% Asian, and 7.4% Other. Finally, group DEP with support consisted of 2 males and 8 females. The ethnicity of the DEP with group was 80% Caucasian, 20% African American, 0% Asian, and 0% Other.

Instrumentation

The instrument used in this study was the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI), developed by Huinker and Enochs (1995). The MTEBI was used to collect data from teachers in classical Christian schools about teacher efficacy beliefs. The MTEBI was modified from the Science Teaching Efficacy Beliefs Instrument (STEBI) which was first developed in 1990. The MTEBI was created 10 years later. The MTEBI has two subcategories: Mathematics Teaching Outcome Expectancy (MTOE) and Personal Mathematics Teaching Efficacy (PMTE). The MTEBI consists of a total of 21 questions (Enochs et al., 2000). The MTOE is comprised of eight items and the PMTE is comprised of thirteen items. For the purposes of this study, both sub scores were used and evaluated individually and as total efficacy. The MTEBI items are each answered using a Likert-scale. The scoring guidelines were Strongly Agree = 5; Agree = 4; Uncertain = 3; Disagree = 2; and Strongly Disagree = 1 (2000). Because there were 21 items, the total number of possible points is 21 * 5 or, 105 points. The fewest possible points is 21. If a teacher refused to answer a question on the instrument, the entire score was discarded. The MTEBI negatively words eight of the questions and therefore required reverse scoring on those eight. The MTOE range of scores was from 8 to 40 and the PMTE subcategory range of scores was from 13 to 65. The researcher also added questions to the MTEBI about demographics and categories. These questions included whether an elementary mathematics specialist supported the teachers at the school and whether the teacher was non-departmentalized or departmentalized. In addition, the teacher's gender, ethnicity, and number of years of experience teaching at the classical Christian school was measured along with the total number of years teaching.

The MTEBI has been proven to be both reliable and valid. The authors report the alpha coefficient for the MTOE subscale is 0.75 and the PMTE subscale is 0.88 (Enochs et al., 2000). Survey instruments with Cronbach alpha levels of 0.7 or higher are considered to have good levels of internal consistency (Kline, 2005). Enochs et al. (2000) also report using EQS software program to confirm validity. The researchers suggest each of the subscales were proven independent. Several researchers have used the MTEBI and have shown it to be both valid and reliable. Lee et al. used it in 2017 to measure self-efficacy. Other researchers have used it to measure both self-efficacy and outcome expectancy (Aydogdu & Peker, 2016; Gresham, 2018a; Isbell & Szabo, 2015). To summarize, the evidence supports the use of the MTEBI because it has been shown to be both a reliable and valid instrument.

Procedures

The researcher first applied to the Institutional Review Board (IRB) and obtained approval from Liberty University. Next, permission was obtained from Dr. DeAnn Huinker, author of the MTEBI. Once IRB was approved the study and Dr. Huinker approved permission for the use of the MTEBI, the researcher sent out emails to the heads of school at the 247 classical Christian schools nationwide to obtain district approval. These email addresses were accessed through ACCS. In addition, the researcher needed to call to heads of school because fewer than 10 schools responded back to the initial inquiry. Links to the survey were then emailed to be shared by the heads of school that respond to the initial email. Those teachers who agreed to participate were sent the Survey Monkey electronic survey. Instructions for completing the survey were sent to the teachers as well. No training was required to complete the survey.

The researcher allowed two weeks for all teachers to complete the survey. Reminder emails were sent out after one week and after 13 days to remind teachers to complete the survey. The survey took approximately six minutes to complete, including the added demographic questions from the researcher. The researcher then gathered all the data obtained from Survey Monkey and exported it to Microsoft Excel. Then, recoding of the eight items that were negatively worded for scoring consistency was conducted.

Data Analysis

SPSS was used to collect statistics for the two independent variables (elementary mathematics specialist support and classroom setting) based on the dependent variable, the MTEBI scores. Specifically, the sample size, means, and standard deviations for the MTEBI scores was measured. Then, data screening was conducted to sort the data and determine if any inconsistencies in the data exist. Next, a box and whisker plot was created to determine if any outliers existed (Foster, 2018).

The researcher utilized a two-way ANOVA to analyze the data. A two-way ANOVA was appropriate for this causal-comparative study that employed a between-subjects' groups (Foster, 2018; Green & Salkind, 2017). A two-way ANOVA was best for this causal-comparative study because there were four groups in the study and therefore four means to compare: non-departmentalized without support (NDEP without), non-departmentalized with (NDEP with), departmentalized without (DEP without), and departmentalized with (DEP with). A two-way ANOVA was required to analyze all three null hypotheses. The dependent variable (self-efficacy) was measured by the MTEBI instrument, and the ANOVA F test was utilized to differentiate quantitative values (Green & Salkind, 2017; Warner, 2013). The Two-Way ANOVA required the researcher to conduct all necessary assumption testing. The ANOVA determined if the Null Hypotheses could be rejected. A significance level of $\alpha < .05$ was applied in each analysis. In order to test for the assumption of normality, histograms were created, and a Kolmogorov-Smirnov test was run (Foster, 2018). Kolmogorov-Smirnov test was chosen because the researcher received more than 50 responses from grammar school teachers (Razali & Wah, 2011). Levene's Test of Equality of Error Variance was then run to test for the assumption of equal variance. Levene’s Test of Equality of Error Variance determined if the error variance of the dependent variable was approximately equal across groups or not (Warner, 2013). A Tukey HSD test was run to determine the between-subject effects as part of the post hoc analysis.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to determine if there was a statistically significant difference in the mathematics self-efficacy scores of classical Christian grammar school teachers who were supported and unsupported by a mathematics specialist or coach and who were in departmentalized and non-departmentalized classroom settings. The responding teachers were surveyed using the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI), a 21-question survey. This causal-comparative design focused on the classroom setting and elementary mathematics specialist support. A two-way analysis of variance was the primary statistical test used utilizing SPSS Version 26.0.0.0 statistical software. Each research question will be discussed individually, and the statistical results and graphical representations are arranged according to the research hypotheses.

Research Question

RQ1: Is there a difference between the self-efficacy scores of classical Christian grammar school mathematics teachers who are supported by mathematics specialists and classical Christian grammar school mathematics teachers who are not supported by mathematics specialists within departmentalized and non-departmentalized classrooms as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)?

Null Hypotheses

H01: There is no significant difference between the self-efficacy scores of classical Christian grammar school teachers when supported by an elementary mathematics specialist and classical Christian grammar school teachers when not supported by an elementary mathematics specialist as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

H02: There is no significant difference between the self-efficacy scores of classical Christian grammar school teachers in departmentalized settings and classical Christian grammar school teachers in non-departmentalized settings as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

H03: There is no significant interaction between the self-efficacy scores of departmentalized and non-departmentalized classical Christian grammar school teachers supported by elementary mathematics specialists and departmentalized and non-departmentalized classical Christian grammar school teachers without elementary mathematics specialist support as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

Descriptive Statistics

A total of 121 grammar school mathematics teachers completed the survey from 47 schools in 25 different states across the United States of America. Of these 121 initial respondents, three skipped one question and another one was identified as an outlier during the box and whisker plot analysis of the spread of the data. All four of those respondents were then removed. This left 117 responses used in the final analysis. Of the 117 remaining respondents, 31.6% were departmentalized and 68.4% were non-departmentalized. Only 22.2% had elementary mathematics specialist support and the remaining 77.8% did not have mathematics specialist support.

The ages of the teachers in each group, means, and standard deviations are shown in Table 1, Demographics of Teacher Age.

Table 1

Demographics of Teacher Age

Group	*N*	Percent	*M*	*SD*
Departmentalized	37	31.6	48.32	12.143
Non-Dep	80	68.4	47.75	11.180
Without Support	91	77.8	48.18	11.838
With Support	26	22.2	47.08	10.107
Total	117	100	47.93	11.444

Figure 1 shows the frequency of teachers' ages at each of five age groups.

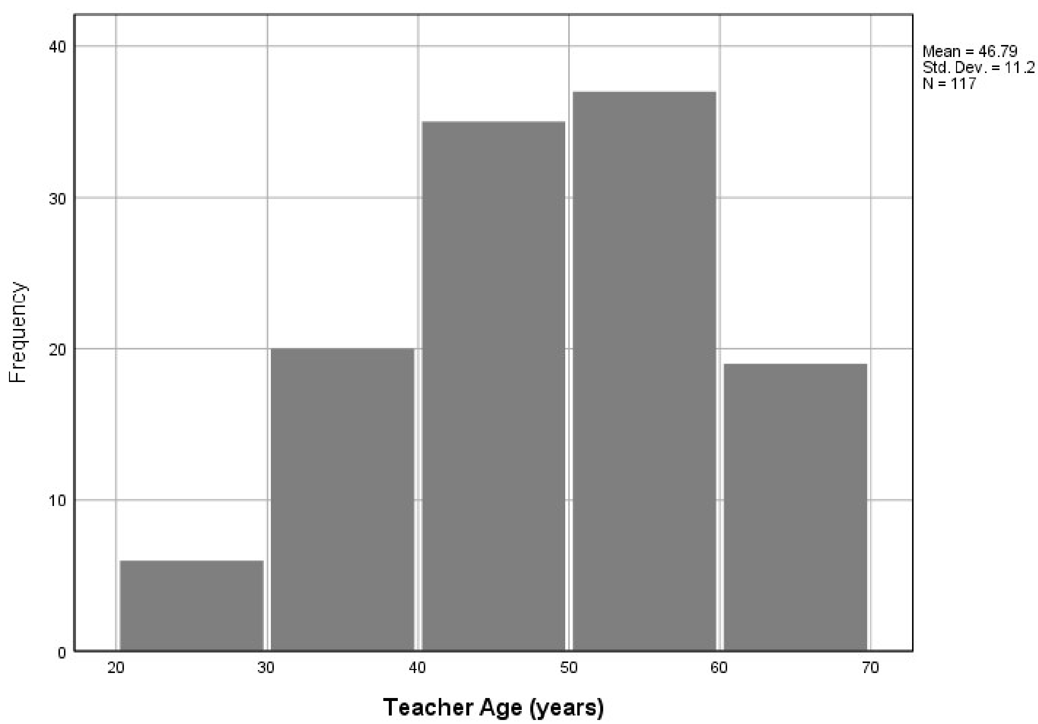

Figure 1: Teacher Age

Note. This histogram reflects the distribution of subjects' self-reported ages.

The distribution of years of experience of teachers is reported in Figure 2.

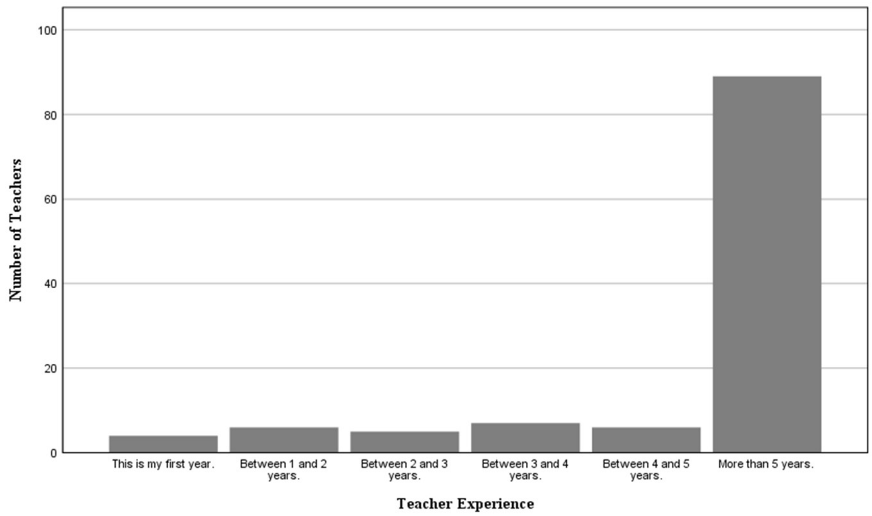

Figure 2: Teacher Experience

The number of years of experience at classical Christian schools is reported in Figure 3.

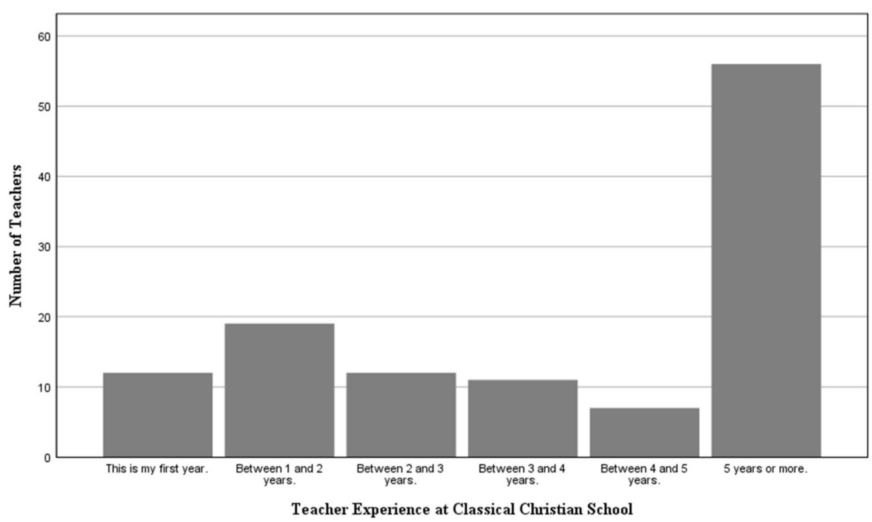

Figure 3: Teacher Experience at Classical Christian Schools

The 117 teachers who participated in the study were comprised of 96.58% female teachers (n = 113) and 3.42% male teachers (n = 4). The respondents self-identified with these races: 95.73% Caucasian (n = 112), 1.71% African American (n = 2), 1.71% Other (n = 2), and 0.85% Asian (n = 1).

The distribution of MTEBI total scores yielded a mean of 89.12 (*SD* = 7.13, *N* = 117). The minimum score was 76 and the maximum score was 108.

MTEBI Sub Scores

The MTEBI has two sub scores: Mathematics Teaching Outcome Expectancy (MTOE) and Personal Mathematics Teaching Efficacy (PMTE). The MTOE sub score had a mean value of 27.35 (*SD* = 3.432, *N* = 117). The minimum score was 18 and the maximum was 38. The PMTE sub score had a mean value of 61.77 (*SD* = 5.483, *N* = 117). The minimum score was 47 and the maximum was 74.

The total scores, means, standard deviations, and numbers of participants for each of the four groups are shown in Table 2: teachers who were not supported by an elementary mathematics specialist in departmentalized classrooms (DEP without), teachers who were supported by an elementary mathematics specialist in departmentalized classrooms (DEP with), teachers who were supported by an elementary mathematics specialist in non-departmentalized classrooms (NDEP with), and teachers who were not supported by an elementary mathematics specialist in non-departmentalized classrooms (NDEP without).

Table 2

Descriptive Statistics for MTEBI, MTOE, and PMTE

Score	Group	*M*	*SD*	*N*
MTEBI	DEP Without	89.93	6.799	27
	DEP With	93.80	6.321	10
	DEP Total	90.97	6.813	37
	NDEP Without	87.89	7.494	64
	NDEP With	89.75	5.520	16
	NDEP Total	88.26	7.151	80
	Total Without	88.49	7.317	91
	Total With	91.31	6.058	26
	Total	89.12	7.130	117
MTOE	DEP Without	28.15	4.120	27
	DEP With	28.40	4.061	10
	DEP Total	28.22	4.049	37
	NDEP Without	26.72	3.114	64
	NDEP With	27.88	2.680	16
	NDEP Total	26.95	3.052	80
	Total Without	27.14	3.482	91
	Total With	28.08	3.212	26
	Total	27.35	3.432	117
PMTE	DEP Without	61.78	5.308	27
	DEP With	65.40	4.477	10
	DEP Total	62.76	5.294	37
	NDEP Without	61.17	5.827	64
	NDEP With	61.88	4.319	16
	NDEP Total	61.31	5.541	80
	Total Without	61.35	5.656	91
	Total With	63.23	4.633	26
	Total	61.77	5.483	117

Results

Data Screening

The initial 121 respondents included three that had incomplete answers. The researcher chose to delete these responses thus leaving 118. Next, a frequency distribution of the total scores was conducted and one outlier was eliminated. The box and whisker plot for total score with the identified outlier is shown in Figure 4. In the final analysis, 117 responses were used.

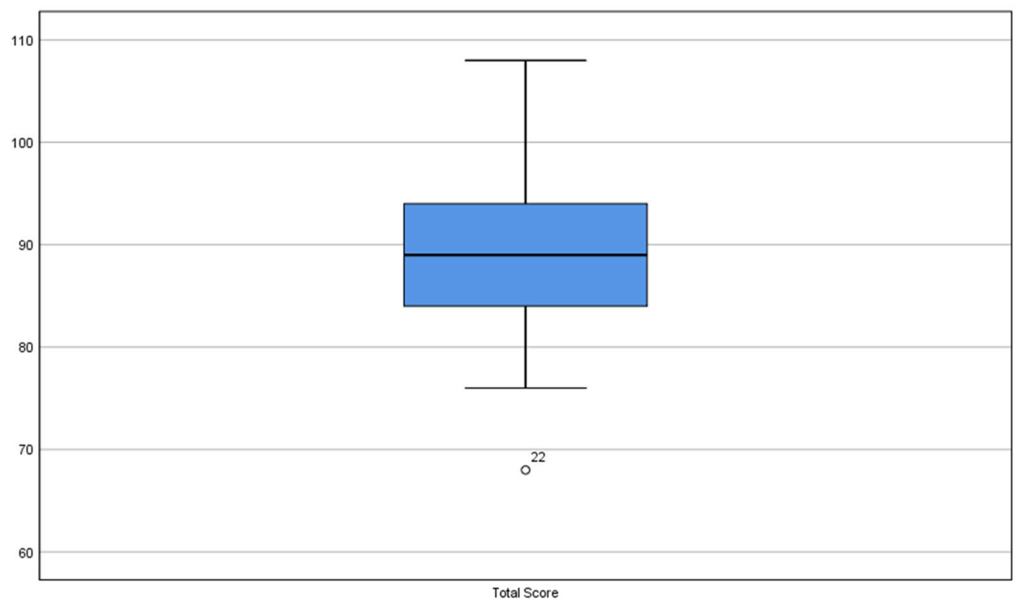

Figure 4: MTEBI Boxplot Before Removing Outlier

Null Hypothesis One

Before testing for significance in null hypothesis one, EMS support, the assumption tests for normality and homogeneity of variance were run. Levene's Test for Equality of Variances was used to determine if the data was equally spread. It was determined that the assumption was met for MTEBI. The assumption of homogeneity of variance was ascertained using Levene's test. The test returned a statistic of $F(1, 115) = 2.760$, $p = .099$ for MTEBI score. No violations were found ($p > .05$), so the assumption of homogeneity was met. Table 3 shows the results of tests for homogeneity of variance for EMS support MTEBI score.

Table 3

Tests of Homogeneity of Variance for EMS Support MTEBI Score

		Levene Statistic	df1	df2	Sig.
MTEBI	Based on Mean	2.760	1	115	.099
	Based on Median	2.973	1	115	.087
	Based on Median and with adjusted df	2.973	1	114.996	.087
	Based on trimmed mean	2.833	1	115	.095

The Kolmogorov-Smirnov test was run on the MTEBI and found the distributions to be normal. Table 4 shows the results for Kolmogorov-Smirnov test for EMS support MTEBI Score.

Table 4

Kolmogorov-Smirnov Test for EMS Support MTEBI Score

		MTEBI Score
N		117
Normal Parameters	Mean	89.12
	Std. Deviation	7.130
Most Extreme Differences	Absolute	.071
	Positive	.071
	Negative	-.066
Test Statistic		.071
Asymp. Sig. (2-tailed)		.200

Tests of homogeneity of variance for EMS support showed Levene's to be .099 for total MTEBI and Kolmogorov-Smirnov normality test for total MTEBI was found to be 0.071. Therefore, a two-way ANOVA measuring EMS support was run.

Results for Null Hypothesis One

Null hypothesis one stated that there is no significant difference between the self-efficacy scores of classical Christian grammar school teachers when supported by an elementary mathematics specialist and classical Christian grammar school teachers when not supported by an elementary mathematics specialist as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

A two-way ANOVA was used to test the first null hypothesis, which examined the differences between the level of support provided by an elementary mathematics specialist. Null hypothesis one was not rejected at a 95% confidence level, where $F(1, 115) = 3.208$, $p = .076$, $\eta^2 = .027$ for MTEBI. See Table 5 for tests of EMS support for MTEBI score.

Table 5

Tests of EMS Support for MTEBI Score

Score	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
MTEBI	Corrected Model	160.039	1	160.039	3.208	.076
	Intercept	653760.791	1	653760.791	13106.476	.000
	EMS Support	160.039	1	160.039	3.208	.076
	Error	5736.286	115	49.881		
	Total	935147.000	117			
	Corrected Total	5896.325	116			

Null Hypothesis Two

Before testing for significance in null hypothesis two, classroom setting, the assumption tests for normality and homogeneity of variance were run. The assumption of homogeneity of variance was determined using Levene's test. The test returned a statistic of $F(1, 115) = .691$, $p = .407$ for MTEBI total score. No violations were found ($p > .05$), so the assumption of homogeneity was met. Table 6 shows the results of tests for homogeneity of variance for classroom setting MTEBI score.

Table 6

Tests of Homogeneity of Variance for Classroom Setting MTEBI Score

		Levene Statistic	df1	df2	Sig.
MTEBI	Based on Mean	.691	1	115	.407
	Based on Median	.544	1	115	.462
	Based on Median and with adjusted df	.544	1	114.996	.462
	Based on trimmed mean	.624	1	115	.431

The Kolmogorov-Smirnov test was run and found the distributions to be normal for MTEBI. Table 7 shows the results for Kolmogorov-Smirnov Test for classroom setting MTEBI score.

Table 7

Kolmogorov-Smirnov Test for Classroom Setting MTEBI Score

		MTEBI Score
N		117
Normal Parameters	Mean	89.12
	Std. Deviation	7.130
Most Extreme Differences	Absolute	.071
	Positive	.071
	Negative	-.066
Test Statistic		.071
Asymp. Sig. (2-tailed)		.200

Tests of homogeneity of variance for classroom setting showed Levene's to be .407 for total MTEBI and Kolmogorov-Smirnov normality test for total MTEBI was found to be 0.071. Therefore, a two-way ANOVA measuring classroom setting was run

Results for Null Hypothesis Two

Null hypothesis two stated that there is no significant difference between the self-efficacy scores of classical Christian grammar school teachers in departmentalized settings and classical Christian grammar school teachers in non-departmentalized settings as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

A two-way ANOVA was used to test the second null hypothesis, which examined the differences between departmentalization and classroom settings. Null hypothesis two was not rejected at a 95% confidence level, where $F(1, 115) = 3.743$, $p = .055$, $\eta^2 = .032$ for MTEBI. See Table 8 for tests of classroom setting for MTEBI score.

Table 8

Tests of Classroom Setting for MTEBI Score

Score	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
MTEBI	Corrected Model	185.864	1	185.864	3.743	.055
	Intercept	812744.018	1	812744.018	16367.430	.000
	Classroom Setting	185.864	1	185.864	3.743	.055
	Error	5710.460	115	49.656		
	Total	935147.000	117			
	Corrected Total	5896.325	116			

Null Hypothesis Three

Before testing for significance in null hypothesis three, interaction between EMS support and classroom setting, the assumption tests for normality and homogeneity of variance were run. The assumption of homogeneity of variance was determined using Levene's test. The test returned a statistic of $F(3, 113) = 1.544$, $p = .207$ for MTEBI total score. No violations were found ($p > .05$), so the assumption of homogeneity was met. Table 9 shows the results of tests for homogeneity of variance for interaction MTEBI score between the four groups.

Table 9

Tests of Homogeneity of Variance for Interaction MTEBI Score

		Levene Statistic	df1	df2	Sig.
MTEBI	Based on Mean	1.544	3	113	.207
	Based on Median	1.306	3	113	.276
	Based on Median and with adjusted df	1.306	3	111.584	.276
	Based on trimmed mean	1.580	3	113	.198

The Kolmogorov-Smirnov test was run on the MTEBI score and found the distribution to be normal. Table 10 shows the results for Kolmogorov-Smirnov test for interaction MTEBI Score.

Table 10

Kolmogorov-Smirnov Test for Interaction MTEBI Score

		MTEBI Score
N		117
Normal Parameters	Mean	89.12
	Std. Deviation	7.130
Most Extreme Differences	Absolute	.071
	Positive	.071
	Negative	-.066
Test Statistic		.071
Asymp. Sig. (2-tailed)		.200

Tests of homogeneity of variance of interaction showed Levene's to be .273 for total MTEBI and Kolmogorov-Smirnov normality test for total MTEBI was found to be 0.071. Therefore, a two-way ANOVA measuring interaction was run.

Results for Null Hypothesis Three

Null hypothesis three specified that there is no significant interaction between the self-efficacy scores of departmentalized and non-departmentalized classical Christian grammar school teachers supported by elementary mathematics specialists and departmentalized and non-departmentalized classical Christian grammar school teachers without elementary mathematics specialist support as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

A two-way ANOVA was used to test the third null hypothesis, which examined the differences between the level of support provided by an elementary mathematics specialist and the classroom setting interactions. Null hypothesis three was not rejected at a 95% confidence level, where $F(3, 113) = 2.302$, $p = .081$, $\eta^2 = .058$ for MTEBI. See Table 11, tests of interaction for MTEBI score.

Table 11

Tests of Interaction for MTEBI Score

Score	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
MTEBI	Corrected Model	339.639	3	113.213	2.302	.081
	Intercept	606918.330	1	606918.330	12342.207	.000
	Classroom Setting	172.107	1	172.107	3.500	.064
	EMS Support	152.780	1	152.780	3.107	.081
	CS*EMS Support	18.865	1	18.865	.384	.537
	Error	5556.686	113	49.174		
	Total	935147.000	117			
	Corrected Total	5896.325	116			

Summary

Chapter Four delivered a summary of the data collected and an analysis of the data. The data presented the results of the overall MTEBI scores of 117 classical Christian grammar school teachers across the United States. Results from Tables 1 through 11 summarized the data. The researcher found no significant differences between grammar school teachers who were supported or unsupported by elementary mathematics specialists, no significant differences between teachers who were in departmentalized and non-departmentalized classroom settings, and no significant interaction between the groups.

CHAPTER FIVE: CONCLUSIONS

Overview

This quantitative causal-comparative study was designed to determine if a statistically significant relationship existed in the self-efficacy scores of classical Christian grammar school mathematics teachers who were supported or unsupported both in departmentalized and non-departmentalized classroom settings on the Mathematics Teaching Efficacy Beliefs Instrument. Teachers at over 240 schools were asked to participate in the study. No research studies were found that compared these four groups of teachers and this study was conducted to fill the gap in the research. This chapter will start with a discussion about the purpose of the study and provide a brief overview of the study. The results of the study will be analyzed with the research question and the three null hypotheses as the framework. Next, the limitations and implications of the study will be presented along with recommendations for further research at the end of the chapter.

Discussion

The purpose of this quantitative, causal-comparative study was to determine if there was a statistically significant difference among the self-efficacy scores of 117 classical Christian grammar school mathematics teachers who were supported or unsupported by elementary math specialists both in departmentalized and non-departmentalized classroom settings as measured by the MTEBI. Departmentalized settings were defined as settings where the teacher teaches mathematics more than once each day to different classes. Non-departmentalized settings were defined as settings where the teachers provided instruction in all content areas to just one set of students (Nelson, 2014). The independent variables in the study were support by an elementary mathematics specialist and classroom settings. The dependent variables were the scores on the

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) test for self-efficacy. A two-way analysis of variance was conducted to determine if statistically significant differences existed in the scores between teachers who were departmentalized or not and who were supported by elementary mathematics specialists or not. This fits within Vygotsky's social development learning theory. He created this theory to describe experts working with novices to learn within the zone of proximal development (Miller, 2011). This applies to the interactions between an expert elementary mathematics specialist and novice teachers because the former would help develop teachers' self-efficacy through positive interactions. The ZPD is the "distance between a student's ability to perform a task under adult guidance and/or with peer collaboration and the student's ability to solve the problem independently" (learning-theories.com, 2018). The results obtained in this study can be explained within Vygotsky's social development theory because it is possible that the number of positive interactions, which was not measured, impacted the scores. The ZPD between the expert and novice could have been narrower in some cases because the interactions could have been fewer in number. The mean score of the group that was supported was higher than the mean score of the group that was unsupported but not enough to be significant in the present study.

Bandura created social learning theory with the construct of self-efficacy. Self-efficacy is the conviction that one can successfully execute the behavior required to produce the outcome (Bandura & Wessels, 1997). There are four areas that help determine a person's self-efficacy: the success or failure of previously similar attempts, the experience of observing others fail or succeed at similar tasks, verbal persuasion, and lastly, physiological and affective states such as arousal, anxiety, fatigue, and physical pain (Miller, 2011). The second area, the experience of observing others fail or succeed at similar tasks, could have been affected in this study if the elementary mathematics specialist was not an expert, or if the number of times the grammar school teacher observed this expert were few. The third area, verbal persuasion, could also have been altered if the elementary mathematics specialist did not interact with the teacher and instead focused on tutoring students who were struggling in mathematics.

The results of the study agree with Cahill (2018) who found no increase in self-efficacy with the presence of an elementary mathematics specialist, but disagree with Green and Kent (2016), Kutaka et al. (2017) and Swars et al. (2018) who did find higher self-efficacy scores with the presence of an elementary mathematics specialist. Teachers who have a high sense of self-efficacy teach with more varied instructional practices and desire to learn more content knowledge (Carrier et al., 2017; Morris et al., 2017). Teachers' self-efficacy in mathematics has been reported as very low even though it is a ubiquitous professional development target area (Marrongelle, Sztain, & Smith, 2013). The results of the study revealed that the mean scores of these teachers were higher, as mentioned, but not enough for significance to be found. It has been shown that it takes at least 20 hours of contact time between novice and experts is needed for significance to occur (Kutaka et al., 2017). It is possible that the relationship between elementary mathematics specialist and grammar school teacher did not have enough time to fully develop. Thus, the scores were higher amongst teachers with EMS support but were not quite to the level to establish a statistically significant relationship.

Finally, the results of the study show that the teachers at these schools were very experienced and had higher self-efficacy scores in each of the four subgroups as compared to a prior study from Syverson (2018). Morris et al. (2017) found that teachers with a strong sense of efficacy were less susceptible to burn-out. Anderson (2016) found that the self-efficacy scores of classical Christian teachers were no different than other teachers. Therefore, the experience level of the teachers comes into play as a possible reason for the high self-efficacy scores. Because the teachers in this study based within classical Christian schools were more experienced, it is possible that their self-efficacy scores were already higher than other teachers.

Research Question One

Is there a difference between the self-efficacy scores of classical Christian grammar school mathematics teachers who are supported by mathematics specialists and classical Christian grammar school mathematics teachers who are not supported by mathematics specialists within departmentalized and non-departmentalized classrooms as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)?

Null Hypothesis One

There was no significant difference between the self-efficacy scores of classical Christian grammar school teachers when supported by an elementary mathematics specialist and classical Christian grammar school teachers when not supported by an elementary mathematics specialist as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

There is not enough evidence to reject null hypothesis one. Mindset of teachers is a possible explanation for the results of this study. Ren et al. (2018) found that the mindsets of teachers need to be growth mindsets for a significant relationship to be found. Lischka et al. (2015) recently showed that professional development with elementary teachers only produced significant results in teaching changes when the teachers possessed a growth mindset. As shown, mindset of teachers can have a huge impact on their own self-efficacy beliefs and could have impacted the results.

Null Hypothesis Two

There was no significant difference between the self-efficacy scores of classical Christian grammar school teachers in departmentalized settings and classical Christian grammar school teachers in non-departmentalized settings as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

There is not enough evidence to reject null hypothesis two. For this study, departmentalized classrooms were those that have more than one teacher planning and delivering the core subject instruction for groups of students (Martin et al., 2016). This research showed no statistically significant difference in the self-efficacy scores of classical Christian grammar school teachers based in different classroom settings. Classical Christian teachers in classrooms that were departmentalized had means that were higher than those in non-departmentalized settings on the MTEBI, but not enough to produce significant results. The results of this study conflict with the results of Lee, Martin, and Trim (2016) who found that departmentalization had an impact on teacher efficacy in public schools in Tennessee. They found an impact on teacher efficacy when the teachers were surrounded by professional learning communities. The results of this study could have been in conflict if time to reflect on lessons was not available in the schools. This is in agreement with Dow (2013) who found the importance of reflection time in discussions impacted teacher efficacy. Teachers who had time to reflect on mathematics lessons because they are either departmentalized or non-departmentalized could have had more planning time (2013). The time spent reflecting on mathematics lessons within both departmentalized and non-departmentalized classrooms could have been a factor that effected the self-efficacy scores of the grammar school teachers in this study.

Null Hypothesis Three

There was no significant interaction between the self-efficacy scores of departmentalized and non-departmentalized classical Christian grammar school teachers supported by elementary mathematics specialists and departmentalized and non-departmentalized classical Christian grammar school teachers without elementary mathematics specialist support as measured by the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI).

There is not enough evidence to reject null hypothesis three. The results of this study conflict with Epps (2018) who discovered elementary mathematics teachers' self-efficacy improved in departmentalized settings when they had the support of a peer coach or mathematics specialist. The results could have conflicted because teachers' self-efficacy could have been lower if the grammar school teachers did not have enough interactions with the elementary mathematics specialist. As Kutaka (2017) found, over 20 hours of interaction time was necessary for significance to occur.

Additional Findings

Study participants self-reported age, years of teaching experience and ethnicity as part of the demographic information was collected. The experience level of the teachers at classical Christian schools was very high. Research has shown self-efficacy scores are at their lowest during the first two years of teaching (Thomson, Walkowiak, Whitehead, & Huggins, 2020). Hoy (2004) found self-efficacy to be most malleable early and suggested the first few years of teacher development was critical to long-term self-efficacy development. Research from Tschannen-Moran and Woolfolk Hoy (2001) found teachers who had less than five years of experience have significantly lower self-efficacy scores than expert teachers. Teacher turnover continues to be a problem at schools around the country and is on the rise (Ingersoll, Merrill, &

Stuckey, 2014). Specifically, novice teachers are more likely to quit the profession in the first 3 years with percentages ranging from 46% to71% turnover (Papay, Bacher-Hicks, Page, & Marinell, 2017). Some sources estimate that 50% of the teachers currently in our classrooms will either retire or leave the profession over the next 5-7 years. The statistics for teacher turnover among new teachers are startling. Close to 50% of newcomers leave the profession during their first five years of teaching (Research Spotlight, 2013). With over 85% of the teachers in the present study having five years of experience or more in the classroom and a startling 75% having five years or more in classical Christian environments, the experience of the teachers may well have impacted the self-efficacy scores.

Implications

The implications of the research are broad and contribute to the knowledge base on classical Christian schools, self-efficacy, and the use of elementary mathematics specialists. This research found that there were no differences in self-efficacy scores of grammar school teachers at classical Christian schools who were supported or unsupported by an elementary mathematics specialist both within departmentalized and non-departmentalized classrooms. Because limited research exists in classical Christian schools, the results of the research, specifically the high self-efficacy scores on the PMTE sub score on the MTEBI, give a better understanding of the characteristics of the teachers in the schools. The results of the research can be used to shape decision making by classical Christian administrators around the country. These schools are in their infancy and have limited funds to use to hire teachers and elementary mathematics specialists. The results of this study agree with Cahill (2018) who demonstrated that teacher self-efficacy was not influenced by peer coaching. Cahill did discover that peer coaching did increase student engagement, more varied instructional strategies, and improve classroom management. The experience level of the teachers at these schools might have impacted the results. Administrators who employ teachers with limited experience should strongly consider providing expert mathematics specialists to assist in the development of self-efficacy of these teachers. Abundant research shows that the content knowledge of elementary teachers is still not at the level it should be (Polly et al., 2014; Schmidt et al., 2017; Taylor-Buckner, 2014; Tutak & Adams, 2017; Webel et al., 2017; Wu et al., 2018). While the self-efficacy scores of the teachers in this study did not produce a statistically significant result, the researcher cannot say that elementary mathematics specialists should not be employed at schools. Elementary mathematics specialists are still needed at these schools to assist with basic fact instructional practices. Early reading interventions are abundant but early mathematics interventions are lacking (Fuchs et al., 2013). Early mathematics competencies consist of the ability to recall basic facts and cardinality. Fact memorization, as has been shown, is a basic objective of classical Christian grammar schools (Perrin, 2004; Vaughn, 2018). Fact recall includes fluency with basic sums (Purpura, Baroody, Eiland & Reid, 2016). Children differ greatly in their ability to reason to retrieve their basic facts (Batchelor, Keeble & Gilmore, 2015). Students who have mastered their basic facts and can reason through the retrieval of basic sums continue to progress in mathematics. Conversely, students who struggle early on with fact recall continue to struggle throughout their mathematics education classes. (Hayes, 2014; Galindo & Sonnenschein, 2015). These struggles are illuminated in national competency tests as well. Because classical schools place a bigger emphasis on memorization of basic facts (Perrin, 2004; Vaughn, 2018), teachers at these schools often use timed tests to help improve fact retrieval. McGee (2017) found that an emphasis solely placed on timed tests without reasoning strategy instruction lead to an increase in math anxiety. Without strong, knowledgeable leaders, these teachers might unwillingly be adding to the anxiety level of students by overemphasizing timed test without reasoning strategies to help students retrieve their facts.

Strong leadership in the mathematics departments at the elementary and grammar school level could help teachers and students learn basic fact retrieval without building anxiety. Kouzes and Posner clearly elucidate the importance of leaders fostering collaboration and strengthening others in their book, *The Leadership Challenge* (2012). Effective mathematics specialists would exemplify this leadership by developing the content knowledge (competence) and beliefs about themselves (confidence) of grammar school mathematics teachers. Secondly, they would also be of great value to encourage the hearts of teachers, as Kouzes and Posner (2012) assert, by celebrating the values and victories necessary to be an effective classical Christian mathematics educator. Elementary mathematics specialists need to be employed to help all teachers with their content knowledge, development and instructional practices, and to specifically assist novice teachers in development self-efficacy in the content specific area of mathematics.

Limitations

Causal-comparative research is used to determine the causes of dependent variable differences between two or more groups. A non-experimental design was chosen because the independent variables were not manipulated. Instead, they were naturally occurring (Gall et al., 2007). This research study was limited to the 117 classical Christian grammar school mathematics teachers who participated in the study from the 47 schools across the country. Causal-comparative research designs are the best choice when researchers aim to determine the causes of dependent variable differences between two or more groups. A non-experimental design was chosen because the independent variables were not manipulated. Instead, they were naturally occurring (Gall et al., 2007). In this study, the cause, the presence or absence of an elementary mathematics specialist in the school, was presumed to affect the differences in self-efficacy scores amongst the separate groups of individuals. Total self-efficacy scores on the MTEBI were compared between the four groups of teachers: those in departmentalized classrooms who received elementary mathematics specialist support, those in departmentalized classrooms who did receive elementary mathematics specialist support; those in non-departmentalized classrooms who received elementary mathematics support, and those in non-departmentalized classrooms who did not receive elementary mathematics specialist support. The four groups were not of equal sizes: there were fewer grammar school teachers who were in departmentalized settings with support and in non-departmentalized settings with support. The researcher did not manipulate the teachers who decided to participate in the study. The participants decided to participate thus threatening the internal validity of the study.

Recommendations for Future Research

The purpose of the study was to examine if the presence of an elementary mathematics specialist in classical Christian classrooms was a factor in the mathematics self-efficacy scores of teachers based on the results of the MTEBI. The study is important because classical Christian schools are increasing exponentially and the teachers at these schools have not been the focus of many research studies. The mathematics self-efficacy scores of these teachers had not been researched until this time. This study provides a starting point in the research of classical Christian teachers and the use of elementary mathematics specialists to support these teachers. While the results were not statistically significant, the experience level and high self-efficacy scores may at least in part explain the results. Classical Christian educators who participated in this survey exhibited strong self-efficacy in the content area of mathematics. These scores show that on average, they feel confident they can successfully execute the behavior required to produce the desired outcome, which is developing a life-long love of learning mathematics in the students they teach. However, classical Christian educational research is sparse, and studies based within classical Christian schools continue to be needed to help determine their efficacy. The researcher recommends the following to help further examine classical Christian schools:

1. The achievement scores with elementary mathematics specialists versus those without. Vaughn (2018) found a significant difference between the mathematics PSAT scores at classical Christian schools versus other non-classical Christian schools but no study was discovered based solely on the grammar school level and achievement at these schools.
2. The amount of training the elementary mathematics specialists had who are employed at these schools would help clarify the results.
3. The time elementary mathematics specialists spend with the teachers at classical Christian schools. The importance of having a respected professional model using appropriate teaching methods cannot be understated in the development of teacher efficacy (Thomson, 2020). In addition, using Kutaka's findings (2017) of the need to have at least 20 hours of contact time would help clarify the results.
4. The methods these experienced teachers used to help students memorize their basic facts would help illuminate whether they were increasing anxiety. Further study should focus on an examination of the areas that these elementary mathematics specialists target in their work. This would help determine the mathematics self-efficacy and mindsets of these teachers. The time that these specialists commit to

tutoring students versus interacting with teachers too would illuminate their importance in schools.

5. The instructional practices these teachers employ. As has been shown in the literature review, instructional practices such as discovery learning, deep discussion of topics, employing higher cognitive level tasks, integration of content, and implementing more visuals have all been researched in schools that do not fall under the classical Christian umbrella have been conducted (Boaler, 2016; Nilson, 2016; Parkay et al., 2014). A studied based within the classical Christian setting would help bridge the gap in research.
6. A correlational study of the self-efficacy scores of grammar school mathematics teachers and student achievement at these schools would also help understand the impact that mathematics teachers' self-efficacy has on achievement. A qualitative study used to examine the question of mindsets or on the quality of relationship between the elementary mathematics specialists and the grammar school teachers they serve would also be helpful.
7. A study of the experience level of the teachers and self-efficacy scores at these schools would help connect an important gap in the research.
8. The spirituality of the teachers and the connection to self-efficacy scores could be further researched. Teacher effectiveness based on spirituality has largely been unexamined in the academic world (Hartwick & Kang, 2013). These researchers studied 333 participants and found that spirituality did affect self-efficacy and persistence. Hartwick (2007) also found 93% of public school teachers surveyed believed prayer has given them comfort during stress and 70.4% believe prayer has

helped them maintain their enthusiasm. Further study in the classical Christian schools may focus on how prayer and the desire to maintain lifelong learning affects self-efficacy and job persistence.

9. The amount of planning time the teachers had to reflect on lessons needs to be studied. As shown, planning time for reflection improves self-efficacy. Dow (2013) illuminated the importance of reflection time in discussions by describing it as allowing the teacher to give students ownership in their learning and providing a sense of purpose to the lessons.

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APPENDIX A

Permission to use the MTEBI

Re: Permission to use the MTEBI
Cristina,

Yes, you have my permission to use the MTEBI for your research as described below.

Best regards,
DeAnn Huinker

On Feb 6, 2019, at 10:01 AM, Dube, Cristina Marie <cmdube@liberty.edu> wrote:

Dear Dr. Huinker,

I am an Ed.D. student from Liberty University and I also serve as the mathematics specialist at the Geneva School of Boerne in Boerne, Texas.

My area of research is examining how the presence of elementary mathematics specialists effects teachers' specialized content knowledge for teaching mathematics, instructional practices, and mathematics self-efficacy in Classical Christian schools.

I am very interested in using the MTEBI and am hoping to receive your permission to use it. My I please use the instrument?

Thank you so much for your consideration.

Best wishes,

Cristina M. Dube

Dr. DeAnn Huinker, Mathematics Education
Professor, Department of Teaching and Learning
Director, Center for Mathematics and Science Education Research (CMSER)
Board of Directors, National Council of Teachers of Mathematics (NCTM)
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APPENDIX B

IRB Approval

From: IRB, IRB <IRB@liberty.edu>
Sent: Friday, October 18, 2019 9:57 AM
To: Dube, Cristina Marie <cmdube@liberty.edu>
Cc: Lunde, Rebecca M (School of Education) <rmfitch@liberty.edu>; IRB, IRB <IRB@liberty.edu>
Subject: IRB Exemption 3943.101819: Self-Efficacy Score Differences between Supported, Unsupported, Departmentalized, and Self-Contained Classical Christian Elementary Mathematics Teachers

Dear Cristina M. Dube,

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 that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:
>
> > (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

Please retain this letter for your records. Also, if you are conducting research as part of the requirements for a master's thesis or doctoral dissertation, this approval letter should be included as an appendix to your completed thesis or dissertation.

Your IRB-approved, stamped consent form is also attached. This form should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document should be made available without alteration.

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,

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office

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APPENDIX C

Recruitment Email

Date: October 28, 2019

Dear Head of School:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for an Ed.D. in Curriculum and Instruction. The purpose of my research is to determine if there is a relationship between grammar school mathematics teachers' self-efficacy in mathematics and the presence of mathematics specialists at schools in both self-contained and departmentalized classrooms based within classical Christian schools.
I am writing to request your permission to invite your teachers to participate in my study. Participants must be current teachers teaching math at a classical Christian grammar (K-5) school across the United States. These teachers will be asked to complete an online survey through SurveyMonkey ®. Heads of school would need to send the email link to all grammar math teachers at the school.
It should take approximately 25 minutes for the teachers to complete the procedure listed. Their participation will be completely anonymous, and no personal, identifying information will be required.

A random drawing will be conducted with all participants. One person will be randomly selected and awarded a $25.00 gift card from Amazon for completing the study.

Should you have any questions, you are encouraged to email me, the researcher, at cmdube@liberty.edu.

Thank you for your time and your consideration for this important study!

Cristina M. Dube

APPENDIX D

Follow-Up Email

Date: November 7th, 2019

Dear Teacher:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for an Ed.D. in Curriculum and Instruction. The purpose of my research is to determine if there is a relationship between grammar school mathematics teachers' self-efficacy in mathematics and the presence of mathematics specialists at schools in both self-contained and departmentalized classrooms.
I am writing to invite you to participate in my study. Participants must be current teachers teaching math at a classical Christian grammar (K-5) school across the United States. If you are willing to participate, you will be asked to complete an online survey through SurveyMonkey ®.
It should take approximately 25 minutes for you to complete the procedure listed. Your participation will be completely anonymous, and no personal, identifying information will be required.
To participate, I ask you to please go to https://www.surveymonkey.com/r/R7SPT8T and complete the survey by November 7th, 2019.
Consent information is provided as the first page you will see after clicking on the survey link. 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. Completion of the survey implies your consent to participate in the research study.
A random drawing will be conducted with all participants. One person will be randomly selected and awarded a $25.00 gift card from Amazon for completing the study.
Should you have any questions, you are encouraged to email the researcher, Cristina Dube, at
Thank you for your time and your consideration!