

TEACHER FACTORS AND THE IMPACT ON  
STUDENT SUCCESS IN ALGEBRA I

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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## ABSTRACT

Algebra I proficiency is an important aspect of a solid foundation in mathematics. Teachers play a critical role in the failure or success of students. Different teacher characteristics are thought to have a significant impact on the potential for student success. This non-experimental correlational research study seeks to examine the potential relationships between specific teacher characteristics and student success in Algebra I as measured by the Algebra I End of Course Exam scores. This study uses ordinary least squares regression analysis to examine the effects of independent variables on successful Algebra I scores. The independent variables in this study include teacher self-efficacy rating, certification type, years of experience teaching in total and teaching Algebra I specifically, and college degree earned. This study seeks to contribute to the body of knowledge by establishing a relationship, or lack thereof, between independent variables and student success in Algebra I. By establishing the presence or absence of a correlation between these variables, school leaders will have more research-based information to affect hiring decisions and teacher placement within Algebra I content areas. Results showed that years of experience teaching Algebra I was a significant predictor for student success in Algebra I. The other variables were not found to be significant predictors. Suggestions for future research are also included.

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### **Dedication**

This work is dedicated to my amazingly supportive and patient husband, Chris. It is also dedicated to every woman who wonders if she can do this and manage family, friends, life....

Yes, you can. Start now.

## Acknowledgements

I am overwhelmed with gratitude by the amount of support, patience, and encouragement I have received from family and friends throughout this process. First and foremost, I am grateful for the unending love and support from my husband, Chris. This would not have been possible without your encouragement and understanding. I am thankful for my parents, David and Pamela, for teaching me that there are no limits to what I can achieve if I am willing to work for it. To my brothers, Drew and Clay, thank you for your never-ending sarcastic jokes about when I will finally graduate and “do something with my life”. You kept me laughing throughout this process.

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## Table of Contents

ABSTRACT .....	3
Dedication .....	5
Acknowledgements .....	6
List of Tables .....	10
List of Figures .....	11
List of Abbreviations .....	12
CHAPTER ONE: INTRODUCTION.....	14
Background .....	14
Problem Statement .....	17
Purpose Statement.....	18
Significance of Study .....	19
Research Question .....	20
Hypothesis.....	20
Definitions.....	21
CHAPTER TWO: LITERATURE REVIEW .....	23
Introduction.....	23
Theoretical and Conceptual Framework.....	24
Bandura’s Social Cognitive Theory .....	24
Conceptual Framework.....	28
Related Literature.....	29
Teacher Quality and Student Learning .....	29
Teacher Certification in Texas.....	34

Standard Certification ..... 34

Alternative Certification ..... 37

Teaching Experience..... 39

Degree Earned..... 42

Efficacy Beliefs..... 44

Self-Efficacy Beliefs ..... 45

Teaching Efficacy Beliefs..... 50

Mathematics-Specific Efficacy Beliefs..... 50

Efficacy Beliefs in Administrators..... 51

Collective Efficacy..... 53

Importance of Algebra I Success ..... 54

Summary ..... 57

**CHAPTER THREE: METHODS ..... 58**

Design ..... 58

Research Question ..... 59

Hypothesis..... 59

Participants and Setting..... 59

Instrumentation ..... 61

Procedures..... 64

Data Analysis ..... 65

**CHAPTER FOUR: FINDINGS ..... 69**

Overview..... 69

Research Question ..... 69

Hypothesis.....	69
Descriptive Statistics.....	69
Results.....	72
Data Screening .....	72
Assumptions.....	73
Results for Null Hypothesis .....	78
Reporting on for Null Hypothesis.....	80
CHAPTER FIVE: CONCLUSIONS .....	81
Overview.....	81
Discussion.....	81
Implications.....	85
Limitations .....	87
Recommendations for Future Research .....	89
References.....	93
Appendix A: Permission to Use MTEBI Instrument.....	114

### List of Tables

Table 1. Descriptive Statistics for Student Scores per Teacher, Years of Teaching, and Years of Teaching Algebra I .....	71
Table 2. Descriptive Statistics for Certification Type and Highest Math-Related Degree Earned .....	71
Table 3. Descriptive Statistics of Efficacy Scores and Algebra I EOC Scores .....	72
Table 4. Correlations Between Continuous Variables (P-values in Parentheses) .....	72
Table 5. Parameter Estimates and Test for Independent Variables for Model Including Total Efficacy .....	79
Table 6. Parameter Estimates and Test for Independent Variables for Model Including PMTE and MTOE Subscales.....	80

### List of Figures

Figure 1. Histogram of Raw Exam Scores on the Algebra I EOC Exam Based on Frequency ....	73
Figure 2. Box and Whisker Plot Showing Distribution of Data Based on Raw Scores on the Algebra I EOC Exam.....	73
Figure 3. Histogram of Residuals for the Model including Total Efficacy .....	75
Figure 4. Box and Whisker Plot of Residuals for the Model including Total Efficacy.....	76
Figure 5. Normal Quantile Plots of Residuals for the Model including Total Efficacy .....	76
Figure 6. Histogram of Residuals for the Model including PMTE and MTOE Efficacy Subscales.....	77
Figure 7. Box and Whisker Plot of Residuals for the Model including PMTE and MTOE Efficacy Subscales .....	77
Figure 8. Normal Quantile Plots of Residuals for the Model including PMTE and MTOE Efficacy Subscales .....	78

### **List of Abbreviations**

Confirmatory Factor Analysis (CFA)

Curriculum-Based Assessment (CBA)

English Language Learner (ELL)

End of Course (EOC)

Every Student Succeeds Act (ESSA)

High Stakes Teacher Evaluation (HSTE)

Intraclass Correlation Coefficient (ICC)

Institutional Review Board (IRB)

Limited English Proficient (LEP)

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)

Mathematics Teaching Outcome Expectancy (MTOE)

No Child Left Behind (NCLB)

Ordinary Least Squares (OLS)

Personal Mathematics Teaching Efficacy (PMTE)

Pedagogy and Professional Responsibilities (PPR)

Professional Learning Community (PLC)

State Board of Education Certification (SBEC)

Statistical Package for the Social Sciences (SPSS)

State of Texas Assessments of Academics Readiness (STAAR)

Science Teaching Efficacy Beliefs Instrument (STEBI)

Texas Administrative Code (TAC)

Texas Academic Performance Report (TAPR)

Texas Education Agency (TEA)

Texas Essential Knowledge and Skills (TEKS)

Texas Examinations of Educator Standards (TExES)

Texas Higher Education Coordinating Board (THECB)

Variance Inflation Factor (VIF)

## CHAPTER ONE: INTRODUCTION

### Background

The National Mathematics Advisory Panel (2008) final report states that algebra is the gateway to higher math, a college degree, and higher earnings from employment. Algebra I is a course that is critical to high school graduation in the state of Texas. Algebra I course credit is a requirement of all four current graduation plans established by the Texas Education Agency ([TEA], 2015). Additionally, Chapter 74 of the Texas Education Code (TAC) states that, “A student may not be enrolled in a course that has a required prerequisite unless the student has completed the prerequisite course(s); the student has demonstrated equivalent knowledge as determined by the school district...” (TAC, §74.11, Subchapter J, 2012a). Algebra I is a prerequisite course for Geometry, Algebra II, and all other advanced math courses offered in Texas (TAC, 2012a). Additionally, Algebra I is one of the five required State of Texas Assessments of Academic Readiness (STAAR) End of Course (EOC) exams required for high school graduation. Due to these requirements, Algebra I success has become an area of intense focus over the last several years in Texas. Student performance on Algebra I EOC exams is directly tied to school district and individual campus accountability ratings (TEA, 2015). As a result, school districts allocate additional resources in order to provide support for Algebra I success. These additional allocations may include financial, time, and personnel resources.

There have been numerous studies that linked a specific teacher as the significant contributing factor to student learning and success (Badgett, Decman & Carman, 2014). As a result, teacher impact on student learning has been a focus of extensive research over the last several decades. Various teacher characteristics such as self-efficacy, years of experience, certification type, content knowledge, and pedagogical knowledge have been studied; however,

the results are mixed and do not provide any conclusive answers regarding the importance of certain teacher characteristics and how those characteristics relate to student learning (Çakır & Bichelmeyer, 2013). Ultimately, school leaders are left without research-based criteria for selecting certain teachers to teach specific subject areas. The area of human capital management, or the practices of hiring, training, and assigning teachers, has grown as a result of research that revealed the connection between teacher quality and student achievement (Donaldson, 2013).

Teacher self-efficacy has been a central focus in the research including both mathematics self-efficacy and mathematics teaching self-efficacy (Bates, Kim, & Latham, 2011). Self-efficacy is defined as “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1977, p. 3). Mathematics self-efficacy relates to a person’s belief in his or her own math skills, whereas mathematics teaching self-efficacy relates to a person’s belief in his or her own ability to effectively teach math skills to students (Bates et al., 2011). Personal agency is a component of Bandura’s social cognitive theory that ties efficacy beliefs to seeking personal growth and development opportunities (Bandura, 2001). This study will apply the lens of social cognitive theory to teachers in the belief that behaviors are produced from personal choices and within the expectations of a specific environment, which in the case of this study will be the academic environment (Bandura, 1991). Social cognitive theory also asserts that human learning occurs in a complex process that involves the interactions of behaviors, environmental constraints, and personal factors (Bandura, 1986).

Although teacher efficacy and student achievement have been the subject of numerous research inquiries, there are several other teacher factors that potentially influence student learning outcomes. Bursal and Paznokas (2006) showed that a perceived lack of knowledge in a content area contributes to a negative attitude about the content, therefore lowering self-efficacy

beliefs regarding successfully teaching math content to students. According to Goddard, Hoy, and Hoy (2000), “Researchers have established strong connections between teacher efficacy and teacher behaviors that foster student achievement” (p. 480). The lack of content knowledge and accompanying lower efficacy beliefs could potentially detract from a teacher’s ability to positively impact student achievement in a specific content area. Content knowledge contributes to mathematics self-efficacy beliefs. Content knowledge includes both the facts and the concepts as well as having an understanding of the principles that guide the specific discipline (Ball, Thames & Phelps, 2008). Content knowledge extends far beyond simply being able to pass an examination or regurgitate facts and figures. Shulman (1986) stated, “The teacher need not only understand *that* something is so; the teacher must further understand *why* it is so, on what grounds its warrant can be asserted, and under what circumstances our beliefs in its justification can be weakened or denied” (p. 9). As math education becomes increasingly complex and focused on mathematical processes rather than memorization of facts, the content knowledge demands on teachers has evolved (Brown, 2012).

Teacher certification (also called licensure in some states) type is another factor that has been studied regarding impact on student achievement. Chapter 228 of the TAC sets the requirements for teacher preparation programs (TAC, 2012b). Texas has both standard certification programs, which are university-based and require enrollment in an education program, and alternative certification programs, in which candidates are sponsored by school districts and have limited accountability (Baines, McDowell & Foulk, 2001). Ultimately, alternative certification programs allow for a quicker path to certification and employment as a teacher. According to Baines et al. (2001), “From content-area courses to field experience, the requirements for the traditional program are far more rigorous than for alternative certification”

(p. 34). However, there is limited research regarding the connection between licensure or certification type and student achievement, or that teachers are sufficiently prepared to enter the teaching field based on completing certification requirements (Goldhaber & Brewer, 2000).

Teaching experience, both years of experience as a teacher and within a specific content area, is an area with limited research regarding connection to student learning. According to a study conducted by Klassen and Chiu (2010), “Teacher self-efficacy often increases in the early stages of teachers’ careers, we found that early- to mid-career teachers reported progressively greater self-efficacies...while late-career teachers reported less self-efficacy” (p. 750). However, studies examining the impact of teaching experience within a specific grade level or content area is not a subject that has been extensively researched (Huang & Moon, 2009).

Bandura’s social cognitive theory supports the idea that specific teacher factors contribute to the overall success of their students and specifically, self-efficacy plays a critical role. According to Bandura (1991), “People form beliefs about what they can do, they anticipate the consequences of prospective actions, they set goals for themselves, and they otherwise plan courses of action that are likely to produce desired outcomes” (p. 248). It is critical to examine factors other than self-efficacy to account for internal and external influences that impact the capability of teachers to positively impact student learning. According to Bandura (1991), “People cannot influence their own motivation and actions very well if they do not pay adequate attention to their own performances, the conditions under which they occur, and the immediate and distal effects they produce” (p. 250).

### **Problem Statement**

Algebra I is of critical importance for accredited secondary schools in Texas. Students in Texas cannot graduate from high school without demonstrating mastery of the Algebra I

curriculum in both the coursework and the Algebra I End Of Course (EOC) exam (TEA, 2015). The Algebra I EOC exam is part of the State of Texas Assessments of Academic Readiness (STAAR) standardized testing program. Every high school student must meet performance standards on five EOC exams to earn a high school diploma. The five required EOC exams in high school are English I, English II, Algebra I, Biology, and US History. As a result, school districts place great focus on student success in Algebra I and allocate a variety of resources, including financial and personnel resources, to this endeavor. Schools strive to assign the most effective math teachers to teach Algebra I to ensure students are successful in the course and on the EOC exam.

The link between teacher quality and student success has been displayed in several studies (Badgett et al., 2014; Kennedy, 2010; Loeb, Kalogrides & Beteille, 2012; McCaffrey, Lockwood, Koretz & Hamilton, 2003). Self-efficacy, specifically regarding teaching self-efficacy, has been a focus of numerous studies focused on predicting teacher success (Bates et al., 2011; Goddard et al., 2000; Klassen & Chiu, 2010). However, additional variables such as teacher certification type, years of experience, and degree earned have not been studied in conjunction with self-efficacy to seek to identify the specific factor or factors that correlate to the highest levels of student success in Algebra I.

Therefore, the problem of this study is that research is needed regarding a variety of teacher factors and their influence on student success in Algebra I, specifically on the Algebra I EOC exam.

### **Purpose Statement**

The purpose of this study was to compare Algebra I EOC scores based on several teacher factors to determine if one or more factors has a statistically significant impact on student

achievement. This study included Algebra I teachers in a major suburban public school district in North Texas. It is important to include the fact that all of the teachers in the study taught in Texas schools because the dependent variable is Algebra I EOC exam scores, which is a standardized test specific to Texas standards and graduation requirements. The independent variables in this study included certification type (standard or alternative), years of experience teaching, years of experience teaching Algebra I, college degree earned (math major, minor, or other), and scores on the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI). The purpose of this study was rooted in social cognitive theory (Bandura, 1991).

### **Significance of Study**

This study is significant due to the gap in the research literature regarding teacher factors on student achievement in Algebra I. Although there is extensive research surrounding some of the independent variables and the effect on varying dependent variables, there is relatively little research examining the specific teacher factors noted previously related to the impact on student learning in Algebra I. There is relatively little existing research that looks specifically at Algebra I achievement related to all students in the course. Studies exist that look at the effects of requiring Algebra I in ninth grade or earlier for specialized student groups, such as low-performing students who have traditionally taken remedial math or students in different racial groups; however, the impact of teacher factors on student scores across the entire population has not been studied (Nomi, 2012; Diemer, Marchand, McKellar, & Malanchuk, 2016). Additionally, much of the research regarding teacher factors impacting student achievement in math studies teachers at the elementary level and does not look at high school math teachers or specifically at Algebra I achievement (Chang, 2015; Kukla-Acevedo, 2009).

Several studies have found the individual teacher to be the most significant factor in student success, which makes hiring teachers of critical importance (Badgett et al., 2014). Currently, school leaders have limited research-based information to inform hiring decisions and give guidance for individual teacher development to impact student achievement. This study will contribute to the body of knowledge by providing information specifically about teacher factors that contribute to student achievement in Algebra I. The outcome of this research may help principals and other school leaders when faced with important decisions regarding hiring teachers and assigning teachers to specific content areas within the mathematics discipline. Additionally, specific characteristics, such as certification type and years of experience, have been used by some school districts as exclusionary characteristics. The results of this study will either support or refute these practices within the screening process for teacher applicants. School leaders will also be able to use the results of this study to provide professional development activities in areas that have a statistically significant impact on student achievement.

### **Research Question**

The study was based on the following research question:

**RQ1:** What teacher factors are significant predictors for student performance in Algebra I?

### **Hypothesis**

**H<sub>0</sub>:** Type of teacher certification, years of teaching experience, years of experience teaching Algebra I, degree earned, and self-efficacy scores will not be significant predictors of student performance in Algebra 1.

## Definitions

1. *Alternative Certification* - Approved certification programs in Texas where the internship or student teaching experience is embedded in the first year of teaching. Candidates are monitored by a program mentor and receive feedback. Standard certification is granted after completion of certification exams and a successful first year of teaching (TEA-Alternative Programs, 2016).

2. *Major Suburban School District* –

A district is classified as major suburban if: (a) it does not meet the criteria for classification as major urban; (b) it is contiguous to a major urban district; and (c) its enrollment is at least 3 percent that of the largest contiguous major urban district or at least 4,500 students. A district also is classified as major suburban if: (a) it does not meet the criteria for classification as major urban; (b) it is not contiguous to a major urban district; (c) it is located in the same county as a major urban district; and (d) its enrollment is at least 15 percent that of the largest major urban district in the county or at least 4,500 students. (TEA, 2016c, p. 1).

2. *STAAR EOC Exams* –

The State of Texas Assessments of Academic Readiness or STAAR, is the state testing program that was implemented in the 2011-2012 school year. The Texas Education Agency (TEA), in collaboration with the Texas Higher Education Coordinating Board (THECB) and Texas educators, developed the STAAR program in response to requirements set forth by the 80<sup>th</sup> and 81<sup>st</sup> Texas legislatures. STAAR is an assessment program designed to measure the extent to which students have learned and are able to

apply the knowledge and skills defined in the state-mandated curriculum standards, the Texas Essential Knowledge and Skills (TEKS) (TEA, 2016d, p. 1).

3. *Standard Certification* - Also called traditional certification. A multi-step program based within the university setting where aspiring teachers complete a bachelor's degree and a certification program. The certification program entails additional coursework, classroom observations, and a student teaching experience. State certification tests are still required (TEA, 2016b, p 1).
4. *Social Cognitive Theory* - Developed primarily by Albert Bandura (1977), social cognitive theory asserts that "learning occurs in a social context, and that much of what is learned is gained through observation" (Anderman & Anderman, 2009, p. 834). Self-efficacy is a major component of social cognitive theory.
5. *Teacher Self-Efficacy* - "A teacher's efficacy belief is a judgement of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Tschannen-Moran & Hoy, 2001, p. 783).
6. *TEXES Tests*- Teacher certification exams for aspiring teachers in Texas. A certified teacher in Texas must pass both the Pedagogy and Professional Responsibilities (PPR) exam and a subject-specific exam. Exams are a criterion-referenced exams (SBEC, 2016).

## CHAPTER TWO: LITERATURE REVIEW

### Introduction

In May of each school year in Texas, all 9th grade students enrolled in Algebra I take the Algebra I End of Course (EOC) Exam. Algebra I is one of five EOC exams required to meet graduation requirements under all graduation plans in Texas (TEA- Graduation Requirements, 2016). In addition, Algebra I is a foundational math class that is a pre-requisite for other math courses required to meet graduation requirements. Chapter 74 of the Texas Administrative Code (TAC) restricts enrollment in courses when the prerequisite requirements have not been fulfilled (TAC- 19, 2012a). Concurrent enrollment in Algebra I and advanced courses such as Geometry and Algebra 2 is not allowed under the current Chapter 74 requirements. As a result, Algebra I has become an area of focus across the state of Texas. School district leaders devote financial, personnel, and academic resources to ensure student success in Algebra I because of its importance to maintain graduation rates and four-year completion rates (Welton & Williams, 2015).

Many studies have shown that the teacher has a significant impact on student learning and student success (Goddard et al., 2000; Smith & Gorard, 2007; Goldhaber & Anthony, 2007). Self-efficacy has been studied numerous times across different subject areas; however, there are additional teacher factors that studies show could contribute to student success in Algebra I. Self-efficacy is defined as “beliefs in one’s own capabilities to organize and execute a course of action required to produce a given attainment” (Bandura, 1997, p. 3); yet, math teaching efficacy has also been studied as a contributor to student success (Bates et al., 2011). This study also examines certification type, content knowledge as reported by college degree earned, and years of experience teaching as variables that impact student success in Algebra I. Although there is

research surrounding these stated variables, there is limited information about these variables specifically related to Algebra I or if one or more of the variables are predictors of student success in Algebra I. This study seeks to examine several variables to determine what impact, if any, each variable has on student success in Algebra I; therefore, the research literature surrounding each variable contributes to the overall body of knowledge regarding the topic.

### **Theoretical and Conceptual Framework**

This study is grounded in both Bandura's social cognitive theory and a conceptual framework established by U.S. Department of Education's Institute for Education Sciences: The National Center for Educational Evaluation and Regional Assistance. Both of these frameworks work in conjunction with each other to provide the complete theoretical and conceptual frameworks that guide the focus of this study.

#### **Bandura's Social Cognitive Theory**

Bandura's social cognitive theory centers around an individual's ability to demonstrate control over aspects of his or her own life and the outcomes he or she experiences. A primary focus of Bandura's theory is that of self-efficacy, or "beliefs in one's capabilities to organize and execute a course of action required to produce a given attainment" (Bandura, 1997, p. 3). Bandura's theory was first proposed in 1963 as a way to explain how people learn. The two main sources of learning at the time of the theory development were observations of others and direct experience (Bandura, 1997). However, as Bandura developed the theory over time it grew to include factors such as "reciprocal determinism, modeling, self-efficacy, and self-regulation" (Cochran, 2007, p. 735). Bandura also emphasizes the role of personal agency within social cognitive theory. According to Bandura (2001), "To be an agent is to intentionally make things

happen by one's own actions...The core features of agency enable people to play a part in their self-development, adaptation, and self-renewal with changing times" (p. 1).

Bandura's social cognitive theory has five core concepts that comprise the overall theoretical framework: observational learning, outcome expectations, self-efficacy, goal setting, and self-regulation (Anderman & Anderman, 2009). Each of these concepts plays a critical role in the application of the theory to different areas of human life including teaching and learning, social behavior, organizational behaviors, and community development. The first central concept of social cognitive theory is observational learning, which includes both watching others perform specific behaviors and observing the consequences or outcomes of these behaviors in a real-world environment. According to Anderman and Anderman (2009), "Observational learning of novel behaviors or skills is dependent on four inter-related processes including attention, retention, production and motivation" (p. 835). Observational learning can be likened to the experiences a preservice teacher has in the teacher preparation programs offered by universities or non-university based alternative certification programs. These preservice learning opportunities have the potential to contribute to the overall preparedness of a teacher entering the profession by providing observational learning opportunities in an authentic environment.

The second central concept of social cognitive theory is outcome expectations. Outcome expectations are the beliefs that a person has about the likely outcome, consequence, or response if a specific behavior is performed (Bandura, 1994). According to Millen and Bray (2009), "For instance, if an individual does not know or understand the potential positive outcomes of resistance training, he/she may be less inclined to engage in that behavior although he/she may feel capable of performing the training behaviors" (p. 316). Social cognitive theory asserts that when more positive outcomes are expected from certain behaviors, the frequency of the behavior

will increase, and when negative outcomes are expected from a certain behavior, the behavior will be avoided (Anderman & Anderman, 2009).

The third core concept in social cognitive theory is self-efficacy. According to Bandura (1994), “Self-efficacy is defined as people’s beliefs about their capability to produce designated levels of performance that exercise influence over events that affect their lives” (p. 71). The concept of self-efficacy is directly related to teaching effectiveness and the ability for a teacher to bring students to the desired outcomes at the end of an academic measure of time, such as an academic year or course. Bandura’s theory about efficacy has also expanded to differentiate between self-efficacy and teaching-efficacy. Bandura described teacher efficacy as “the outcome of a cognitive process in which people construct beliefs about their capacity to perform at a given level of competence” (Goddard et al., 2000, p. 481). Researchers Tschannen-Moran and Hoy (2001) expanded upon Bandura’s distinctions between self-efficacy and teaching-efficacy. The researchers proposed that a teacher’s beliefs about their own personal abilities to impact outcomes in student learning directly impact the effort put into planning, teaching, goal setting, and academic aspirations (Tschannen-Moran & Hoy, 2001).

The fourth core concept in social cognitive theory is goal-setting. Goal-setting exemplifies the visualization of perceived outcomes of certain behaviors and patterns of behavior. According to Anderman and Anderman (2009), “Goals exemplify the agency within Social Cognitive Theory that people not only learn, they use forethought to envision the future, identify desired outcomes, and generate plans of action” (p. 836). Further, social cognitive theory posits that goal-setting is a pre-requisite for self-regulation, the final core concept of the theory. Anderman and Anderman (2009) explain, “they [goals] provide objectives that students are trying to achieve and benchmarks against which to judge progress” (p. 836).

The final core concept in social cognitive theory is self-regulation. Self-regulation is comprised of three sub-processes that include self-observation, self-judgment, and self-reaction (Anderman & Anderman, 2009). The sum of these processes is the systematic way in which a person monitors their own decisions and behaviors, evaluates the results, and responds by either continuing, modifying, or avoiding the initial behavior. Bandura (1991) explains, “Self-regulation operates through a set of psychological sub-functions...neither intention nor desire alone has much effect if people lack the capability for exercising influence over their own motivation and behavior” (p. 249).

Examining the characteristics of teachers and the impact on student learning through the lens of social cognitive theory allows the researcher to view each variable as either a choice made by the teacher or as an environmental influence. Social learning theory asserts that human learning and development occurs based on the interactions of choices and behaviors, environmental influences, and personal factors (Bandura, 1991). Additionally, Bandura (1977) explains that most learning is acquired through observation of modeling and experiences. This contributes to the growth and development of teachers and the impact each teacher has on individual student achievement.

Both Bandura’s social cognitive theory and the work of Tschannen-Moran and Hoy evolved from Rotter’s (1966) locus of control social learning theory. Although self-efficacy and internal locus of control are sometimes perceived to be the same concept, they are two different concepts. The relationship, or lack thereof, is explained by the statement, “One may believe that a particular outcome is internally controllable [locus of control]...but still have little confidence that he or she can accomplish the desired actions [self-efficacy]” (Goddard et al., 2000, p. 481).

Bandura's self-efficacy beliefs center around the internal controls a person has to influence or affect external outcomes and successfully complete a task or accomplish a goal.

### **Conceptual Framework**

In 2008, the U.S. Department of Education published a final report with the results of a study examining teacher certification types and the impact on student learning (Constantine et al., 2009). Although the focus of the study was relatively narrow and centered primarily on one variable in the proposed study for this paper (certification type: traditional versus alternative), data collected for the purposes of the study support the theoretical and conceptual framework of the present study. Data collected by the Institute of Education Sciences include student achievement, teacher practices, teacher characteristics, and teacher certification program experiences (Constantine et al., 2009). This study's framework highlights the potential link between teacher characteristics and student achievement. Although the focus of the proposed study is wider in focus than the study completed by the Institute of Educational Sciences on behalf of the U.S. Department of Education, it still seeks to study the same potential link between teacher characteristics and student learning outcomes. The study conducted by Constantine et al. (2009) utilized a conceptual framework created by the U.S. Department of Education that evaluates the effectiveness of a teacher through the following four categories: "teacher education and work experience, professional development and support, classroom practices and social content, and effects on student performance and achievement" (p. 3). The proposed study also seeks to identify if there is a statistically significant link between specific teacher characteristics and the achievement levels of the students he or she teaches.

## **Related Literature**

There are numerous studies that examine self-efficacy in teachers and the impact on student achievement; however, the variables in this study have not been studied in a synthesized format. Many of the factors in the study have been examined in isolation or with a slightly different focus. The related research literature was examined in a way that sought to identify trends and connections between the independent variables.

### **Teacher Quality and Student Learning**

The link between the teacher and a student's educational success has been studied at length over the last several decades. It has been well-established in research that teacher quality has a direct impact on student success (Jimerson & Haddock, 2015; Smith, 2008; Terhart, 2011). Wayne and Youngs (2003) claim there is a substantial connection between student achievement and the teacher responsible for the student's instruction. Other studies assert that teacher quality is the single most important factor in predicting student achievement (Bear & Jones, 2017; Gordon, Kane & Staiger, 2006). As cited by Rice (2010), "Sanders and Rivers estimated that 'students of the most effective teachers (the highest quintile) have learning gains four times greater than students of the least effective teachers (lowest quintile)—but cumulative over time'" (p. 178).

Although the link between the individual teacher and student success is well-documented, there is limited research on which specific factors are the most important in determining teacher quality and predicting potential impact on student learning (Badgett et al., 2014). However, despite the overwhelming amount of research emphasizing the importance of teacher quality, underqualified and ineffective teachers still plague school systems across the United States.

President George W. Bush's No Child Left Behind (NCLB) Act strongly emphasized the need for high quality teachers in all schools, but particularly in schools with high-need students (U.S. Department of Education, 2001). High-need students are typically defined as those living in poverty, students of parents with low levels of educational attainment, and students with high mobility rates (Anderson & Stillman, 2010). As a result of the 2001 NCLB Act, school districts across the nation have focused on improving both teacher quality and professional capacity within schools. The Every Student Succeeds Act (ESSA) replaced NCLB legislation and is currently in the early stages of implementation. ESSA continues to emphasize the need for highly qualified teachers by mandating that each state submit plans for the professional development, retention, and advancement of high quality educators in the state (Anonymous, 2016). One significant difference between NCLB and ESSA legislation is returning the responsibility of ensuring the quality and credentials of teachers back to the states. The TEA released its 2017-2021 Strategic Plan in June 2016. There are four main goals included in the strategic plan, the first of which is "Recruiting, Supporting, and Retaining Teachers and Principals" (TEA, 2016a). It is evident through the goals of NCLB, ESSA, and the TEA strategic plan that teacher quality continues to be a critical focus in the mission of increasing student achievement.

Many research articles cite the work of William Sander and his decade-long study of teacher quality and the impact on student learning. According to Sander (2008), "Good teachers can have a relatively large effect on achievement" (p. 308). Although the impact that high quality teachers have on student learning is widely accepted, the specific factors that make a teacher of high quality have been debated and heavily researched.

Darling-Hammond and Berry (2006) addressed the issue of labeling teachers as highly qualified when they had only begun their professional certification programs. Under NCLB standards, school districts are able to label a teacher as highly qualified who is not yet certified to teach, but is enrolled in a professional preparation program, which creates an unclear picture of which teachers really are or are not highly qualified to teach students (Darling-Hammond & Berry, 2006). The need for legitimately highly qualified teachers is diluted by using semantics to grant qualifications to nearly every teacher and justify hiring practices.

Lasley, Seidentop, and Yinger (2006) took a deeper look at teacher quality and examined the teacher behaviors within a classroom that indicate high quality teachers in an effort to develop the professional capacity of less successful classroom teachers. Instructional characteristics of high quality teachers include “differentiation and complexity of instructional strategies, questioning practices, and level of disruptive student behavior” (Stronge, Ward, Tucker, & Hindman, 2007, p. 179). Developing these three practices in less successful teachers could increase student learning. Donaldson (2013) examined teachers as “human capital” and studied the recruitment, hiring, and development practices of principals to determine the best strategies for identifying, training, and retaining the most effective teachers (p. 840). The study did not identify specific practices that would benefit all schools regardless of student population, but instead focused on initiatives at the state-level to develop incentives for teachers working in high-need schools and to give principals greater autonomy in the evaluation and dismissal process (Donaldson, 2013).

Harris and Sass (2011) studied the links between teacher training, teacher quality and student achievement. The study focused primarily on years of experience and effects of professional development on student achievement and did not provide conclusive results that

could be applied across different educational levels. Middle school math was the only area that had a statistically significant result connecting experience as a teacher and professional development opportunities to higher levels of student achievement (Harris & Sass, 2011).

The issue of attracting and retaining high quality teachers, especially in high-need, high-poverty schools, is related to teacher quality and its connection to student achievement. High quality teachers are often recruited away from high-need schools by districts with a higher level of student socioeconomic status or higher teacher pay (Petty, Fitchett, O’Conner, 2012). The rate of teacher turnover puts a strain on the recruiting, training, and professional development demands of an already at-risk school. There is a statistically significant relationship between teacher effectiveness and the recruitment, assignment, development, and retention practices put in place by campus administration (Loeb et al., 2012). The challenge to recruit and retain high quality teachers requires school leadership to carefully screen applicants to ensure the highest quality teachers are selected for positions and best practices are in place for retention. It is argued that a principal often lacks the authority to make necessary hiring decisions that benefit his or her specific campus due to centralized mandates imposed by district- or county-level administration (Donaldson, 2013). To make the task of recruiting and hiring effective teachers more challenging, there is a difference between the public perception of teachers and teachers’ beliefs about the public perception of teachers. According to Everton, Turner, Hargreaves, and Pell (2007), the public perception of teachers is overwhelmingly positive, yet “despite this generally positive view, teachers themselves are often pessimistic about the ‘public opinion of teaching’” (p. 249). Teachers report feeling undervalued, unappreciated, and suffer from a lack of necessary time and resources to satisfactorily perform the job (Everton et al., 2007).

Rice (2010) examined the factors that influenced the decisions of where to teach of both highly effective teachers and teachers with lower levels of effectiveness. Highly effective teachers cited the following factors in their decisions of where to teach: “The desire to teach a particular subject, teach at a given level, extend their skills or work in a particular school culture” (Rice, 2010, p. 188). Contrastingly, teachers of lower levels of effectiveness cited the following reasons: “Needing a job, wanting to teach close to home, and having a contract expire” (Rice, 2010, p. 188). The factors that drive a teacher’s career moves can be telling regarding their overall quality as a teacher and potential to impact student achievement.

Kennedy (2010) proposes that there is a difference between teacher quality and teaching quality, and attribution error might be a cause behind the lack of definitive research results about the qualities that define a successful teacher. According to Kennedy (2010), “We examine teaching quality by looking at personal characteristics- credentials, licensure test scores, skills, personal values- and overlook resources out of their control” (p. 591). The study strongly suggested that the overemphasis of personal characteristics of teachers, as opposed to teaching methods and skill, contributes to the lack of knowledge regarding effective teachers. Further, the differences in student characteristics, such as poverty levels and mobility rates, are likely to confound the estimated effects of teacher quality and the impact on student success (McCaffrey et al., 2003).

Research proving the importance of high quality, highly effective teachers is abundant. What is less clear are the qualities and characteristics that identify a teacher as being of high quality. As school officials are tasked with the recruitment, development, and retention of high quality teachers, the research is not as definitive on specifically what characteristics are of utmost importance and will have the most impact on student success.

## **Teacher Certification in Texas**

All states within the United States have requirements for potential teachers. Texas uses the certification process, while other states may call a similar process licensure. There are two primary types of teacher certification programs in Texas: standard (also called university-based) and alternative. All approved teacher certification programs in Texas must meet the requirements established by the State Board for Education Certification (SBEC, 2016) which include the following nine components: Governance; Admission Criteria; Curriculum based on TEA standards; Coursework, Training, Program Delivery, and Ongoing Support; Assessment and Evaluation of Candidates and Program; Professional Conduct; Complaints; Certification Procedures; and Integrity of Data Submission (TAC, 2012b). The culmination of both types of programs are the Texas Examinations of Educator Standards (TExES) certification exams. A teaching candidate in Texas must pass both a content area exam and a Pedagogy and Professional Responsibilities (PPR) exam before earning a certification. Content area exams are both subject and grade-range specific within the state of Texas. Although standards exist for all certification programs, there is mixed research if these requirements actually ensure a candidate is prepared to enter the teaching profession upon certification or licensure (Goldhaber & Brewer, 2000).

### **Standard Certification**

Standard certification programs, also called university-based certification programs, are programs that are traditionally administered in the university setting as part of an undergraduate degree. University-based teacher certification programs traditionally include courses that deliver pedagogy-related curriculum, field-based observations, and a student teaching practicum (Linek et al., 2012). Some proponents of the traditional certification program model assert that the

university-based program is more rigorous and in-depth than the alternative certification options (Linek et al., 2012). A 2000 study out of Princeton University showed that the students of alternatively certified teachers significantly underperformed as compared to peers with traditionally certified teachers (Baines, 2006). However, the author of the Princeton University study from 2000 and others in the same time frame attributed some of the difference in results to rapid rate of growth and lack of accountability within alternative certification programs at the time. Additionally, some comparison groups were not between traditional and alternative groups, but instead between traditional and non-traditional, which could result in the inclusion of teachers with no standard training being included in the non-traditional group results (Nougaret, Scruggs & Mastropieri, 2005). For example, Nougaret et al. (2005) state, “It was seen that first year teachers who had participated in a traditional education program greatly outperformed first year teachers with emergency provisional licensure” (p. 225). However, the practice of emergency provisional licensure was halted after NCLB legislation was passed in January 2002. Emergency provisional licensure would allow an individual to be hired as a teacher before completing any licensure requirements and would instead give time expectations meeting on licensure requirements, usually within a year time frame (Sharkey & Goldhaber, 2008).

The strongest research supporting the superiority of university-based or standard teacher certification lies within the strength of the preservice training teacher candidates receive. Kosnik and Beck (2009) assert that the seven critical components of preservice training include “program planning, pupil assessment, classroom organization and community, inclusive education, subject content and pedagogy, professional identity, and a vision for teaching” (p. 8). The argument in favor of the traditional delivery of preservice instruction through university-based courses stems from the ability to deliver a more consistent, rigorous, and lengthy

preparation curriculum as compared to an abbreviated or accelerated alternative program (Lit, Nager, & Snyder, 2010; Preston, 2017).

One aspect of the preservice teacher training provided in university-based teacher certification is the student teaching practicum. Ajayi's 2017 study examines the quality of student teaching practicum experiences related to preparedness to address the social justice needs of an educational community, specifically in rural border towns. The study asserts that most student teaching experiences focus on mainstream knowledge such as content-area knowledge and instructional best practices; however, these programs fail to differentiate the experiences based on the community in which the student teacher is placed (Ajayi, 2017). The study examines the inclusion of social justice education in the preparation program and experiences for student teachers. According to Ajayi (2017), social justice teaching practices include culturally relevant lessons that "teach sociopolitical analysis, encourage individuals to fight for resources for equity, and where lessons facilitate critical thinking and support for social transformation" (p. 55). Ultimately, Ajayi seeks to shed light on the fact that not all preservice teacher education programs provide an adequate and appropriate base of knowledge. In order to provide the most benefit and training to prospective teachers, a teacher preparation program and the student teaching experience should be tailored to meet the needs of the specific community and students a teacher serves. Goldhaber, Krieg, and Theobald (2017) support the general assertions of Ajayi (2017) in a study that examines the impact of student teaching experiences on teacher effectiveness. The study states, "Teachers appear to be more effective when the student demographics of their school are similar to the student demographics of the school in which they did their student teaching" (Goldhaber et al., 2017, p. 351).

Studies supporting standard certification programs for teachers also cite the rate of attrition for standard versus alternatively certified teachers. Linek et al. (2012) cite the five year retention rate for teachers from traditional preparation programs as 76%, whereas the retention rate for alternative certification is only 68% (p. 70). Researchers assert that the cause for this difference in retention could potentially be that alternatively certified teachers are not adequately prepared to meet the challenges required of new teachers, and the mentoring and support provided by the school administration is not enough to bridge the gap (Chappelle & Eubanks, 2001). However, Sharkey and Goldhaber (2008) are quick to point out that traditional licensure is not a guarantee of teacher readiness to successfully lead a classroom.

### **Alternative Certification**

Texas allows non-university based programs to apply for approval to prepare prospective teachers to pass the certification exams and meet the requirements for standard certification. There are 20 different educational regions within the state of Texas and each region maintains a list of its approved teacher preparation programs. According to the TEA website (2017), there are over 150 approved teacher educator programs in Texas and over one third of the programs are not affiliated with a university or college.

Historically, alternatively certified teachers have not been viewed in the highest regard. Alternative certifications were created to meet the needs created by a teacher shortage, not necessarily to match the rigor and complexity of a traditional, university-based program. Baines et al. (2001) cite differences in alternative certification programs such as qualifications for admission, hours required in training, and screening processes to determine suitability to teach that present alternative programs as an inferior avenue to certification when compared to the traditional path. Alternative certification programs have been described as requiring the

minimum, not adequately preparing teachers, and taking advantage of a teacher shortage to make a profit (Cohen-Vogel & Smith, 2007; Darling-Hammond, 2010; Koehler, Feldhaus, Fernandez & Hundley, 2013).

It is also argued that alternative certification programs take advantage of lax preparation standards in times of teacher shortage to meet an immediate need, but provide no indication of a teacher's true readiness or quality upon entry (Baines et al., 2001). According to Baines et al. (2001), the greatest challenges for novice teachers were found to be "classroom management, student motivation, dealing with individual differences, assessment, and getting along with parents," all of which are difficult to extensively address in an alternative certification program (p. 36).

However, the research is complex regarding alternative certification programs. Alternative certification programs are not as time intensive as traditional university programs related to hours in the classroom, hours of observation, and practice before being certified as a full time teacher. However, the research is not definitive on whether or not alternative certification programs are actually less effective at preparing teachers than traditional certification programs (Baines, 2006; Goldhaber & Brewer, 2000; Brown, Vaughn, & Smith, 2004; Koehler et al., 2013). Studies discussed outside factors that may contribute to the success or failure of candidates in teacher preparation programs. For example, differences in industry experience, graduate degrees, age, and perceived preparedness were found to be more significant factors in predicting a teacher's quality than the type of certification program he or she participated in (Koehler et al., 2013).

Additionally, several studies focused on the difference in the type of candidate the different programs attract and how this can impact perceived success or failure of the program.

For example, university-based certification programs are more likely to include the traditional college student, meaning a student who is 18 to 22 years old, enrolled in school full-time, and who has not had another full-time career prior to beginning a teacher preparation program (Brown, 2012). Alternative certification programs are more likely to appeal to non-traditional students. According to Brown (2012), “A student is categorized as non-traditional based on factors such as: age; racial/ethnic background; a lack of access to a baccalaureate degree; or his/her time away from the academic setting” (p. 191).

Since the passing of NCLB legislation in early 2001, states have developed more stringent requirements of alternative certification programs to attempt to provide a more uniform preparation process for prospective teachers. Currently, there are studies that show that alternative certification routes can be an avenue to teacher improvement educational reform (Cohen-Vogel & Hunt, 2007).

Supporters of alternative certification avenues assert that the “what works” movement has created resources for new teachers such as the What Works Clearinghouse and other high yield practices that are being taught in alternative programs whereas university-based programs have not adjusted curriculum and programming to meet the current needs of students and teachers (Cohen-Vogel, Tichnor-Wagner, Allen, Harrison, Kainz, Socol, & Wang, 2015; Dynarski, 2008; Means & Penuel, 2005). There is a legitimate argument that alternative programs are able to quickly implement new research, practices, and ideas to prepare teachers to meet the burgeoning needs of the current students in schools.

### **Teaching Experience**

The impact of teaching experience on student success is a teacher factor that has been studied in two primary ways: years of experience and quality of experiences by a teacher.

Research literature examining years of experience simply looks at the impact of a teacher's years of experience on the student outcomes. Research literature that examines quality of experiences analyzes a variety of factors including student teaching experiences, social justice education, and the types of environments in which a teacher has gained experiences. The years of teaching experience is not always included in this area of literature regarding experiences.

While it is sometimes argued that more years of experience as a teacher will lead to higher levels of student success, the research is not conclusive and has shown mixed results. Teaching experience has often been studied in relation to self-efficacy, which will be discussed in a later portion of this chapter. Studies have shown that teachers generally have very high self-efficacy beliefs prior to entering the profession, but efficacy drops dramatically for the first three years as teachers struggle to balance the demands of the job and have student success in learning (Atta, Ahmad, Ahmed, & Ali, 2012; Huang & Moon, 2009). Studies have also shown that year five of teaching is when teachers generally begin to produce more consistent rates of higher student success, but it is not always the case (Warren & Hale, 2016).

Goldhaber and Brewer (1997) reported a correlation between graduate degrees held by a teacher and 10th grade student achievement; however, that was weakened by a follow up study that focused on 12th graders. Goldhaber and Anthony (2007) report only a weak correlation between years of teaching experience and levels of student success and that teaching experience is only "suggestive" of potential for student success (p. 136). These findings are confirmed by Çakır and Bichelmeyer's (2013) study that did not find any significance in the relationship between professional characteristics of teachers (years of experience and degree earned) and student achievement.

Teaching experience is linked to other factors that can influence student success such as professional confidence, classroom management, and ability to handle unexpected change in the classroom (Ünal & Ünal, 2012). As teachers gain more years of experience, they feel more prepared to address barriers to student learning such as classroom management, behavior issues, and changes to the curriculum. Although not directly linked to student achievement scores, a teacher's confidence in his or her ability to effectively manage these variables can contribute to the overall success or failure of their students. However, in later stages of a teaching career, self-efficacy and student achievement have an inverse relationship with years of teaching experience. It is believed that as a teacher reaches the latter stages of his or her career, there is more of a struggle to relate to the needs of the current student body and stay current on instructional strategies and curriculum expectations (Klassen & Chiu, 2010).

Additionally, studies have shown that not all teaching experience is equal when used as a potential indicator to predict student success (Warren & Hale, 2016). Huang and Moon (2009) found that teaching experience within a specific subject area led to greater levels of student success within that content area. For example, although teachers gain general professional skills over time, such as classroom management and instructional strategies, an experienced teacher moving from fourth grade math to seventh grade math may not fully feel prepared to meet the challenges of the new content when compared to the level of confidence felt from years of experience within the same subject area. Extensive experience and success in one content area does not guarantee success in a different content area or grade level (Warren & Hale, 2016).

Research literature that examines the impact of quality teacher experiences on student achievement often look at the different environments in which teachers or prospective teachers gain experience. A 2017 study by Borgerding and Caniglia examines the experiences of

preservice experiences of math and science teachers in a Masters of Arts in Teaching program, and the experiences in the study participants' first two years of teaching. The study reflects the importance of gaining experience in high-needs environments prior to obtaining a teaching position in a high-needs environment. According to Borgerding and Caniglia (2017), "Scholars without high-needs teaching experiences had many concerns based on their own experiences, and even their service learning experiences, and these sometimes reflected deficit perspectives" (p. 69). Further, the study reveals that scholars with extensive experiences in high-needs environments expressed much more confidence in their abilities regarding classroom management, behavior intervention, and instructional capabilities than their counterparts without high-needs experience (Borgerding & Caniglia, 2017). The study's discussion section underscores the importance of gaining experience in a variety of environments prior to entering the teaching profession as an independent teacher.

The research literature is divided into two clearly distinct areas regarding the impact of experience on student success: years of teaching experience and the quality, or variety, of experience gained. Although teaching experience has been studied extensively regarding a connection to teacher self-efficacy, there are limited studies that examine experience in isolation of efficacy beliefs, or in connection specifically to Algebra I, as this study proposed.

### **Degree Earned**

All certified teachers in Texas must have a bachelor's degree prior to applying for state certification. However, the research is mixed when evaluating whether or not the type of degree earned has an impact on student success. The research is even more lacking when examining Algebra I specifically. The requirements to be certified in high school math in Texas do not include earning a college degree in mathematics. According to SBEC (2017), after a teacher's

first year as a fully certified educator, he or she is eligible to take any content area test he or she chooses. Although it is stated that prospective teachers typically test in an area of major or minor study, this is not a requirement. School districts can impose stricter requirements for new teachers; however, a teacher with a standard certification in high school English can elect to take the composite mathematics exam and be certified to teach high school math.

There is limited research on the effect, if any, of the type of degree, major, or minor a teacher earned in college and student success rates. Dee and Cahodes (2008) found a relationship between math and science teachers who were teaching out of their field of study and a negative impact on student success. Wayne and Youngs' (2003) study examining the connection between student achievement and the teacher found a weak connection between math teachers and degree earned and the impact on student achievement. The research surrounding undergraduate degrees is limited and has not been replicated to confirm results; however, research exists that studies the effects of teachers with master's degrees in a given content area.

Copur-Gencturk, Hug & Lubienski (2014) discuss the instructional implications of lab science teachers with master's degrees and found higher levels of student engagement, higher rates of use of research-based instructional practices, yet a dip in the teacher's ability to connect current learning to practical non-scholastic student experiences. Conway, Eros, and Stanley (2009) found that there is a lack of research that documents the assertion that "graduate work is a powerful professional development experience" as propagated by school districts and rewarded with incentive pay (p. 129). A study by Badgett et al. (2014) found no statistically significant difference between reading teachers with master's degrees and those without in relation to eighth grade reading levels. However, the study posed the point that although graduate degrees may not have a statistically significant impact on student reading levels, teachers with graduate degrees

contribute to the overall goal of building a strong professional learning community focused on growth and development within schools (Badgett et al., 2014).

Bursal and Paznokas (2006) examined the math anxiety of preservice teachers and their confidence levels and found that content knowledge affects anxiety, efficacy beliefs, and classroom teaching strategies. The study did not seek data regarding the degree earned by the teachers; therefore, it is not possible to link degree earned with content knowledge in the context of this study to determine if teachers with math degrees had lower levels of math anxiety, thus higher self-efficacy beliefs (Bursal & Paznokas, 2006). Ball et al. (2008) further expand upon the concept that low content knowledge correlates with low efficacy beliefs, but also added the finding that content knowledge is completely different than instructional needs. The researchers found that a successful teacher must have a combination of strong content knowledge and the ability to implement instructional strategies to effectively teach the content (Ball et al., 2008).

This study seeks to address the gap in the literature regarding Algebra I teachers and the type of degree held in relation to student success. Considering there are no current studies that look specifically at the type of bachelor's degree held by math teachers and the impact on student achievement, this study will contribute to the overall body of knowledge that can inform the recruitment, training, and retention of quality teachers in Texas.

### **Efficacy Beliefs**

The concept of self-efficacy was developed out of Bandura's (1977) social cognitive theory. Bandura (1977) asserted that a teacher's belief in his or her personal ability to impact student learning outcomes has a direct link to their persistence through difficult teaching activities and their effort applied to teaching. It is important to note the difference between efficacy beliefs and the concepts in Rotter's locus of control theory. Although Bandura's beliefs

about self-efficacy were born out of Rotter's locus of control, there are some marked differences. Rotter's locus of control theory focuses on a person's beliefs on who or what has control over outcomes: self (internal), powerful others (external), or chance (Roddenberry & Renk, 2010). Those with an internal locus of control believe that the individual, or self, is responsible for the outcomes experienced. According to McGee and McGee (2016), "Locus of control is correlated with earnings, educational attainment, and unemployed job search" (p. 89).

### **Self-Efficacy Beliefs**

Self-efficacy, as defined by Bandura (1997), is "the beliefs in one's capabilities to organize and execute a course of action required to produce a given attainment" (p. 3). The difference between locus of control and self-efficacy lies in the individual's beliefs about individual ability to change outcomes. Roddenberry and Renk (2010) explain using personal health as the topic: "For example, although individuals may have high internal health-related locus of control and feel in control, they may not feel efficacious in performing a specific treatment regimen that is essential to maintaining their own health" (p. 355). Further, Fives and Buehl (2012) explain that efficacy beliefs are either explicit or implicit, meaning that some efficacy beliefs are directly communicated and some are unintentionally communicated to students. It is possible that teachers unintentionally communicate a message of negative efficacy beliefs to students, which has the potential to impact student performance and/or relationship between the student and the teacher.

The research surrounding efficacy beliefs in teachers is expansive and generally consistent with higher self-efficacy beliefs having a correlation with positive educational outcomes (Beswick, 2011; Goddard et al., 2000; Tschannen-Moran & Hoy, 2001). Sehgal, Nambudiri, and Mishra (2017) found that "teacher self-efficacy was positively associated with

the two aspects of teacher effectiveness, namely, teacher's role in facilitating teacher/student interactions and teacher's role in regulating student learning" (p. 509). The study supported Bandura's self-efficacy beliefs that higher levels of self-efficacy correlated to increased motivation, effort, and persistence toward a goal.

High self-efficacy beliefs in teachers have been linked to student success that reaches far beyond the classroom. According to Blazar and Kraft (2016/2017), "Teachers can and do help develop attitudes and behaviors among their students that are important for success in life" (p. 161). Teachers who are effective at raising test scores are effective at teaching life skills and attitudes required for future success as well. Studies have shown that self-efficacy beliefs in teachers impact nearly every aspect of a teacher's job functions. Teachers with higher self-efficacy beliefs have better student outcomes, such as test scores and student achievement (Guskey, 1984; Webb & Ashton, 1986). Webb and Ashton's (1986) study explored, at length, the link between teacher dissatisfaction, low morale, low self-efficacy beliefs, and low student achievement. The teachers in the study felt ineffective at impacting student learning which led to a reduction in effort, commitment, and willingness to stay in the profession (Webb & Ashton, 1986). Currently, many teachers report feeling overwhelmed, over-stressed, and ineffective due to High Stakes Teacher Evaluation (HSTE). Ford, Van Sickle, Clark, Fazio-Brunson, and Schween (2017) claim that "one unintended consequence of high stakes teacher evaluation is overall decline in teacher professional commitment and satisfaction due to the pressure to perform" (p. 205). The study posits that school leaders can remedy this negative consequence of HSTE by valuing teacher efficacy and utilizing professional development practices that increase teacher efficacy beliefs (Ford et al., 2017).

Guskey's (1984) study focused on the characteristics of highly effective teachers. The study found that teachers with high self-efficacy beliefs were more likely to adopt innovative instructional practices and enjoy higher rates of student achievement (Guskey, 1984).

Tschannen-Moran, Hoy, and Hoy (1998) have significant contributions to the field on the topic of self-efficacy in teachers and the impact on student achievement. The researchers established a strong connection between teacher efficacy and student achievement and sought to identify professional development practices to help develop efficacy, thus affecting student achievement (Tschannen-Moran et al., 1998). A 2003 study found that providing mastery activities for preservice and student teachers helped increase teaching efficacy beliefs and had positive impacts on student learning (Cantrell, Young & Moore, 2003). More recently, Miller, Ramirez, and Murdock (2017) found that,

When students observe teachers confidence with difficult subjects such as science and mathematics, this provides them with a vicarious experience and could in turn also impact their own efficacy, and likely will impact their engagement and achievement in these courses. (p. 266)

The results of this study demonstrated that teachers with high self-efficacy beliefs project this confidence in a way that is perceived and internalized by students.

Outside of increased student achievement, teachers with higher self-efficacy beliefs were found to be more likely to persist when facing obstacles in the classroom. Teachers with lower levels of self-efficacy were found to experience more feelings of burnout and more likely to leave the teaching profession after prolonged periods of difficulty when compared to peers with higher levels of self-efficacy beliefs (Skaalvik & Skaalvik, 2007). Wolters and Daughterty (2007) found that "teachers who reported greater confidence in their ability to modify their

instruction and assessment strategies to fit student needs also tended to report using instructional practices that focus students on improvement, overcoming a challenge, and learning” (p. 190). Further, teachers with lower levels of self-efficacy were found to be less likely to seek out new methods of instructional delivery when faced with challenges such as disinterested or disengaged students (Wolters & Daugherty, 2007).

In addition to persisting when faced with challenges, teachers with higher self-efficacy beliefs were found to be more innovative in the classroom to engage students in meaningful learning (Riggs & Enoch, 1990). Additionally, teachers with higher self-efficacy belief scores were found to be more likely to consult, collaborate, and team-teach, all of which are high-yield practices shown to increase student engagement and achievement (Allinder, 1994). Participating in collaboration with other teachers to deliver engaging instructional strategies showed to have a reciprocal effect on teacher self-efficacy and continued efforts to provide meaningful, innovative instruction (Shachar & Shmuelewitz, 1997). Teachers with higher self-efficacy beliefs were found to assess students in ways that were more authentic, meaning students demonstrated proficiency by connecting knowledge to real-world skills and processes (Adeyemi, 2015). Essentially, collaboration with other teachers about the delivery of engaging instructional strategies led to higher self-efficacy beliefs which contributed to more collaboration and innovation. Building self-efficacy in teachers was found to be most effective in authentic collaborative experiences with other teachers that focused on quality instructional delivery, whereas professional development opportunities that were disconnected from the classroom were found to have minimal impact on a teacher efficacy beliefs (Smylie, 1988).

Self-efficacy beliefs have also been shown to impact self-reflection practices and stress levels in teachers. According to Vartuli (2005), “Teachers with high self-efficacy set standards

of performance for themselves, accept responsibility if the standards are not met, and respond to failure with renewed effort and persistence” (p. 77). As teachers develop higher self-efficacy beliefs, they are more likely to critically reflect on performance, areas of weakness, and to seek out development opportunities (Vartuli, 2005). Teachers with high levels of self-efficacy beliefs were found to have higher job satisfaction, lower levels of reported stress, and feel empowered to create a work environment that is productive, professional, and conducive to learning (Caprara, Barbaranelli, Steca & Malone, 2006). Teacher self-efficacy was found to be a statistically significant factor in job satisfaction when teachers felt they not only understood the academic needs of their students, but also felt empowered to make the instructional decisions to meet the needs of students (You, Kim, & Lim, 2017).

Wang, Tan, Li, Tan and Lim (2017) showed that teachers in low-achieving, high-need schools tend to have lower self-efficacy beliefs. According to Wang et al. (2017), “Mastery experiences provide the most influential source of efficacy information because they are based on individuals’ authentic experiences” (p. 140). The study suggests that teachers in low-achieving, high-need schools have fewer opportunities to have successful mastery experiences with students and build self-efficacy beliefs. According to Wang et al. (2017), “Teacher’s self-efficacy was greatly dependent on their experiences in assisting low-achieving students make academic progress and produce good exam results” (p. 147).

Teacher self-efficacy has also been linked to student perceptions of relationship quality between the student and the teacher. According to Summers, Davis, and Woolfolk-Hoy (2017), teachers with higher efficacy beliefs were more optimistic about their students and the students perceived to have a stronger relationship with the teacher. It is important to note that task-difficulty must be included in this construct. The study found that teachers had varying efficacy

beliefs regarding the impact on student achievement based on the perceived difficulty of the task at hand (Summers, Davis & Hoy, 2017).

### **Teaching Efficacy Beliefs**

Research noted a difference between teaching efficacy and self-efficacy. According to Skaalvik and Skaalvik (2007), “Teacher self-efficacy should be distinguished from [teaching efficacy], which we have defined as teachers’ general beliefs about limitations to what can be achieved through education” (p. 621). Essentially, teaching efficacy is the general belief about what can be accomplished through education that affects the outcomes of individual students. However, teacher self-efficacy refers to the individual belief a single teacher has on his or her ability to impact student outcomes in the classroom. It is possible for a teacher to have high beliefs about teaching efficacy in general, but to have low self-efficacy beliefs (Skaalvik & Skaalvik, 2007). There is limited research about prevalence of teachers with drastically differing beliefs in teaching efficacy and self-efficacy and the impact on student achievement, teacher effort in the classroom, and job satisfaction.

### **Mathematics-Specific Efficacy Beliefs**

There have been several studies that look specifically at the efficacy beliefs of mathematics teachers and the impact of efficacy beliefs on student achievement in math (Beswick, 2011; Bates et al., 2011; Chang, 2015). According to Beswick (2011), “There is broad acceptance that mathematics teachers’ beliefs about the nature of mathematics influence the ways in which they teach the subject” (p. 127). Based on this assumption, the beliefs of math teachers have been examined to determine the impact, if any, on student learning and performance in math courses. Brown (2012) found a positively correlated relationship between non-traditional preservice math teachers and their self-efficacy beliefs. The researcher asserted

that the age and experience of the older preservice teachers contributed to the self-confidence and efficacy beliefs due to the problem-solving focus in math curriculum (Brown, 2012).

There are identified differences between math efficacy and math teaching efficacy and the impact of each on the educational environment (Bates et al., 2011). Math self-efficacy is one's confidence in the ability to understand and perform mathematical tasks, whereas math teaching efficacy is one's belief in successfully teaching others mathematical concepts (Bates et al., 2011). According to the above mentioned study, teachers with higher confidence in math abilities correlates to higher teaching efficacy beliefs, but not necessarily to the belief that student outcomes will be different due to the teaching (Bates et al., 2011). Essentially, content knowledge does not correlate to confidence in being able to significantly impact student learning outcomes in math. The math efficacy beliefs and math teaching efficacy beliefs of a teacher were found to have a statistically significant effect on both the achievement levels and the math efficacy beliefs of students (Chang, 2015). Thus, the study argues that the personal math efficacy and math teaching efficacy beliefs of teachers play a critical role in the math achievement of students. The development of math efficacy in teachers should be a focus for professional development and should include the following components: "mastery experiences, verbal persuasion, vicarious experiences, and psychological arousal" (Chang, 2015, p. 1318).

### **Efficacy Beliefs in Administrators**

Administrators play a key role in developing the culture of a campus and directing the efforts of teachers regarding professional development and instructional priorities. According to Flessa (2012), "A central tenet- and empirical finding- of the school leadership literature is that leadership matters for instructional improvement in schools" (p. 326). Research has supported the transition away from the "principal as school manager" style of leadership and toward the

“principal as transformative or instructional leader” style (Mehdinezhad & Mansouri, 2016, p. #). Transformational leaders are credited with specific leadership behaviors that influence teacher efficacy and student achievement such as improved trust, student engagement, and increased team collaboration and improvement (Mehdinezhad & Mansouri, 2016).

Ware and Kitsantas (2007) discuss three different types of teacher efficacy that impact student learning: “enlist administrative direction, to influence decision making, and their own classroom management” (p. 307). All three of these types of efficacy were found to be correlated with job satisfaction, turnover rates, and teacher commitment (Ware, Cheema & Kitsantas, 2013). The role of administration, specifically the principal, has been examined within the realm of teacher efficacy as well. Tschannen-Moran and Gareis (2004) studied the effects of principals with high efficacy beliefs and the impact on the campus as a whole. Low efficacy principals are unable to facilitate long-term change, implement effective strategies campus-wide or develop the capacity and self-efficacy within teachers and support staff (Tschannen-Moran and Gareis, 2004). Principals with high levels of self-efficacy are more effective in efforts to institute positive change in curriculum or instructional practices on campus to improve student achievement; however, the results also highly emphasized the impact that the school environment and economic demographics can have on a principal’s efficacy beliefs (McCullers & Bozeman, 2010).

There is also a link between principal efficacy and teacher professionalism. Kosar’s (2015) study revealed that principals with higher efficacy beliefs had levels of trust from teachers, which then correlated to more professional behavior and attitude regarding school expectations and student outcomes. Donaldson (2013) studied the approaches of principals in the efforts to develop teaching capacity, and the study found hiring practices of the principals to

be one of the critical factors to developing a teaching staff with high levels of self-efficacy (Donaldson, 2013). According to Ingle and Rutledge (2010), “Hiring is a central activity in which school leaders can build professional communities” (p. 44). The role of campus leadership in the development of teacher efficacy cannot be overlooked or undervalued.

### **Collective Efficacy**

Collective efficacy is also explored at length in the literature. According to Lyons, Thomason, and Timmons (2016), “Personal efficacy refers to an individual’s belief in their capabilities while collective efficacy refers to people’s shared belief in their collective power to achieve desired results” (p. 892). Collective efficacy differs from self-efficacy in that it is a school-level variable, not an individual-level variable (Lee, Zhang & Yin, 2011). Collective efficacy is viewed as important because it provides insight into the level of cohesion of the school environment (Ware & Kitsantas, 2007). Collective efficacy combines the individual-level teacher efficacy and principal self-efficacy to establish an understanding of the efficacy beliefs of the campus or organization as a whole. The study also showed that collective efficacy could be built or improved upon with school leaders who demonstrate a willingness to provide supportive feedback and opportunities for growth and development, as opposed to creating a punitive climate of distrust (Ware & Kitsantas, 2007). A study conducted by Lyons et al. (2016) connected higher levels of collective efficacy to improved teaching practices, more success in modification of student behavior, and higher rates of successful implementation of innovative strategies in the classroom. According to Ninković and Knežević Florić (2016), “A high level of collective efficacy leads to the commitment of teachers toward common objectives, the creation of high professional expectations, and acceptance of responsibility for their students’ academic outcomes” (p. 2).

Overall, higher efficacy beliefs in both teachers and administrators have been connected to higher levels of student achievement and greater student success. The previously mentioned types of efficacy do not operate in isolation, but have significant relationships with each other. Teacher efficacy, collective efficacy, and administrative efficacy beliefs are positively correlated and all have found to be predictors of student achievement (Ninković, & Knežević Florić, 2016). It is important to consider all types of efficacy when studying the educational environment and seeking to understand the factors that contribute to or detract from student achievement. Efficacy studies continue to be a frequently studied area of education research.

### **Importance of Algebra I Success**

The United States is facing an epidemic of college-bound students who are not mathematically prepared for the rigors of college-level math courses. According to Silva and White (2013), “60 percent of the nation’s 13 million community college students...are unprepared for college level courses and must enroll in at least one developmental course” (p. 3). This figure is on the rise when compared to the fact that according to a 2005 report from the National Center for Education Statistics, in 2004 more than 50% of students entering college were required to enroll in a developmental or remedial math course (Barnes & Slate, 2014). Additionally, although progress has been made in all demographic areas over the last decade when looking at education in general terms, the achievement gap is still the widest in the area of mathematics (Tate, 1997). African-American and Latino students enter college requiring remedial math class at an estimated rate of 80% to 90%, which is significantly higher than their white counterparts (Moses & Cobb, 2002). Moses and Cobb (2002) further assert that the impact of affirmative action practices in higher education are often negated due to high numbers of students failing to master remedial math skills, and thus, never completing a college degree.

Math competency has been found to be critically important long before students reach Algebra I. According to Cross and Woods (2009), preschool math proficiency can predict future success in math courses through high school, even when controlling for factors such as socioeconomic status, IQ, and parental education levels. A study conducted by Siegler et al. (2012) showed that high school algebra performance could be predicted using performance data from the unit on fractions in third and fifth grade math. Additionally, according to Siegler et al. (2012), “Marked individual and social-class differences in mathematical knowledge are present even in preschool and kindergarten” (p. 691). Further, Watts, Duncan, Siegler, and Davis-Kean (2014) found “preschool and first-grade mathematical ability are positive and highly significant predictors of mathematics achievement through age 15, even after adjusting for differences in other academic skills, attention, personal and family background characteristics” (p. 357). Mathematical skills are clearly important through a student’s entire educational career, with the potential for predicting outcomes based on math skills beginning as early as preschool.

Although there is argument for the development of the achievement gap occurring far before students reach Algebra I, there are several studies that look at Algebra I as a foundational math class that has the potential to both narrow or close the achievement gap and prepare students for college-level math courses (Spielhagen, 2006). Nomi (2012) labels Algebra as a gateway course to success in all upper level math and science courses. Additionally, there is research that shows that skills learned in Algebra I are comparable to those learned in other countries in the 8th grade, or around age thirteen, which nullifies the argument that Algebra I is too complicated for the adolescent brain (Loveless, 2007). Algebra is of critical importance to both high school success and post-secondary readiness due to its inclusion in nearly every advanced math and science course in high school. According to Adelman (1999), students who

successfully complete Algebra II are four times more likely to graduate from college than students who do not pass or attempt Algebra II. Additionally, the National Mathematics Advisory Panel (2008) final report states that algebra is the gateway to higher math, a college degree, and higher earnings from employment. Algebra is not simply a skill needed to complete high school; it is also a factor that can predict the future socioeconomic status of students.

The importance of Algebra I skills spurred on the birth of movements such as the “Algebra for All” initiative, which states the goal of all students demonstrating proficiency in basic algebraic skills (Eddy et al., 2015). Although the goals of the “Algebra for All” initiative are to eliminate the remedial math track for lower-level math students, studies have shown that the results were not as intended. Following the implementation of the “Algebra for All” initiative, math course failure rates increased as test scores dropped, especially in the high level where students were experiencing more heterogeneous class compositions (Nomi, 2012). More research is needed to evaluate the true impact of the “Algebra for All” movement on different student groups, specifically middle and high level math students, who are not the intended target of the math initiative (Nomi, 2012). Algebra I has become an intense focus in Texas due to the Algebra I requirement in every available graduation plan in Texas schools. Texas aims to certify all high school graduates as “college ready,” which includes a requirement of passing five STAAR EOC exams before graduation (Welton & Williams, 2015).

Although the goal of the graduation requirements is to produce college-ready graduates, research has shown that such exit exams do not have a statistically significant impact on college matriculation rates. Perna and Thomas (2009) explain that the requirements actually shift the focus of administrators, teachers and counselors away from college preparation and, instead, toward test preparation and remediation. There is a lack of definitive research that shows if the

Algebra I EOC exams actually predict college readiness for math courses or potential for success in attaining a college degree; however, there is no debate that Algebra I skills are a necessary foundation for success in future math courses, including college math.

### **Summary**

The goal of this study was to synthesize a series of variables that have proven to have some effect on student success in Algebra I and determine if there is a relationship between certain teacher factors and student achievement. While there is extensive research in the area of teacher efficacy, including self-efficacy, teaching efficacy, collective efficacy, and math efficacy, there is limited research that is specifically applied to Algebra I student success in this area. Although the current researcher expects there to still be a statistically significant relationship, the math focus may produce different results. Additionally, there is limited research that looks at the type of certification held, degree type, and experience in relation to Algebra I student success. Although many of these areas have been studied in the past, the specific focus on Algebra I is lacking. Considering the math achievement gap, the importance of Algebra I to foundational math skills, and Texas high school graduation requirements, this study will contribute to the overall body of knowledge and help inform the hiring and professional development practices of administrators and math curriculum coordinators.

### **CHAPTER THREE: METHODS**

This chapter includes important information about the design, methodology, procedures, and data analysis of the study. Specific rationale, backed by literature and past research studies, is included to give a detailed explanation of decisions made regarding the design and execution of this study. Additionally, Bandura's social cognitive theory (1991) provides direction regarding the theoretical framework of the study. Social cognitive theory supports the idea that specific teacher factors contribute to the overall success of their students, and that self-efficacy specifically plays a critical role (Bandura, 1991). This study examined factors in addition to self-efficacy to account for internal and external influences that impact a teacher's ability to positively impact student learning.

#### **Design**

This study utilized a non-experimental correlational research design. Regression analysis was used to examine the effects of independent variables on student success in Algebra I (as measured by EOC scores). Based on the review of the literature, the independent variables in this study were as follows: self-efficacy rating, certification type, years of teaching experience, years of Algebra I teaching experience, and college degree earned. There are numerous studies that cite these factors as being factors that contribute to student achievement; however, these specific factors have not been studied with a specific focus on Algebra I performance prior to this study (Çakır & Bichelmeyer, 2013). These variables were examined as "important determinants of the characteristic" in the study (Gall, Gall, & Borg, 2007). A non-experimental correlational research design was selected as it allows the researcher to look at a larger number of variables within a single study, rather than focus on a single identified variable (Gall et al., 2007). Many studies exist that examine a single variable examined in this study; however, the

research is limited when examining several variables and their impact on the dependent variable (Bates et al., 2011; Bursal & Paznokas, 2006; Baines et al., 2001). This design and the analysis methods enabled the researcher to examine the individual impact of each variable on student success in Algebra I, as well as look at the combined effect of variables.

### **Research Question**

The research question for this study was as follows:

**RQ1:** What teacher factors are significant predictors for student performance in Algebra I?

### **Hypothesis**

The hypothesis for this study was as follows:

**H<sub>0</sub>:** Type of teacher certification, years of teaching experience, years of experience teaching Algebra I, degree earned, and self-efficacy scores will not be significant predictors of student performance in Algebra 1.

### **Participants and Setting**

The participants in this study were comprised of a convenience sample of all Algebra I students taking the Algebra I EOC exam in a major suburban district in north central Texas. The participants in this study were considered to be a convenience sample because the participants were solicited from a site with relative proximity to the researcher and by a school district interested in participating in the study; therefore, the results are not generalizable across all populations of students taking Algebra I (Gall et al., 2007). Only students taking the Algebra I exam at the high school level (grades nine through twelve) were included in this study. The school district participating in the study offers Algebra I to advanced eighth grade students as an honors course. Due to the academically advanced nature of these students, the passing rate and

mean score is significantly higher than the state average and would skew the data for the purposes of this study if these students were included. Additionally, only students who were enrolled in the Algebra I course during the 2016-2017 school year were included in the sample for this study. Students who passed the Algebra I course but failed the EOC exam in a previous school year were not included in this study because there was teacher data with which to match student EOC scores.

The sample of students was derived from the five traditional high schools in the school district. The traditional high schools serve students in grades nine through twelve. Students traditionally take Algebra I during their freshman (9th grade) year of high school; however, there was a small percentage of students from other grade levels in this study. It is possible that a student could move into Texas from another state or country without having credit for Algebra I and would take the course and the EOC exam as a sophomore, junior, or senior.

Each of the five traditional high schools in the participating school district had approximately 300 students whose EOC scores were reported in this study. The convenience sample yielded a sample size of 1,217 students. The large sample size of students assured the researcher the sample was large enough to meet the requirements for a large effect size with a statistical power of .7 at the .05 alpha level (Gall et al., 2007).

The large sample size in a diverse school district provided a sample that is highly generalizable with similar populations across the state of Texas. The school district has an economically disadvantaged population of 40.3% and an English Language Learner (ELL) rate of 10.5% (TEA, 2017). According to the TAC (2012c), “A student with limited English proficiency means a student whose primary language is other than English and whose English language skills are such that the student has difficulty performing ordinary coursework in

English.” The terms Limited English Proficient (LEP) and ELL are used interchangeably in Texas Public Education vocabulary terms. The participating school district is also a racially heterogeneous sample with the following demographics: 28.8% African American, 23.5% Hispanic, 37.5% White, 6.2% Asian, and 3.8% identifying as two or more races (TEA, 2017). The demographics across Texas vary slightly from the study site’s demographics which makes it inappropriate to generalize results to represent all Algebra I students.

The instructional setting in each of the five high schools is very similar, but not uniform. According to an interview with the Secondary Math Coordinator for the district, all Algebra I teachers in the participating district teach the same curriculum at a relatively standard pace. The district gives students periodic standardized curriculum-based assessments that measure student performance and assist teachers in staying on pace with the district’s curriculum pacing guide (Buchhorn, 2017). All of the Algebra I classes in the participating district operate on a 90-minute block schedule.

### **Instrumentation**

There are two primary instruments that were used in this study: the MTEBI and the 2017 Algebra I STAAR EOC Exam. The MTEBI was used to collect data about teacher efficacy beliefs. This instrument was developed in 2000 by Enochs, Smith, and Huinker as a modification of the Science Teaching Efficacy Beliefs Instrument (STEBI) developed in 1990. The MTEBI is comprised of 21 items on two subscales: Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectancy (MTOE) (Enochs et al., 2000). There are 13 items within the PMTE subscale and 8 within the MTOE subscale. Both subscales were considered to be important to the purpose of this study and were examined both individually and collectively.

The 21 items on the MTEBI are written to be answered in a Likert-style scale. The scoring guidelines are as follows: Strongly Agree = 5; Agree = 4; Uncertain = 3; Disagree = 2; and Strongly Disagree = 1 (Enochs et al., 2000). The possible scores on the MTEBI range from 21 to 105. The possible scores for each subscale are 13 to 65 on the PMTE subscale and 8 to 40 on the MTOE subscale. There are eight items that are negatively worded and were reverse scored for consistency. The MTEBI has been used in several studies and has proved to be both reliable and valid for its purposes (Alsawaie & Alghazo, 2010; Isbell & Szabo, 2015; Rethlefsen & Park, 2011; Sancar-Tokmak, 2015). Each of the subscales of the MTEBI is also valid and reliable. The alpha coefficient for the PMTE subscale is 0.88 and the alpha coefficient for the MTOE subscale is 0.75 (n=324) (Enochs et al., 2000).

The MTEBI was developed by modifying the STEBI, which was confirmed to be valid through factor analysis. According to Enoch et al. (2000), “The MTEBI discussed here, however, was subjected to a more rigorous confirmatory factor analysis using a structural modeling software program called EQS” (p. 195). Construct validity was examined using a Confirmatory Factor Analysis (CFA). According to Enoch et al. (2000), “CFA...relies on a specific hypothetical or expected factor structure and serves to confirm its presence (or lack thereof) in the data set at hand” (p. 196). The results of the factor analysis through the EQS software program demonstrated that the two subscales within the MTEBI are independent. In summary, the authors of the MTEBI find the instrument to be reliable and valid regarding the assessment of mathematics teaching self-efficacy and outcome expectancy (Enochs et al., 2000). Additionally, the authors suggest that future research studies focus on the capabilities of this instrument to predict effectiveness of math teachers (Enochs et al., 2000).

Four demographics questions were added to the end of the MTEBI to gather critical information about the Algebra I teachers of the students in the study. Teachers self-reported college degree earned, years of teaching experience, years of Algebra I teaching experience, and certification type. This information was necessary for the reporting of the additional independent variables in this study. The researcher coded the data based on preassigned values for non-numeric answers. All non-numeric answers were multiple choice questions; there were not any open-ended questions on the survey. The survey had a response rate of 100% of eligible Algebra I teachers in the participating district. Teachers were only eligible to take the survey if they taught Algebra I in the participating district during the 2016-2017 school year.

The second instrument that was used to gather data for the purposes of this study was the STAAR EOC exam in Algebra I. This exam was given during the first week of May 2017 to all Texas public school students in Algebra I. Individual student results were reported to the participating school district June 1, 2017.

The EOC exam is historically a valid and reliable exam, and the Algebra I test has not undergone a significant blueprint design change since the last external reliability and validity study conducted (TEA, 2016e). According to TEA (2012), “Internal consistency estimates ranged from 0.81 to 0.93” (p. 108). Additionally, the reliability for the test as a whole was considerably higher than individual score reporting categories which could contain as few as one question per reporting category (TEA, 2012). TEA requires that state exam performance and course passing rates are correlated. According to TEA (2016), “The Spearman correlation between the Algebra I EOC scale scores and the Algebra I course grades for all students was 0.64 ( $p < .0001$ )” (p. 7). The study found that for the random sample of 20,000 Algebra I

students, students who performed better on the Algebra I EOC exam had higher course grades (TEA, 2016f).

### **Procedures**

The researcher secured permission from the participating school district to complete this study. Due to the direct connection to district goals and state accountability requirements, the school district volunteered the Office of Testing and Accountability to aide in data collection and masking of the data to preserve confidentiality. The researcher secured permission from Dr. DeAnn Huinker, author of the MTEBI instrument (See Appendix A). After securing permission from the study site and the instrument author, the researcher submitted an application to the Institutional Review Board (IRB). No data were collected until permission was granted by the IRB to conduct the study.

After all permissions were secured, data collection began. The Office of Testing and Accountability distributed the MTEBI with demographics questions to all high school Algebra I teachers in the participating district. The survey was distributed through school district email addressed to participating teachers. The email contained a link to the survey administered through the SurveyMonkey website and instructions regarding survey procedures. No training was required for teachers to take the survey; however, the Secondary Math Coordinator made herself available to teachers should they have technical difficulties or needed assistance accessing the survey. Teachers were able to request a paper copy of the survey if they did not wish to complete the survey electronically. Algebra I teachers had four weeks to complete the survey. A reminder email was sent weekly to encourage participation. The survey took approximately 20 to 25 minutes to complete, including added demographics questions.

Student test scores from the May 2017 administration of the Algebra I STAAR EOC exam were collected when individual student score reports were distributed to school districts across Texas. The Office of Testing and Accountability of the participating school district matched results from the MTEBI administered to teachers to individual student scores on the Algebra I EOC exam. All individual data for teachers and students were masked to protect the identities of those who participated in the study. Each student's EOC score included the data of his or her corresponding Algebra I teacher's self-efficacy score and demographics data (additional independent variables) matched to it. A single line of data included the following information: student Algebra I EOC score, teacher self-efficacy score from the MTEBI (total score and a score for each of the two subscales), teacher certification type, years of experience teaching, years of experience teaching Algebra I, and degree earned.

Due to the researcher having a personal connection to the participating school district, all data given to the researcher by the Office of Testing and Accountability were masked. The researcher did not have access to identifying information about the teachers or the students during this study. Although the data were masked, it was kept on a single, encrypted hard drive that was only accessible by the researcher. The Office of Testing and Accountability for the study site was responsible for maintaining security of any unmasked data and confidentiality of all participants during and after the study.

### **Data Analysis**

To analyze the data for this correlational study, Ordinary Least Squares (OLS) regression analysis was used to evaluate the effect of the independent variables (teacher factors) on student scores on the Algebra I EOC exam. OLS regression is also commonly referred to as linear regression. Linear regression analysis allowed the researcher to evaluate whether or not a

correlation existed between any independent variables and the dependent variable (Gall et al., 2007).

Based on the nature of the data collected for this study, the researcher considered multilevel modeling regression as an option for data analysis. Multilevel modeling regression differs from OLS regression because it “produces unbiased estimates of the standard errors associated with the regression coefficients when the data are nested and easily allows group characteristics to be included in models of individual outcomes” (O’Dwyer & Parker, 2014, p. 2). Nested data are when the individual observations are grouped together, such as multiple students belonging to the same teacher. This is common in educational studies when the data collected are at the student level. According to Condon, Lavery, and Engle (2016), “Educational researchers across disciplines have turned to hierarchical modeling to account for the structure of school communities...accounting for the nested structure and various subnetworks within the school” (p. 1197). Essentially, multilevel regression analysis partitions the total variance in the dependent variable, in this case, Algebra I EOC scores, into two sources: within-variance (student level variation within teachers) and between-variance (teacher-level variance). Thus, there are two error terms in the multilevel regression analysis model, one for the within-group error and the other for the between-group error (O’Dwyer & Parker, 2014).

Ultimately, multilevel modeling was not used due to a variety of factors that indicated no significant correlation between students within teachers. According to O’Dwyer and Parker (2014), “Models with fewer than 20 to 25 groups may not provide accurate estimates of the regression coefficients and their standard errors, or of the variance components and their standard errors” (p. 7). Researchers Hox and Maas have conducted extensive research on multilevel modeling techniques and best practices. According to Hox, Maas, and Brinkhuis

(2010), "...with unbalanced data a group-level sample size of 100 is required for sufficient accuracy of the model test and confidence intervals (CI) for the parameters" (p. 161). Although this study included only 15 teachers and only five teachers had a group level sample size that exceeded 99, multilevel regression was still considered a viable option if the data still provided sufficient evidence to support the technique. Intraclass correlation coefficient (ICC), which is a measure of the correlation between teachers and student scores nested within those teachers was not significant for the model including total efficacy (0.16), nor for the model including the two efficacy subscales (0.18). Furthermore, the average Algebra I EOC scores did not significantly differ between teachers, as indicated by comparing side-by-side boxplots and was confirmed with a one-way ANOVA ( $F = 0.155$ ,  $p = 0.694$ ). Thus, multilevel modeling was not the most appropriate method of analysis, despite the fact that data could be nested under individual teachers.

Before the regression analysis was conducted, assumption testing was completed to ensure that the assumptions required for this analysis method were met. The assumptions that required for regression analysis are as follows: dependent variable should be measured on a continuous scale; at least two independent variables; linearity between dependent and independent variables; homoscedasticity of data; no multicollinearity between independent variables; independence of observations; no outliers or highly influential points; and normal distribution of residuals (Warner, 2013). After assumptions were met or the test is decided to be robust enough to account for any assumptions not met, the researcher began the OLS regression analysis.

SPSS was used to run all regression analyses between the dependent variable of Algebra I EOC exam scores and the independent variables of teacher efficacy scores, certification type,

years of experience teaching, years of experience teaching Algebra I, and college degree earned.

A significance level of 0.05 was used for all testing (Warner, 2013). The researcher reported Pearson's  $r$  because, according to Gall et al. (2007), " $r$  can be calculated for any two sets of scores, even if one or both measures do not yield scores in continuous form" (p. 347).

Additionally, the coefficient of determination, expressed as  $R^2$ , was reported as it "provides a more accurate index of the relationship between two variables than other correlational statistics when the relationship is markedly nonlinear" (Gall et al., 2007, p. 349).

## CHAPTER FOUR: FINDINGS

### Overview

OLS regression analysis was used to evaluate the effect of the independent variables (teacher factors) on student scores on the Algebra I EOC exam. This chapter outlines results and includes descriptive statistics and assumption testing for the multilevel regression analysis. The results of the testing show that the results of the data analysis cause the researcher to reject the null hypothesis. The independent variable of years of experience teaching Algebra I was found to be the only significant predictor of student scores on the Algebra I EOC exam.

### Research Question

The research question for this study was as follows:

**RQ1:** What teacher factors are significant predictors for student performance in Algebra I?

### Hypothesis

The hypothesis for this study was as follows:

**H<sub>0</sub>:** Type of teacher certification, years of teaching experience, years of experience teaching Algebra I, degree earned, and self-efficacy scores will not be significant predictors in student performance in Algebra 1.

### Descriptive Statistics

The sample resulted in 1,217 Algebra I student scores with survey data matched to 15 different teachers. The highest number of students' scores per teacher was 124 for one teacher and the lowest number was only 1 student score for one teacher. The mean number of student scores per teacher was 71.7 with a standard deviation of 39.97. The mean number of years teaching was 8.28 with a standard deviation of 4.815, while the mean number of years teaching

Algebra I was 5.88 with a standard deviation of 4.723. The proportion of traditional versus alternative certifications was almost equal, with 52.9% having alternative certifications and 47.1% having traditional certifications. With regard to the highest math degree earned, 35.3% of the teachers had a Bachelor of Science in a mathematics-related field, 23.5% had a Bachelor of Arts in a math-related field, 29.4% had a Bachelor of Science in a non-math related field, 0.1% had a Master's Degree in a math-related field, and 0.1% had no math related degree. These teacher demographics are summarized in Tables 1 and 2.

Total teacher efficacy scores had a mean of 84.39 with a standard deviation of 7.415, the PMTE subscale had a mean of 56.1 and a standard deviation of 3.91, and the MTOE subscale had a mean of 28.29 with a standard deviation of 4.719. The mean raw score for the Algebra I EOC exam was 31.27 with a standard deviation of 9.021, while the mean scale score was 3929.25 with a standard deviation of 371.087. Efficacy scores and Algebra I EOC scores are summarized in Table 3.

Correlations between the continuous variables indicated significance between years of teaching experience and all three of the efficacy scales (total efficacy and the two subscales). Similarly, years of teaching Algebra I experience was also significant with all three efficacy scales. Algebra I EOC scores, however, were only significantly correlated with years of teaching and years of teaching Algebra I and not with any of the other three efficacy scales. These correlations are summarized in Table 4.

Table 1

*Descriptive Statistics for Student Scores per Teacher, Years of Teaching and Years of Teaching Algebra I*

	<b>Mean</b>	<b>Std. Dev.</b>
Student Scores Per Teacher	71.7	39.97
Years of Teaching	8.28	4.815
Years of Teaching Algebra I	5.88	4.723

Table 2

*Descriptive Statistics for Certification Type and Highest Math-Related Degree Earned*

	<b>Mean</b>	<b>Std. Deviation</b>
<b>Certification Type</b>		
Alternative	9	52.9
Traditional	8	47.1
<b>Highest Math-Related Degree Earned</b>		
BS in Math-Related Field	6	35.3
BA in Math-Related Field	4	23.5
BS in Non-Math Field	5	29.4
Masters in Math Field	1	0.1
No Math-Related Field	1	0.1

Table 3

*Descriptive Statistics of Efficacy Scores and Algebra I EOC Scores*

	<b>Mean</b>	<b>SD</b>
Total Efficacy Scale	84.39	7.415
PMTE Efficacy Subscale	56.10	3.910
MTOE Efficacy Subscale	28.29	4.719
Algebra I EOC Raw Scores	31.27	9.021
Algebra I EOC Scaled Scores	3929.25	371.087

Table 4

*Correlations Between Continuous Variables (P-Values in Parentheses)*

	Total Efficacy Scale	PMTE Efficacy Subscale	MTOE Efficacy Subscale	Algebra I EOC Raw Scores
Years of Teaching	0.132 (<.001)*	0.080 (0.005)*	0.141 (<.001)*	0.066 (0.021)*
Years of Teaching Algebra I	0.265 (<.001)*	0.149 (<.001)*	0.292 (<.001)*	0.092 (0.001)*
Algebra I EOC Raw Scores	-0.007 (.798)	-0.028 (0.335)	0.011 (0.690)	

**Results****Data Screening**

Data screening for this research study were conducted on the dependent variable, raw scores for Algebra I EOC exam, with specific attention given to outliers. There were no outliers in the data; therefore, there were no observations of concern (see Figures 1 and 2).

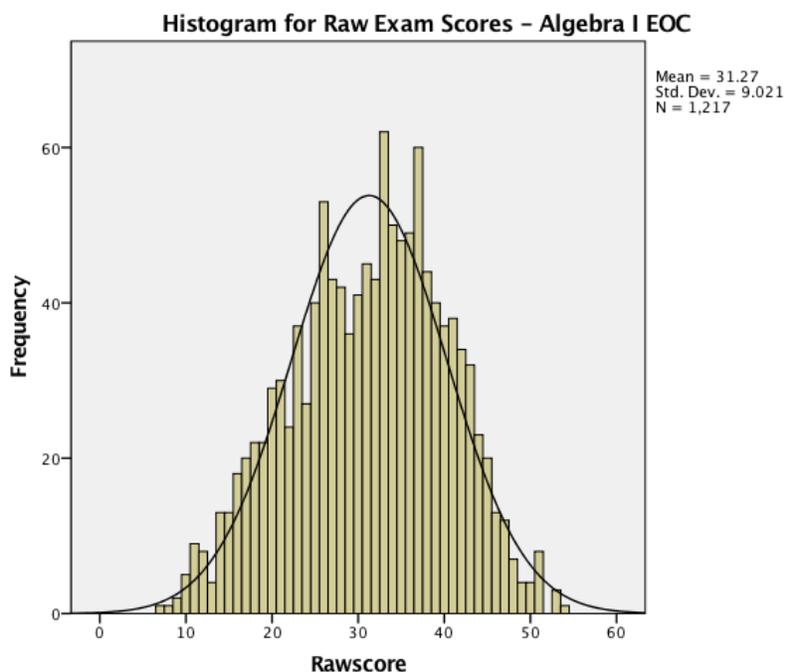


Figure 1. Histogram of raw exam scores on the Algebra I EOC exam based on frequency.

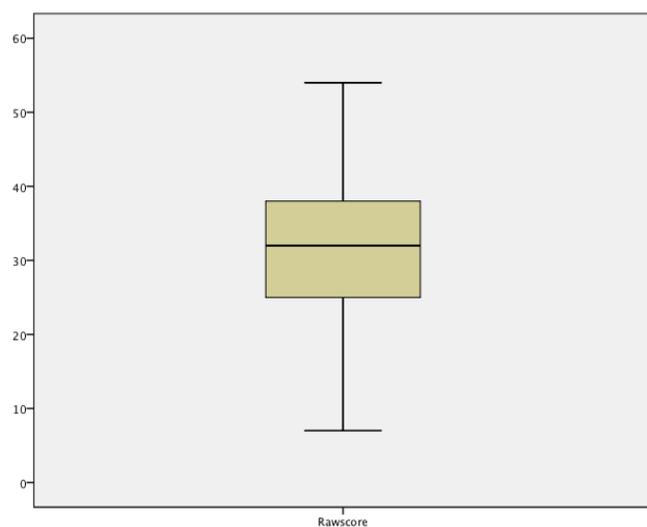


Figure 2. Box and Whisker plot showing distribution of data based on raw scores on the Algebra I EOC exam.

### Assumptions

Assumptions for the model including total efficacy were assessed through residual plots, including histograms, boxplots, and normal quantile plots. All plots demonstrated approximate normality of the residuals, no violations of homoscedasticity, and no violations of linearity for

the model including total efficacy (see Figures 3, 4, and 5). Assumptions for multicollinearity also indicated no violations, with all variance inflation factor (VIF) values below 10. VIF is a measure of multicollinearity. According to Jou, Huang, and Cho (2014), “VIF values indicate how the variance of the corresponding coefficient is inflated due to data collinearity” (p. 1517). “Although there is no rule of thumb for VIFs, a value of 10 is often adopted, but with caution” (Jou et al., 2014, p. 1517). VIF values greater than 10 are regarded as unacceptable, although some exceptions exist (Tamhane & Dunlop, 2000). There is a VIF value for each variable. In the model that included total efficacy, the highest VIF value was 5.116 and the lowest was 1.216. In the model that included the efficacy subscales, the highest VIF value was 5.310 and the lowest was 1.369.

Independence of observations was confirmed through the ICC to rule out any significant correlation between students within teachers. The ICC was 0.16, which is a very low correlation and indicates independence was not violated due to nesting within teachers. Furthermore, the Durbin-Watson statistic was 1.653, which is close enough to 2 to indicate no dependence among observations or significant autocorrelation. “The Durbin-Watson test statistic tests the null hypothesis that the residuals from an Ordinary Least Squares (OLS) regression are not autocorrelated” (SPSS, 2004, p. 177). The Durbin-Watson test statistic for the model including total efficacy was 1.653. The Durbin-Watson test statistic for the model including the efficacy subscales was 1.654. “The Durbin-Watson test statistic ranges in value from 0 to 4. A value near 2 indicates non-autocorrelation; a value toward 0 indicates positive autocorrelation and a value toward 4 indicates negative autocorrelation” (SPSS, 2004, p. 177).

Assumptions for the model including PMTE and MTOE efficacy subscales were assessed through residual plots, including histograms, boxplots, and normal quantile plots. All plots

demonstrated approximate normality of the residuals, no violations of homoscedasticity, and no violations of linearity for the model including the PMTE and MTOE efficacy subscales.

Assumptions for multicollinearity also indicated no violations, with all VIF values below 10.

Independence of observations was confirmed through the ICC to rule out any significant

correlation between students within teachers. The ICC was 0.18, which is a very low correlation

and indicates independence was not violated due to nesting within teachers. Furthermore, the

Durbin-Watson statistic was 1.654, which is close enough to 2 to indicate no dependence among observations or significant autocorrelation.

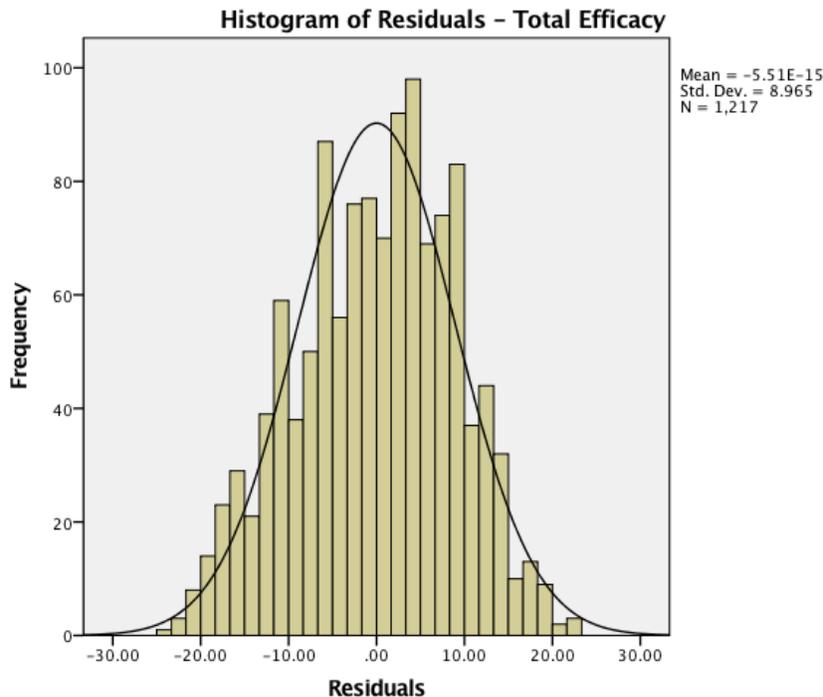


Figure 3. Histogram of residuals for the model including total efficacy.

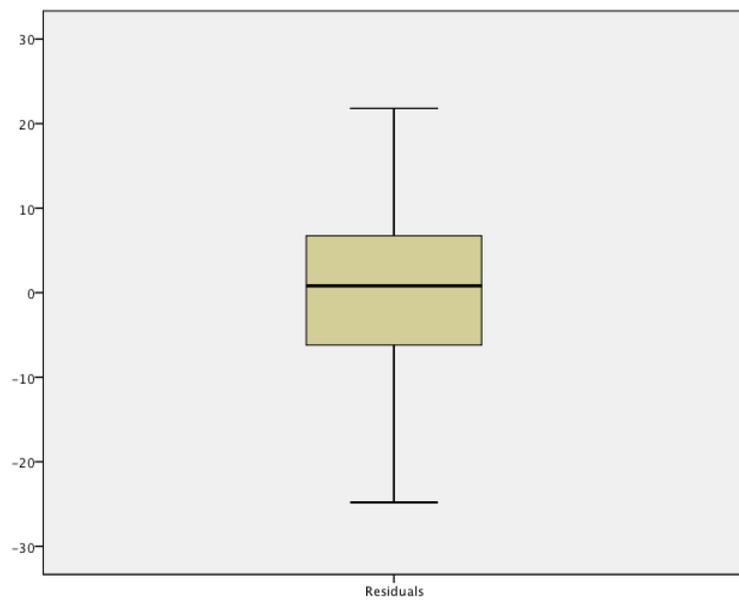


Figure 4. Box and whisker plot of residuals for the model including total efficacy.

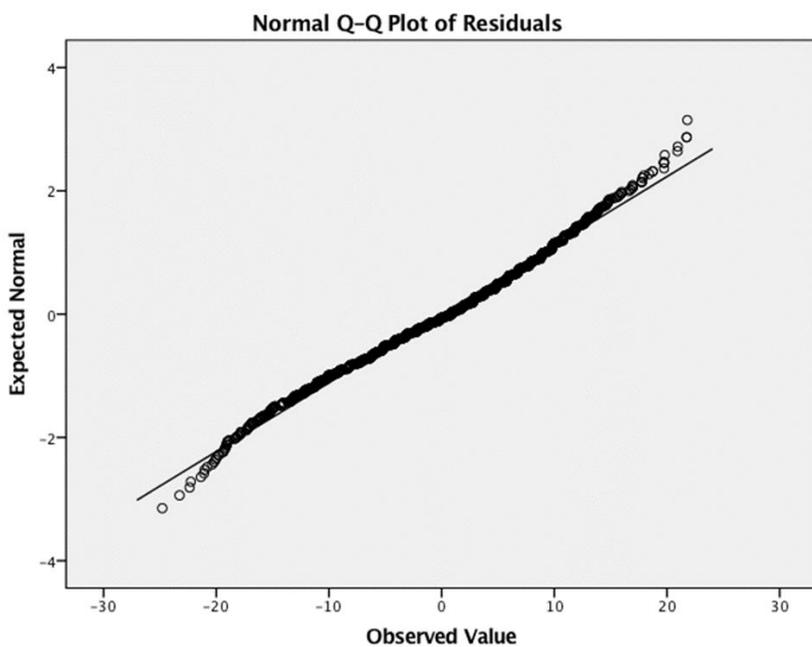


Figure 5. Normal quantile plots of residuals for the model including total efficacy.

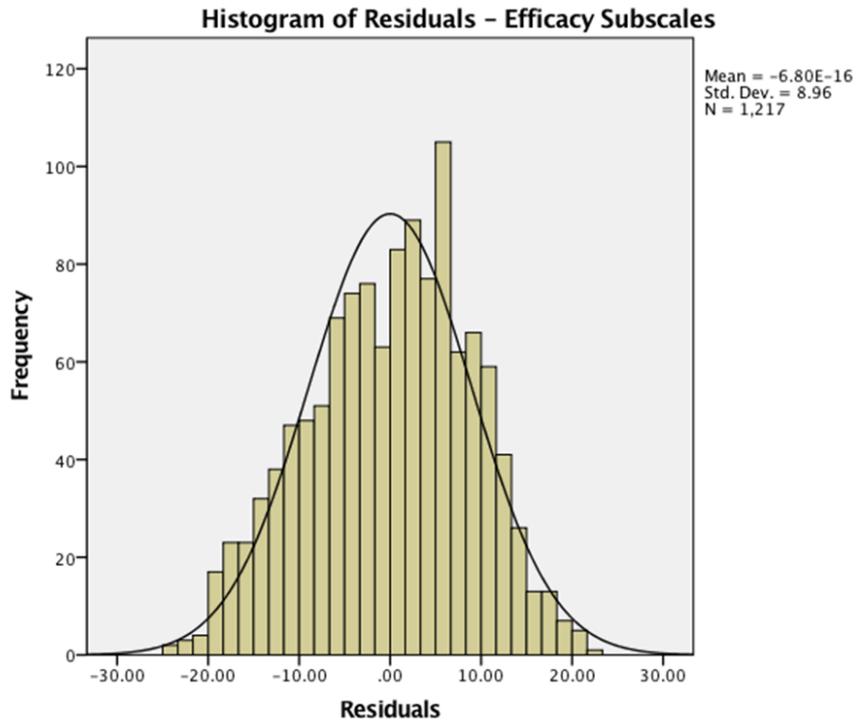


Figure 6. Histogram of residuals for the model including PMTE and MTOE efficacy subscales.

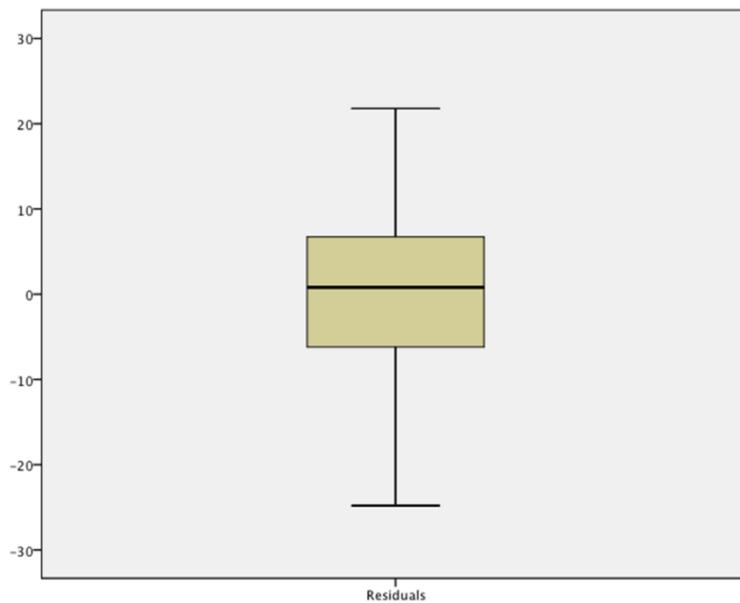
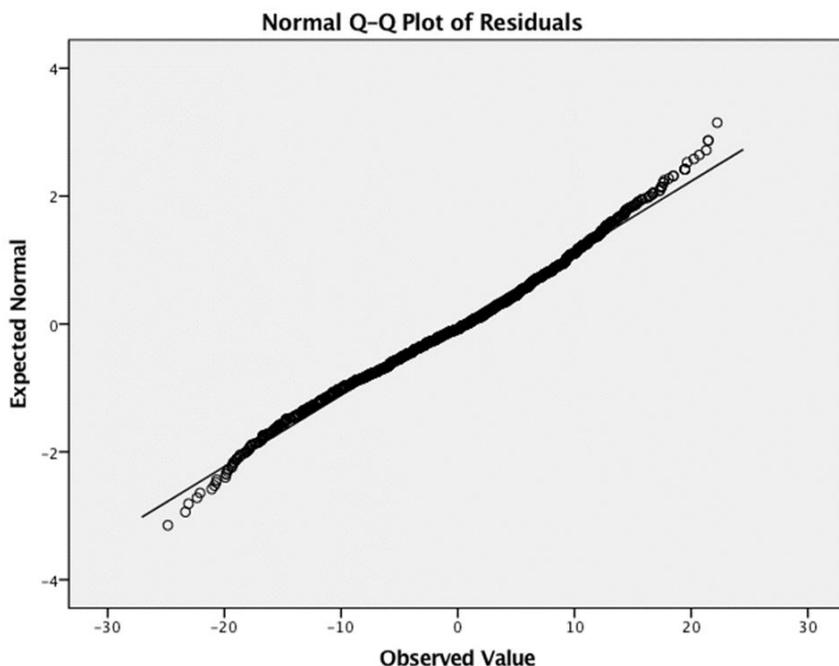


Figure 7. Box and whisker plot of residuals for the model including PMTE and MTOE efficacy subscales.



*Figure 8.* Normal quantile plots of residuals for the model including PMTE and MTOE efficacy subscales.

### Results for Null Hypothesis

OLS regression analyses were performed using certification type, highest math-related degree earned, number of years teaching, number of years teaching Algebra I, total efficacy, PMTE efficacy, and MTOE efficacy scales as predictors for Algebra I EOC raw scores. Because the total efficacy is the sum of the two subscales, one analysis included total efficacy as a predictor and the second included the two subscales as predictors. OLS regression was used instead of multilevel modeling regression due to the varied sample sizes for each teacher with nested students. Although multilevel analysis accounts for the correlated errors associated with nested models that would violate the assumptions for ordinary least squares regression, it was not determined to be the most appropriate method of analysis for this study.

Results for the model including total efficacy as a predictor indicated that the only significant predictor for Algebra I EOC scores was years of teaching Algebra I ( $t=2.708$ ,  $p=.007$ ). Parameter estimates for the model are summarized in Table 5.

Table 5

*Parameter Estimates and Test for Independent Variables for Model Including Total Efficacy.*

<b>Parameter</b>	<b>Estimate</b>	<b>Std. Error</b>	<b>Test statistic (t)</b>	<b>p-value</b>
Intercept	31.43	3.61	8.705	<.001
Certification Type	0.964	0.722	1.335	0.182
Years of Teaching	-0.0995	0.109	-0.910	0.363
Years of Teaching Algebra I	0.334	0.123	2.708	0.007*
Highest Level of Math Degree Earned	0.198	0.346	0.572	0.568
Total Efficacy	-0.023	0.040	-0.572	0.567

Similarly, results for the model including both the PMTE and MTOE efficacy subscales indicated that the only significant predictor for Algebra I EOC scores was years of teaching Algebra I ( $t=2.424$ ,  $p=.015$ ). Parameter estimates for the model are summarized in Table 6.

Table 6

*Parameter Estimates and Test for Independent Variables for Model Including PMTE and MTOE Subscales*

<b>Parameter</b>	<b>Estimate</b>	<b>Std Error</b>	<b>Test statistic (t)</b>	<b>p-value</b>
Intercept	33.73	4.07	8.293	<.001
Certification Type	0.993	0.723	1.374	0.170
Years of Teaching	-0.072	0.112	-0.640	0.522
Years of Teaching Algebra I	0.305	0.126	2.424	0.015*
Highest Level of Math Degree Earned	0.349	0.367	0.950	0.342
PMTE Efficacy	-0.104	0.077	-1.348	0.178
MTOE Efficacy	0.051	0.072	0.711	0.477

### **Reporting on for Null Hypothesis**

OLS regression analysis was used to evaluate the effect of the independent variables (teacher factors) on student scores on the Algebra I EOC exam. The first model included type of teacher certification, years of teaching experience, years of experience teaching Algebra I, degree earned, and the total self-efficacy scores. The second used the same independent variables, replacing total efficacy scores with the two subscales PMTE and MTOE for efficacy. Both models indicated that the only significant variable was years of teaching Algebra I, with a significance of 0.007 for the model including total efficacy scores and 0.015 for the model including the two subscales. Thus, the null hypothesis is rejected for the variable years of teaching Algebra I for both models, but for this variable alone.

## **CHAPTER FIVE: CONCLUSIONS**

### **Overview**

The purpose of this non-experimental correlational research study was to compare Algebra I EOC scores based on several teacher factors to determine if one or more factors has a statistically significant impact on student achievement. The independent variables used in this study were certification type (standard or alternative), years of experience teaching, years of experience teaching Algebra I, college degree earned (math major, minor, or other), and efficacy beliefs. These variables were measured using student scores from the Spring 2017 administration of the Algebra I EOC exam and the MTEBI. Chapter Four included a complete statistical analysis of the data using OLS regression. The analysis showed that the only statistically significant variable was years of experience teaching Algebra I. The remainder of this chapter will use the results from the analysis to discuss the findings of the study and address possible implications based on the findings of the study. Additionally, limitations associated with this study and recommendations for future research studies on this topic are discussed.

### **Discussion**

The research question for this study was directly linked to the purpose of determining if specific teacher factors or characteristics have a significant impact on student achievement. Thus, this study focused on a single, central research question: What teacher factors are significant predictors for student performance in Algebra I? The individual characteristics examined were efficacy beliefs, certification type, years of teaching experience, years of Algebra I teaching experience, and degree earned. The study focused on teacher characteristics due to evidence from several studies that linked a specific teacher's influence as the significant

contributing factor to student achievement (Badgett et al., 2014). The regression analysis only indicated significance in one variable: years of Algebra I teaching experience.

When looking at this specific study in context of the body of literature surrounding this topic, it is important to acknowledge that this study is the only study that looks specifically at student success as measured by Algebra I EOC scores in relation to the five selected independent variables. Although there are studies that identify the teacher as being the most significant contributing factor in student achievement, these studies do not examine specific characteristics these teachers possess. Additionally, other studies may examine specific teacher characteristics in relation to a variety of dependent variables, this is the only known study that examines student achievement as measured by Algebra I EOC scores and the potential significance of the five selected dependent variables.

The only variable that this study found to be significant was years of experience teaching Algebra I ( $p = .007$ ). This is consistent with the findings of Huang and Moon (2009) who found that increased years of teaching experience within a specific content area led to higher levels of student achievement within that content area. Additionally, Warren and Hale (2016) conducted a study that concluded that general teaching experience compared to years of teaching experience in one specific content equal are not equal in terms of student success outcome expectancy.

Although it could be interpreted as closely related to years of experience teaching Algebra I, general years of teaching experience was not a significant predictor of student success in Algebra I in this study. Studies examining general teaching experience as a predictor for student success has yielded inconclusive results. Goldhaber and Anthony (2007) found only a weak correlation between years of teaching experience and levels of student success. These results were confirmed by a follow up study by Çakir and Bichelmeyer (2013) that examined

teacher characteristics (years of experience and degree earned) and the impact on student success. Previous studies have noted the difficulty in measuring years of teaching experience as an isolated variable. Other factors such as professional confidence, classroom management skills, and ability to handle unexpected change in the classroom are thought to have a direct, positive relationship with years of teaching experience, meaning as years of teaching experience increase, the previously mentioned skills increase as well (Ünal & Ünal, 2012). Additionally, efficacy beliefs have been found to have a relationship with years of teaching experience, which further complicate examining the variable in relative isolation (Klassen & Chiu, 2010).

Teacher certification type was not found to be a significant predictor of student success in Algebra I in this study. However, the research was mixed regarding the differences between traditional and alternative certification programs and the impact on student achievement. Baines (2006) showed that alternatively certified teachers significantly underperformed when compared to their traditionally certified counterparts. However, other studies attribute the success of certification programs to the quality of the pre-service training, or student teaching, which can be accomplished in both traditional and alternative certification programs (Ajayi, 2017; Kosnik & Beck, 2009). Overall, the research surrounding teacher certification and the impact on student success is inconclusive (Baines, 2006; Brown et al., 2004; Goldhaber & Brewer, 2000; Koehler et al., 2013). It has been asserted that certification type alone cannot be isolated to determine effectiveness or impact on student success and that other factors such as industry experience, graduate degrees, age, and perceived preparedness influence the performance of teachers as much as or more than certification type alone (Koehler et al., 2013).

The type of degree earned was not a significant predictor of student success in Algebra I. Some research exists regarding the impact of a teacher's degree on student performance;

however, there was very limited impact regarding Algebra I teachers specifically. Dee and Coates (2008) found a negative impact on student success for math and science teachers who did not have a degree in the content area. There is research to support that a master's degree in the content area taught has a positive impact on student success (Copur-Gencturk et al., 2014); however, the number of teachers in this study was too small to include a sufficient variety of degrees earned, especially masters degrees.

Although there is significant research examining the effects of the efficacy beliefs of teachers and the connection to student success, this study did not yield significant results for any of the efficacy subscales or for the efficacy beliefs survey as a whole. The researcher ran two different regression analyses to ensure that efficacy was examined thoroughly. One analysis included total efficacy scores for the survey, and the second analysis looked at each of the two subscales within the survey independently. Despite the overwhelming volume of research supporting teacher efficacy beliefs and the impact on student success, none of the measures of efficacy in this study approached significance.

There are numerous studies that link efficacy beliefs to student outcomes, both in the classroom and beyond. Blazar and Kraft (2017) found that teachers with high self-efficacy beliefs develop skills in their students that are transferrable to other content areas and to independent life outside of school. Additionally, teachers with high self-efficacy beliefs are more likely to stay in the profession, adopt innovative practices, and persist when faced with challenges (Guskey, 1984; Riggs & Enoch, 1990; Webb & Ashton, 1986).

Recently, there has been a focus on relationship quality between the teacher and the student and the impact on student outcomes. Sointu, Savolainen, Lappalainen and Lambert (2017) found that a stronger student-teacher relationship positively impacted student success by

fostering student social-emotional growth and increasing engagement in the class activities.

Summers, Davis, and Hoy (2017) found that teachers with higher self-efficacy beliefs were more optimistic about their students' abilities and potential.

There are studies that have tied efficacy beliefs to school demographics. Wang et al. (2017) assert that efficacy is built by a teacher experiencing mastery experiences with high-need students. A teacher in a low-performing, high-need school may have fewer opportunities to experience mastery experiences with students, thus fewer opportunities to develop a greater sense of self efficacy.

It is possible that the limited sample size of teachers included in this survey might not have yielded a diverse enough sample to adequately analyze the effect of efficacy beliefs on student achievement. Although there was variation in the self-efficacy survey scores, all of the scores were clustered in the top three quintiles of possible scores. The absence of scores in the lower ranges leaves many questions unanswered regarding efficacy beliefs and the impact on student success in Algebra I.

### **Implications**

Although only one variable in this study was determined to be a significant predictor of student success in Algebra I, this study is an important starting point for future research on the topic. The National Mathematics Advisory Panel (2008) reports on the importance of Algebra I as a gateway to higher math, a college degree, and higher future earnings. Algebra I is a course of critical importance for high school graduation in Texas. It is a graduation requirement for all of the graduation plans within Texas, and it is a prerequisite for several other required courses (TAC, 2012a). There is a void in the literature in regards to teacher selection to help school leaders make data-driven, research-based decisions regarding hiring and teacher placement. This

study sought to identify teacher characteristics that impact student achievement in Algebra I to aide school leaders in the endeavor to allocate staff in the way that most benefits students.

As discussed earlier in this chapter, there are several teacher factors that have been studied with mixed or inconclusive results; however, the studies did not focus primarily on Algebra I performance, but on academic achievement as a whole. Based on the critical nature of Algebra I for Texas high school students as a foundational math course needed for future success, this study focused on teacher characteristics specifically for Algebra I.

It is the opinion of the researcher that this study is merely the tip of the iceberg regarding data to be discovered about this topic. Suggestions for future research will be discussed at length later in this chapter; however, one of the greatest implications of this study is the clear need for additional research on this topic to gain greater clarity. It is the belief of the researcher that more variables in this study could have shown significance if a larger sample existed, or if the sample included a more diverse group of students and teachers.

Extensive research exists regarding best instructional practices for a variety of academic topics including math instruction (Rakes, Valentine, McGatha & Ronau, 2010), classroom management (Egeberg, McConney & Price, 2016), teaching diverse populations (Griner & Stewart, 2013), and developing math confidence in students (Finlayson, 2014). However, numerous studies cite the teacher, not instructional practices, as the significant contributing factor to student learning and success (Badgett et al., 2014). It is based on this finding that this study should be viewed as the introductory study to further research regarding teacher factors and the impact on student success in a variety of subject areas, geographical settings, and student populations.

The single significant variable in this study, years of teaching experience, does provide school leaders research-based information to help assign teachers to the appropriate curriculum. It is common practice for teachers with more seniority to move into the more advanced classes, such as junior and senior level courses that are often not needed for graduation. According to Jacob (2007), retention rates for teachers can vary drastically depending on the demographics of the school, the perceived difficulty of teaching the subject, and the perceived pressure placed on the teacher by school officials. These factors can create an environment where the most novice teachers are responsible for foundational, state-tested courses such as Algebra I. This study should serve as deterrent for this style of teacher assignments, and it should reflect the importance of experienced teachers taking responsibility for the most critical courses to students.

### **Limitations**

The main limitations to this study are the sample type and size. A convenience sample was used by the researcher due to proximity and access to the data needed for the study. Additionally, the participating school district had interest in the study due to its correlation to district-wide goals. Due to this, the school district offered to assist with data collection and coordinate all matching and masking of student and teacher data. The convenience sample only allows the results of the study to be generalized to similar populations regarding geographical location and school district demographics (Gall et al., 2007). As noted in Chapter 3, the sample for this study was collected from a major suburban school district in north central Texas. The sample included student and teacher data from each of the five traditional high schools in the district. The student population of the participating school district is moderately heterogeneous and 40.3% of students are identified as economically disadvantaged. Although the participating school district is diverse and includes a moderate number of students living in poverty, this study

could not be generalized to districts that have student demographics on the extremes of the demographics spectrum. For example, a district with a relatively homogeneous student population with a high level of poverty would not be able to apply the results of the study to its own student population regarding predicted EOC score outcomes.

Additionally, as this study was conducted in a Major Suburban district, as designated by TEA, the results would not be generalizable to include rural or urban school districts. In 2016, TEA reported that 1,207 separate public school districts existed in Texas. These 1,207 school districts are broken up into nine categories: Major Urban (11 districts), Major Suburban (79 districts), Other Central City (41 districts), Other Central City- Suburban (161 districts), Independent Town (68 districts), Non-Metropolitan: Fast-Growing (31 districts), Non-Metropolitan: Stable (174 districts), Rural (459 districts), and Charter (183 districts). The results from this study could only reasonably be generalized with other school districts classified as Major Suburban or Other Central City Suburban, and maintained similar student demographics.

Further, the dependent variable in this study was EOC exam scores. The STAAR EOC exams are specific to public schools within Texas only. EOC exams are based on the mastery of the prescribed Texas Essential Knowledge and Skills (TEKS) for each tested subject area. Other states would not be able to generalize the results of this study without significant research to determine of the state's standardized testing methods aligned with Texas's STAAR EOC exam system.

One major limitation in this study is the sample size. As discussed in Chapter 3, multilevel modeling was considered as a method of data analysis for this study. Multilevel modeling analysis "produces unbiased estimates of the standard errors associated with the

regression coefficients when the data are nested and easily allows group characteristics to be included in models of individual outcomes” (O’Dwyer & Parker, 2014, p. 2).

Initially, multilevel modeling appeared to be the most appropriate and powerful method of analysis for this study; however, the number of groups and sample sizes at the group level did not justify the use of multilevel analysis. According to O’Dwyer and Parker (2014), “Models with fewer than 20 to 25 groups may not provide accurate estimates of the regression coefficients and their standard errors, or of the variance components and their standard errors (p. 7). Further, a group-level sample size of 100 is the required minimum when there are unbalanced group sizes under each nest (Hox et al., 2010). Although there were 1,219 student test scores included in the sample, the data was nested under only 15 individual teachers. There was also a large difference in sample sizes at the group level (nests under each individual teacher). These factors made multilevel modeling an inappropriate method of analysis for this data.

A study with a larger sample size that included at least 20 to 25 teachers with a minimum of 100 students in each nest would allow a researcher to utilize multilevel modeling. Although OLS regression is a valid, appropriate method of analysis for this study, a larger sample that allowed the researcher to utilize multilevel modeling would yield valuable results to this field of study.

### **Recommendations for Future Research**

Based on the literature reviewed and the results of this study, there are a variety of future studies that would contribute to the body of knowledge in this subject area.

First, a replication study with a significantly increased sample size is a needed contribution this area of research. As discussed in the previous section, if a future study included at least 20 to 25 teachers with a minimum of 100 students nested under each teacher, multilevel

modeling could be used. This would provide more information about the impact an individual teacher has on his or her students regarding Algebra I EOC performance. A replication study with an expanded sample size is feasible considering Texas has 79 Major Suburban school districts. Although not all of the Major Suburban districts have a population that is comparable to the district in this study, it is reasonable to expect that a large enough sample size could be drawn from district of similar demographics to meet the sample size requirements to conduct multilevel modeling analysis.

Second, similar studies that draw a sample from a vastly different student population are needed to evaluate the generalizability of results. This sample for this study was drawn from a Major Suburban district in north central Texas. Replicating the study with an emphasis on rural school districts would address a large number of school districts within Texas. Of the 1,207 school districts within Texas, 459 are designated as rural districts. It is reasonable to expect a marked difference in both the student and teacher populations and demographics in rural school districts. However, the use of rural school districts would likely limit the researcher to using OLS regression as the method of analysis due to small student populations in rural districts. It is highly unlikely that many rural districts would have a teacher with 100 students in the same content area. Additionally, drawing a sample from one or more of the 11 Major Urban districts in Texas would provide more insight regarding the generalizability of the results of this study. The 11 Major Urban districts in Texas have a high percentage of the population that are designated as economically disadvantaged. Additionally, the student populations in Major Urban districts are relatively homogeneous and are comprised primarily of African American or Hispanic students.

Third, studies that examine student growth in a content area rather than raw score on an EOC exam would provide more insight regarding the impact a teacher has on an individual student. The present study only examined raw scores on the May 2017 Algebra I EOC exam and compared these scores to teacher characteristics. If a future study employed a pre-test/post-test method, student growth under the instruction of the specific teacher could be measured. Additionally, the STAAR EOC system provides a Progress Measure for each student based on individual student performance standardized test from the previous year and the current year. This could be a viable option for a future study to examine student growth as opposed to a scaled score that only determines if a student met or failed to meet the designated passing standard for the exam.

Fourth, a study that examines the instructional preparation styles of teachers would provide more insight into this area of research. This study did not examine the instructional preparation methods of teachers who participated in the study because of the participating district's expectations of teachers. Teachers in the participating district participate in Professional Learning Communities (PLCs) where they use a district-prescribed curriculum to design lessons and common assessments. Additionally, the participating district periodically uses Curriculum-Based Assessments (CBAs) to evaluate student progress through the curriculum. There are several studies that examine the method of instructional preparation (isolation, collaborative, or directive) and the impact on student achievement (Conley & Cooper, 2013; Seghal et al., 2017). Further, in a review of the literature conducted by Vescio, Ross, and Adams (2008), they found that "all eight studies that examined the relationship between teachers' participation in PLCs and student achievement found that student learning improved" (p. 86). A future study that included the instructional preparation type as an independent

variable would contribute to the body of knowledge regarding best practices to increase student achievement in Algebra I.

All of the recommendations made in this section were made with the focus of understanding what factors impact student achievement in Algebra I. The ultimate goal is to provide educators and campus leaders with a robust body of data from which to inform instructional decisions regarding hiring and teacher content and course assignment.

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## Appendix A: Permission to Use MTEBI Instrument

**From:** DeAnn M Huinker <[huinker@uwm.edu](mailto:huinker@uwm.edu)>  
**Date:** October 18, 2016 at 8:40:07 AM CDT  
**To:** "McMullen, Kalee" <[KaleeMcMullen@misdmail.org](mailto:KaleeMcMullen@misdmail.org)>  
**Subject:** Re: Seeking Permission to use MTEBI

Kalee,

You have my permission to use the MTEBI instrument in your work.

Best to you in your research endeavors,  
Dr. Huinker

On Oct 15, 2016, at 8:26 AM, McMullen, Kalee <[KaleeMcMullen@misdmail.org](mailto:KaleeMcMullen@misdmail.org)> wrote:

Dr. Huinker-

I am a doctoral student at Liberty University in Lynchburg, Virginia. I am in the beginning stages of the dissertation process and I have identified the MTEBI as the instrument I would like to use in my study. What is needed to obtain permission to use this instrument?

Thanks for your guidance,

Kalee McMullen  
Academic Associate Principal  
Summit High School  
[kaleemcmullen@misdmail.org](mailto:kaleemcmullen@misdmail.org)  
[682-314-0927](tel:682-314-0927)

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