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Religiosity, Mindset, and Math Achievement

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Abstract

Growth mindset and religiosity as separate constructs have been shown to increase student achievement. This study sought to discover if a relationship existed between religiosity and mindset, as well as if mindset or religiosity could predict math achievement. A mixed methods study, guided by Brofenbrenner's bioecological model, was conducted. This non-experimental quantitative study found a small statistically significant relationship between mindset and religiosity ($p < .05$). However, religiosity and mindset were not correlated with math achievement; therefore, these constructs could not be used to predict math achievement. Focus group interviews were used to further study the relationship between mindset and religiosity. Students were asked to describe how they developed both their mindset and religiosity beliefs, and then to discuss how these constructs work, both together and separately, to impact academic achievement. Through In Vivo and Process coding, two themes and one key assertion emerged from the interviews. Theme 1: Environmental factors impact religiosity and mindset. Theme 2: Religiosity and mindset impact academic success. Key Assertion: Religiosity and mindset are two distinct yet harmonious constructs within adolescents. Religiosity and mindset influence each other as students grow, develop, and achieve in school.

Keywords: mindset, religiosity, achievement, math achievement, bioecological model

Dedication

I dedicate this work to my students. I have learned more from you than you have from me.

Pursue your dreams and never stop learning!

Acknowledgements

I'd like to acknowledge my family. Chris—thank you for your love and support every step of the way. My life is better because you are in it. Noelle—thank you for being my homework buddy. I have enjoyed our Starbucks dates and late-night Netflix marathons. Anni—thank you for giving the best hugs and always knowing exactly when I need one! Izzy—thank you for showing me the importance of thinking outside the box. Triah—thank you for always making me smile and reminding me to slow down and enjoy all of life's blessings.

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Chapter 1: Introduction

Students enter high school with a wide range of mathematical understanding and achievement (Boaler, 2016). To understand the diverse achievement levels of students, it is important to consider students' mindset regarding their achievement. Mindset beliefs refer to the beliefs students hold about their ability or the ability of others to learn (Dweck, 2006). This view of intelligence "profoundly affects the way you live your life" (Dweck, 2006, p. 6). Students' beliefs regarding their intelligence can often be seen in the attitudes they display during academic tasks. According to Dweck (2006), a person with a fixed mindset, or an *entity theory of intelligence*, believes that one is born with intellectual and academic abilities and that teachers and students can do little to change the amount of intelligence a student possesses. A fixed mindset can lead to less resilience, grit, effort, confidence in one's ability, and, ultimately, to low achievement (Dweck, 2006). However, a growth mindset, or an *incremental theory of intelligence*, is the belief that intelligence can be developed. For example, Dweck (2006) found that a teacher with a growth mindset believes each student can experience academic success and thus, uses curriculum and instruction that supports all learners. Growth mindset has also been related to high levels of motivation and resilience (Dweck, 2006). Furthermore, students with a growth mindset find value in learning from mistakes and strive to develop their intelligence (Boaler, 2016).

Boaler (2016) has taken Dweck's (2006) research on mindset and applied it to learning mathematics. In so doing, she coined the term *math mindedness* to define a student's mindset in the mathematics classroom. The field of mathematics has a deep history of a fixed mindset; it is a common belief that some students are not mathematically inclined and that there is little that can be done to become successful math students (Boaler, 2016; Dweck, 2006). These fixed mindset

beliefs have become a multi-generational problem which gravely affects mathematical achievement (Boaler, 2016). Recognizing these patterns is an important step toward ending the cycle of low mathematics achievement because it promotes a growth mindset among all stakeholders in education—students, parents, teachers, and administration. Math mindedness and mindset beliefs greatly affect students' attitudes toward learning.

In addition to mindset, religion and spirituality have been found to motivate students and increase academic achievement (Claro & Paunesku, 2014; Jeynes, 2003, 2010; Messemer, 2007). A historical analysis of the role of God and goodness in United States public education revealed a transition from a sense of Protestant-based religious morality to the current atmosphere of a complete and total separation between church and state. Leopold and Juniu (2008) found that teachers who do not educate the whole child, including spiritual elements, are failing to address an important environmental factor which impacts student growth and development. Students' religiosity has also been shown to increase academic achievement and lower the achievement gap for underrepresented students (Jeynes, 2003, 2010). Acknowledging the importance of religiosity is an important, yet often neglected, component of educating the whole child.

Problem Statement

Growth mindset and religiosity as separate constructs have been shown to increase student achievement (Blackwell et al., 2007; Boaler, 2011; Claro et al., 2016; Claro & Paunesku, 2014; Jeynes, 2003, 2010; Messemer, 2007). The potential connection between these two sets of belief systems has not been investigated. This research gap results in interesting questions regarding a possible relationship between the two sets of beliefs. A hypothesis which investigated whether or not students with a strong religious belief system and growth mindset have higher mathematical achievement deserves to be pursued. This mixed methods dissertation

study investigates the potential linkages between religiosity, mindset, and math achievement. First, a quantitative survey analysis measured relationships between variables followed by a qualitative study component which examined how students' mindset interacts with their religiosity and how these constructs affect their mathematical academic achievement.

Nature of the Study

The research design for this dissertation study was a mixed method, non-experimental, self-administered, and cross-sectional survey with a qualitative component of follow-up focus groups interviews. This study was informed by a partial version of Bronfenbrenner's bio ecological model which states that all the components of an individual's environment are significant and contribute to the growth and development of the individual (Bronfenbrenner & Morris, 2006). A full or mature version of the bioecological model includes process, person, context, and time. This dissertation's focus is process and person; context and time are not fleshed out in this study.

Research Questions

1. What, if any, relationship exists between mindset, religiosity, and math achievement among high school students?

2. Can secondary student math achievement be predicted by mindset and religiosity?

3. How do students believe their environments have contributed, if at all, to their religiosity and mindset?

4. To what extent do students report that religiosity and mindset impact math achievement?

Hypotheses

> **Research question 1.** Null hypothesis: There is no relationship between a student's religiosity and mindset.

> Alternate hypothesis: There is a relationship between a student's religiosity and mindset.

> **Research question 2.** Null hypothesis: Religiosity does not predict a student's mathematic achievement and mindset does not predict a student's mathematic achievement.

> Alternate hypothesis: Religiosity does predict a student's mathematic achievement and mindset does predict a student's mathematic achievement.

> **Research questions 3 and 4.** Due to the discovery nature of qualitative research, no hypothesis was imposed on the participants.

Research Objectives

The objective of this research project was to examine if a relationship existed between a student's mindset and religiosity. If a relationship was found, then a multiple linear regression would have been used to identify whether there was an interaction effect between religiosity, mindset, and math achievement. A qualitative component of focus groups or interviews added a human element to the study. The objective of this qualitative component was to understand how students understand their mindset and religiosity working together, if at all, and then how these constructs have affected their math achievement.

Purpose

The purpose of this cross-sectional survey research study was to analyze whether a relationship existed between the motivational framework of mindset and the faith based religious construct of religiosity in high school seniors who attended parochial high schools in the

Midwest region of the United States. If a relationship between mindset and religiosity was identified, the researcher would have analyzed whether students' religiosity and mindset could be used to predict mathematics achievement. Follow-up interviews were conducted after survey data had been recorded and analyzed. In these interviews, students were grouped based upon scores on high religiosity and growth mindset, high religiosity and fixed mindset, low religiosity and mixed mindset. The interview protocol inquired about environmental factors that students believed led to their religiosity and mindset views and if they believed either of these constructs influenced their math achievement.

Conceptual Framework

A person's environment plays a crucial role in the growth and development of the person. Bronfenbrenner's bioecological model is a useful conceptual framework for examining the mindset and religiosity of adolescents and their impact on math achievement. Bronfenbrenner's theory stated that to understand the development of a child, it is necessary to understand the environmental factors which affect the child. Bronfenbrenner and Morris's (2006) model was chosen for the conceptual framework of this dissertation because the model is based on the interconnectedness of all the parts of an individual's environment and on how those parts can impact development. Although Bronfenbrenner's model does not explicitly discuss mindset, mindset attitudes and beliefs are established and reinforced in every part of a student's environment. Based on Bronfenbrenner's model, both mindset, although not directly part of the model, and religiosity have profound impact on individuals and cannot be divorced from the way they holistically view and interpret the world. This conceptual framework is discussed in more detail later in this manuscript.

Definitions of Terms

This dissertation study has three variables: math achievement, religiosity, and mindset. The dependent or outcome variable was math achievement. Math achievement was measured by the ACT math subtest score, which every student in the population had taken (ACT, 2018). The ACT, a standardized test, is usually taken by students in their junior year of high school in order for colleges to measure and judge academic achievement through high school. Using this score removes school, teacher, and course bias and measuring error that would have occurred if local measures like grades were used.

Religiosity. In this study, religiosity, an independent or predictor variable, was defined as a measure of a student's attitude towards God and religion. Francis, Brockett, and Village (2014) found attitudinal measures of religiosity are an advanced measure because they "offer a particularly fruitful basis for coordinating empirical inquiry into the correlates, antecedents, and consequences of religiosity across the life span" (p. 3). Attitudinal measures of religiosity are attractive for four main reasons (Francis et al., 2014). First, attitude towards religion provides a more conceptual view of religion, as compared to behaviors and opinions which can be more volatile. "To assess attitude toward religion is to get close to the heart of religion in an individual's life" (Francis et al., 2014, p. 3). Second, "attitudes provide a purer measure of religion than either beliefs or practices" (Francis et al., 2014, p. 3). Attitudes represent a bigger picture of religion than divisions between denominational practices which can be divisive. Third, the psychological study of religions has been built on well-established psychological techniques for scaling and assessing attitudes. Fourth, attitudes can be consistently measured over a wide age range while measuring beliefs develop and change over a life span. Due to this stability of attitudinal measures, a cross sectional survey is an appropriate

measure of students' religiosity. An attitudinal measure is also appropriate under

Bronfenbrenner's (2006) bioecological model because attitudes are developed through a lifetime

of interactions between students and their complex multi layered environment.

Mindset. The second independent or predictor variable is mindset. Dweck (2000)

developed the concept of growth mindset versus fixed mindset to describe student beliefs on

their ability to learn. A growth mindset is also referred to as an incremental view of intelligence;

a belief that new material can be learned through grit and hard work (Dweck, 2000).

Conversely, a fixed mindset, also known as an entity theory of intelligence is the belief that a

person has a limited number amount of learning potential (Dweck, 2000). A student's mindset is

a crucial factor in determining students' academic success (Claro & Paunesku, 2014). Boaler

(2013) applied Dweck's (2000) mindset theory to learning mathematics, thus coining the term

math mindedness to refer specifically to students' mindset regarding their mathematics

achievement. In this dissertation study, students' mindset was measured using Dweck's (2000)

Measure of Implicit Theories of Intelligence Scale.

Assumptions

The two surveys and the measure of math achievement used in this dissertation study

have robust validity evidence. Dweck's (2006) measures of mindset are considered the gold

standard of surveys to measure mindset and have been used as mindset measures in hundreds of

studies, including a nationwide study of the relationship between mindset and achievement of all

tenth-grade students in Peru (Claro & Paunesku, 2014). Measures of religiosity are frequently

found in nursing and health related studies as they relate to patients coping with life threatening

illnesses. The National Institute for Health Care Research (NIHR) and the leading health care

researches from major United States Universities have been the key researchers in developing,

testing validity and reliability, and publishing surveys that measure religiosity (Hill & Hood, 1999). The Astley-Francis Scale of Attitude toward Theistic Faith (AFS) was chosen as the measure of religiosity for this dissertation study (Francis et al., 2014). The AFS assesses the attitudinal dimensions of religion within a multi-faith context and has been shown to be a valid measure (Francis et al., 2014).

Limitations

Limitations for this study are found in the convenience sample of the population. By selecting participants who had proof of parental consent and then gave personal assent could have limited students who did not have the opportunity to have a parent sign the form or who forgot to bring the sheet to school the day of the survey. The convenience sample also limited participation to any student who was absent the day the survey was given. This sampling could have made it difficult for specific groups to take part of the survey. Convenience sampling makes results biased and limits the power to generalize the results to the entire population.

Another limitation to this study was the lack of public-school districts or schools willing to participate. Public school districts in the same geographical region did not give permission to administer this survey to students because of the religious nature of the topic and fear of mixing church and state. To be able to generalize this study to a more diverse group of high school seniors, the population would need to include public, private, and parochial schools.

Scope and Delimitations

This study was delimited to 12th grade students at two parochial high schools in the Midwest region of the United States. The original intent of the study was to have three high schools participate in the study, however, only two schools completed the study. The third school backed out of the study and the reasons are discussed later in chapters 3 and 4.

Significance

Society, schools, and students will potentially benefit from this study. Society benefits by adding to both mindset and religiosity literature. Researchers benefit from expanding the research on student success in areas of great need (i.e., math). Parochial schools could benefit from better understanding how the religious attitudes and mindset of students affect academic achievement. Potential benefits could include a teacher in-service seminar to area Lutheran high schools explaining the relationship between educational motivational beliefs of mindset and student's attitude towards religion. If religiosity and mindset work together to drive academic achievement, then teachers could incorporate both mindset and religious activities into their disciplines. Through focus group interviews, the individual students can benefit from self-reflection, causing them to think about how their environment has directly impacted their attitudes toward religion and their attitudes towards how they learn (mindset) and how both impacts their achievement.

Another potential benefit could be to inform parents of young students how important a child's environment is while they are developing mindset and religious beliefs. Parental choice and voucher programs are growing and providing families an opportunity to consider sending their students to non-public schools. A relationship between religiosity and growth mindset could be used to promote achievement in private religious education. Furthermore, this study would add to the current literature on both mindset theory and religiosity. Mindset and religiosity have separately been shown to increase academic achievement and could be even more powerful if a relationship between the two constructs exists.

Summary and Transition

Bronfenbrenner's bioecological model is the conceptual framework for this dissertation study. According to Bronfenbrenner and Morris (2006), understanding the students' layered environmental factors can affect the growth and development of students. Environmental factors and proximal processes influence students' as they develop their beliefs attitudes about constructs that effect their education. In this mixed methods dissertation study three variables were considered: academic achievement (measured through the math subsection of the ACT), religiosity (a measure of students' attitude towards religion), and mindset (students' beliefs about their ability to learn). This study used follow-up interviews/focus groups to further understand the role of these variables in the constructs under investigation. The goal of the research was to determine whether religiosity and mindset are similarly developed through environmental factors and what, if any, impact religiosity and mindset have on math achievement.

This introduction is followed by four chapters, which form the dissertation study. Chapter 2 explains the conceptual framework of this study, contains a review of the literature on mindset theory and religiosity, as well as a review on the methodological literature that has previously studied these topics. Chapter 3 describes the methodological design for this study. Chapter 4 discusses data analysis and study results. Chapter 5 concludes the dissertation with a discussion and summary.

<center>**Chapter 2: Literature Review**</center>

Introduction

Adolescent students experience many changes throughout high school. They are transitioning from childhood to adulthood. Significant growth and development occur in multiple domains: physical, social, emotional, and academic. While experiencing these changes, students are immersed in environments which shape the way they interpret the world around them. Two significant belief systems through which students see the world are motivational beliefs and religious beliefs. These belief systems help adolescents define themselves and their place in the world.

Dweck's (2006) mindset theory, the framework of motivational beliefs considered in this dissertation study, describes a continuum from a fixed mindset to a growth mindset. *Mindset beliefs* are the foundation of how students view their capacity to learn and develop the skills necessary to be successful. Students with a *growth mindset* believe that intelligence is malleable and that they can face challenges, overcome them, and succeed through perseverance and hard work. In contrast, students with a *fixed mindset* do not believe it is possible to increase skills and knowledge. This mindset can lead to failure and a lack of grit and perseverance in academic pursuits (Dweck, 2006). Students' mindsets act as a filter through which they perceive school and the world. Through the lens of a growth mindset, students may welcome changes and challenges and believe they have the ability to try new things and be successful. Conversely, students with a fixed mindset may fear challenges and lack the persistence necessary to be successful.

A framework of religious beliefs is another lens through which adolescent students view and perceive their changing environment. Painter (n.d.) contended that religion feeds the soul,

and it "immediately discerns and appropriates the truth according to its needs" (p. 59). Students should not ignore the needs of their soul. Practicing religion is a transforming experience that takes external practices (such as religious texts, churches, prayer, meditation) and, by nurturing the soul, turns the external internal and embodies a person's innermost thoughts and feelings (Painter, n.d.). This filtering of the external world transforms a person's consciousness, reinforcing the significance of religion in that person's life. Thus, religiosity can act as a filter through which students view the world. While some researchers define religiosity broadly as a measure of religious beliefs, this study understands religiosity as a measure of students' attitudes towards religious beliefs (Francis et al., 2014).

Adolescent students use many lenses to interpret their changing environment. These lenses may significantly impact their lives and influence both small and large decisions they make. Many researchers have studied the motivational beliefs (i.e., mindset), and others have studied the impact of religious beliefs (i.e., religiosity). In this dissertation study, the researcher seeks to examine whether or not there is a relationship between the mindset, religiosity, and mathematical achievement of adolescent students.

Study topic. There is a substantial body of literature on mindset and religiosity as separate entities. Religiosity and mindset have individually been linked to academic achievement (Blackwell et al. 2007; Boaler, 2011; Claro & Paunesku, 2014; Claro et al., 2016; Jeynes, 2003, 2010; Messemer, 2007). However, existing studies have not looked for a relationship between mindset, religiosity, and math achievement; therefore, further investigation should be done to see if a relationship exists between these constructs. The purpose of this mixed methods study was to investigate whether or not a relationship exists between religiosity, mindset, and math achievement. A survey was used to separately measure mindset and religiosity. Mathematics

achievement was measured by the scale score on the math section of the American College Testing (ACT). The researcher used follow-up focus group interviews to look for why a potential relationship exists between students' attitudes toward religion and the degree to which they are driven by their mindset. Focus group interviews had students reflect on environmental factors that have led to the development of their mindset and religiosity.

 Context. The purpose of this dissertation study was to examine if a relationship exists between mindset and religiosity and to determine whether those constructs affect math achievement. The sample consisted of seniors from two diverse parochial high schools in the United States' Midwest region. The student body at one of the schools was diverse in many categories, including race, ethnicity, gender, socioeconomic status, family background, culture, and family educational attainment. The student body had an enrollment of approximately 800 students in Grades 9 to 12 for the 2017–2018 school year. Approximately 50% of the students qualify for government vouchers under the state's choice programs, and the other 50% pay tuition. Approximately 75% of the student body receives financial aid from state-funded vouchers or scholarships (School 1, n.d.). This mix of middle- to upper-class tuition-paying students and students living in poverty who qualify for vouchers provides a unique element of diversity. This school is also geographically diverse, with students from urban and suburban parts of the city.

 The other school was smaller, located in the suburbs of the same city, and had a student body of approximately 320 with approximately 90 seniors. Both of these schools were part of the choice program and were diverse in gender, socioeconomic status, and family educational attainment. However, unlike the large urban school, this school was predominately white and had very little racial or ethnic diversity. While both of these parochial high schools teach religion

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courses and have daily chapel/assembly, not all of the student body have the same religious beliefs as it is not a requirement of the schools to adhere to any religious organization or belief system. While the sample has some religious diversity, a majority of students come from a conservative Protestant background.

Bronfenbrenner's bioecological model was a useful conceptual framework for examining the mindset and religiosity of adolescents and their impact on math achievement (Bronfenbrenner & Morris, 2006). Bronfenbrenner's theory states that in order to understand the development of a child, it is necessary to understand the environmental factors which affect the child. Bronfenbrenner and Morris's (2006) model was chosen for the conceptual framework of this dissertation because the model is based on the interconnectedness of all the parts of an individual's environment and on how those parts can impact development. Although Brofenbrenner's model does not explicitly discuss mindset, mindset attitudes and beliefs are established and reinforced in every part of a student's environment. Based on Bronfenbrenner's model, both mindset, although not directly part of the model, and religiosity have profound impact on individuals and cannot be divorced from the way they holistically view and interpret the world. This conceptual framework is discussed in more detail later in this chapter.

Significance. Society, researchers, teachers, administrators, and students will benefit from this study. Society benefits by adding to both mindset and religiosity literature. Researchers will benefit from expanding the research on student success in math, which is an area of great need (Boaler, 2011). Parochial schools could benefit from better understanding how the religious attitudes and mindset of students affect academic achievement. Potential local benefits could include a teacher in-service seminar to area Lutheran high schools explaining the relationship between educational motivational beliefs of mindset and student's attitude towards religion. If

religiosity and mindset work together to drive academic achievement, then teachers could incorporate both mindset and religious activities into their disciplines. Through focus group interviews, the student participants benefited from self-reflection, causing them to think about how their environment has directly impacted their attitudes toward religion and their attitudes towards how they learn (mindset) and how both of these impacts their achievement.

Parents of young students can also benefit from learning about the importance of a child's environment while they are developing mindset and religious beliefs. Parental choice and voucher programs are growing and providing families an opportunity to consider sending their students to non-public schools (Wisconsin Parental Choice Program Payment and History, 2018). A relationship between religiosity and growth mindset could be used to promote achievement in private religious education. Furthermore, this study would add value to the current literature on both mindset theory and religiosity. Mindset and religiosity have separately been shown to increase academic achievement and could be even more powerful if a relationship between the two constructs exists.

Problem statement. Students enter high school with a wide range of mathematical understanding and achievement. To understand the diverse achievement levels of students, it is important to consider students' mindset regarding their achievement. Mindset beliefs refer to the beliefs students hold about their ability or the ability of others to learn (Dweck, 2006). This view of intelligence "profoundly affects the way you live your life" (Dweck, 2006, p. 6). Students' beliefs regarding their intelligence can often be seen in the attitudes they display during academic tasks. According to Dweck (2006), a person with a fixed mindset, or an *entity theory of intelligence*, believes that one is born with intellectual and academic abilities and that teachers and students can do little to change the amount of intelligence a student possesses. A fixed

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mindset can lead to less resilience, grit, effort, confidence in one's ability, and, ultimately, to low achievement (Dweck, 2006). However, a growth mindset, or an *incremental theory of intelligence*, is the belief that intelligence can be developed. For example, Dweck (2006) found that a teacher with a growth mindset believes each student can experience academic success and thus uses curriculum and instruction that supports all learners. Growth mindset has also been shown to relate to high levels of motivation and resilience (Dweck, 2006). Furthermore, students with a growth mindset also find value in learning from mistakes and strive to develop their intelligence (Boaler, 2016).

Boaler (2016) has taken Dweck's (2006) research on mindset and applied it to learning mathematics. In so doing, he coined the term *math mindedness* to define a student's mindset in the mathematics classroom. The field of mathematics has a deep history of a fixed mindset (Boaler, 2016; Dweck, 2006). It is a common belief that some students are not mathematically inclined and that there is little that can be done to become a successful math student. These fixed mindset beliefs have become a multi-generational problem, which gravely affects mathematical achievement (Boaler, 2016). Recognizing these patterns is an important step toward ending the cycle of low mathematics achievement because it promotes a growth mindset among all stakeholders in education—students, parents, teachers, and administration. Math mindedness and mindset beliefs greatly affect students' attitudes toward learning.

In addition to mindset, religion and spirituality have been found to motivate students and increase academic achievement (Claro & Paunesku, 2014; Jeynes, 2003, 2010; Messemer, 2007). A historical analysis of the role of God and goodness in United States public education reveals a transition from a sense of Protestant-based religious morality to the current atmosphere of a complete and total separation between church and state. Leopold and Juniu (2008) found that

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teachers who do not educate the whole child—including spiritual elements—are failing to address an important environmental factor which impacts student growth and development. Religiosity of students has also been shown to increase achievement and lower the achievement gap for underrepresented students (Jeynes, 2003, 2010). Acknowledging the importance of religiosity is an important, yet often neglected, component of educating the whole child.

Constitutionally, public schools cannot teach religion. However, students and parents who value religious education can find private parochial schools where both religiosity and growth mindset can be taught. This is especially relevant in areas where vouchers or parental choice programs are available to pay for children to attend their school of choice.

Growth mindset and religiosity as separate constructs have been shown to increase student achievement (Blackwell et al., 2007; Boaler, 2011; Claro et al., 2016; Claro & Paunesku, 2014; Jeynes, 2003, 2010; Messemer, 2007). The potential connection between these two sets of beliefs systems has not been investigated. This research gap results in interesting questions regarding a possible relationship between the two sets of beliefs. The researcher will investigate whether or not students with a strong religious belief system and growth mindset have higher mathematical achievement deserves to be pursued. In this quantitative dissertation study, the potential linkages between religiosity, mindset, and math achievement will be investigated. In a small qualitative component of the study, the researcher will examine how students' mindset interacts with their religiosity and how these constructs affect their mathematical academic achievement. Students will reflect on environmental factors that contributed to their mindset and religiosity.

Organization. A literature review was conducted to inform this dissertation study. First, Bronfenbrenner's bioecological model was used to guide the collection, analysis, and interpretation of data. This model is discussed further in this chapter and also in Chapter 3, where the researcher described how it informed this study's data collection and analysis. Second, this chapter includes a review of the literature on mindset, religiosity, and mathematical academic achievement; it is summarized and presented in the form of eight claims. Third, this chapter presents a thorough review of the methodological literature which was conducted to identify the methods researchers have used to study these topics. Fourth, this chapter includes a review of the methodological issues in the literature, focusing on the strengths and weaknesses of the methodologies used from research. Fifth, research findings are synthesized, and major findings from the literature and methodologies are noted. Sixth, a critique of previous reviews examines the evidence, claims, and major concepts from the literature. This study will add to the literature by examining whether a relationship exists between religiosity and mindset. Finally, a summary of the previous sections is provided to conclude Chapter 2.

Conceptual Framework

This research study is based on a partial version of Bronfenbrenner's bioecological model of human development. It is an evolving scientific theory, which Bronfenbrenner and Morris (2006) defined as a "phenomenon of continuity and change in the biopsychological characteristics of human beings, both as individuals and as groups" (p. 793). In other words, in order to understand the development of a child, it is necessary to understand significant factors within the child's environment. Bronfenbrenner separated or layered environmental factors into three main divisions: the microsystem, exosystem, and macrosystem. The microsystem is the first environmental layer that children experience, which consists of direct experiences with

family, school, health services, peers, and religious institutions. Children and adolescents spend most of their time within this microsystem layer. High school seniors are at a crucial juncture where they are transitioning into other environmental layers of exosystem and macrosystem. This dissertation study mostly focuses on students' microsystem layer.

The overarching theme of this conceptual framework is the powerful impact of the environment in the development of an individual. The totality of an individual's environment is a major influence on human development. The following diagram depicts Bronfenbrenner's bioecological model of human development. The two-way cross-dimensional arrows are the most significant part of this conceptual framework. Bronfenbrenner and Morris (2006) highlighted that an individual's environment is crucial to understanding growth and development. This interconnected environment includes people, objects, symbols, culture, and belief systems in many different layers (see Figure 1).
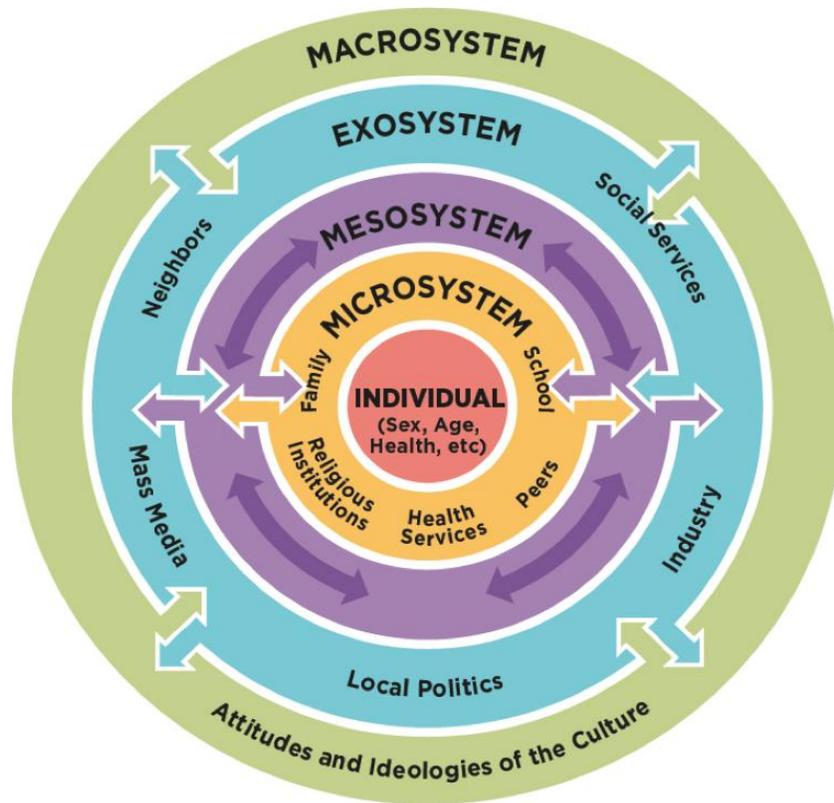
Figure 1. A visual depiction of Bronfenbrenner's Bioecological Model. (Untitled Illustration of Bronfenbrenner's Bioecological Model, n.d.)

The bioecological model consists of four defining features within each environmental layer: process, person, context, and time. Each of these works together in integrative and interdisciplinary ways to aid researchers in the study of childhood and adolescent development to enhance policies, practices, and programs. Bronfenbrenner and Morris (2006) claimed, "in science, a good theory is one that can be translated into corresponding research designs that match the defining properties of the theory" (p. 796). The bioecological model does, in fact, meet that criterion for a "good theory" by allowing researchers to understand the effect of the environment on the process of human development.

The core of this bioecological model is process (which the framework calls proximal process), referring to the interactions between an individual and the environment. These

interactions, processes, significantly impact the growth and development of students. In addition to process, the bioecological model includes person, context, and time as factors that contribute to individual development.

Person, the second defining feature of Bronfenbrenner and Morris's (2006) bioecological model, is defined by three biopsychological characteristics that shape his or her future development: dispositions, resources of ability, and demand characteristics. A person's disposition works with developmental domains and allows proximal processes to occur. Dispositions are similar to personality traits, such as cheerful, thoughtful, hesitant, and aggressive. Religiosity and mindset are also dispositions. Bioecological ability resources include experiences, knowledge, and skills which affect proximal processes, and these resources are activated through an individual's dispositions. Demand characteristics are apparent by looking at an individual and include age, gender, skin color, and personal appearance. Individuals grow and develop in different areas or domains throughout their lives. This growth and development is greatly affected by dispositions, ability resources, and demand characteristics.

The third defining feature of the framework, context, refers to a person's interactions with objects and symbols in the environment. The final element is time, which gives the framework its power. Time can be considered past, present, and future for developmental themes. For this dissertation study, only a partial version of the bioecological model is used. Context and time and not fleshed out according to this model.

These four features (process, person, context, and time) are key components of the propositions of Bronfenbrenner's bioecological model (Bronfenbrenner & Morris, 2006). Proposition 1 defines proximal process as a series of progressively more complex interactions between the persons, objects, and symbols in a subject's immediate environment or microsystem.

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For a process to become a defining characteristic of a person, it must occur on a regular basis over extended periods of time. Proposition 2 is the moderating factors of first proposition and include the joint functioning of a person's characteristics and the environment in which development occurs. Both propositions are interdependent and can be subjected to empirical testing.

Religiosity, or a lack thereof, is found within each layer of an individual's environment. However, most formal religious beliefs are introduced in a child's microsystem and grow and develop through the outer layers. Therefore, religiosity includes all four elements of process, persons, context, and time. Religiosity is a process because it influences the way an individual interacts within their environment. It is also related to time because religion needs to be practiced regularly in order to substantially affect a person's development (Bronfenbrenner & Morris, 2006). Adherence to a specific belief system impacts students' environments and, therefore, their development.

Although not specifically mentioned in the bioecological model, mindset can also be understood with respect to Bronfenbrenner's conceptual framework. A person's mindset is closely tied to the environment and culture in which he or she was raised (Dweck, 2006). Therefore, a student's mindset is the result of dispositions, resources of ability, and demand characteristics which, in turn, affect behaviors. Traditionally, stakeholders in mathematics education have fixed mindsets. This belief has resulted in declining math achievement at all levels of mathematics education in the United States (Boaler, 2006). The belief that math can only be learned and mastered by some seems to be thoroughly engrained in many families and has become a normalized part of a student's environment. This fixed mindset has led to the United States falling behind other countries in math achievement (Boaler, 2006). One way to

reverse declining mathematics scores is to eradicate stakeholders' fixed mindset toward mathematics (Boaler, 2006).

It is important to examine whether a relationship exists between mindset, religiosity, and mathematics achievement. Bronfenbrenner's bioecological model suggests that these elements impact the growth and development of an individual because they impact the individual's environment. Consequently, because religion and mindset are fundamental environmental factors which affect one's belief systems, it is necessary to embrace them as a part of the life and development of students. Because academic achievement is the primary goal of education, both mindset and religiosity will be measured in regard to their relationship to mathematics achievement.

Review of Research Literature

Current and past literature regarding mindset, religiosity, and their relationship to math achievement was studied. Notes from these studies were recorded in a literature matrix which was further analyzed for common themes. The literature review can be summarized in eight claims: mindset is a form of student motivation; mindset theory as it applies to mathematics is called math mindedness; mindset is malleable; mindset leads to grit and resilience, which creates persistence in academic achievement; student mindset can predict academic achievement; the mindset of all stakeholders affects student achievement; religion and spirituality cannot be separated from a student's development; and religion and spirituality impact student motivation and achievement.

Mindset as a form of student motivation. Mindset is one branch in the larger field of achievement motivation. Mindset considers how a student perceives and handles obstacles and challenges in the learning process. Motivated students push themselves to work through

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challenges and learn, while unmotivated students have little desire or drive to learn anything new. Yeager and Dweck (2012) found motivation or a lack thereof to be determined by a student's mindset. Blackwell et al. (2007) found that students with an incremental theory of intelligence are more motivated to learn than students with a fixed mindset. Blackwell et al. (2007), who tested mindset as one of four motivation constructs, found that students with an incremental theory of intelligence showed greater academic achievement when compared to other motivational factors (learning goals, positive beliefs about effort, causal attributions, and strategies). For students to be motivated, teachers, students, and the curriculum need to work together to drive achievement (Miller, 2002). Thus, according to Brofenbrenner's model, student motivation and mindset are student dispositions which influence proximal processes. Therefore, religiosity and mindset affect how students interact with their environment, interpret their experiences, and make sense of these experiences.

Math mindedness. When mindset theory is applied to mathematics, it is called math mindedness. Boaler (2014) stated that the implications of mindset theory on mathematics is profound. Mathematics in the United States has been plagued with fixed mindset beliefs about ability (Boaler, 2013). This fixed mindset mentality has the potential to damage students' confidence and motivation to pursue and be successful in mathematics. Fixed mindset beliefs are frequently communicated to students, thus damaging students' ability to engage in learning opportunities and growth throughout their lives. Boaler (2013) has documented how Dweck's (2006) mindset theory is beginning to change fixed mindsets in mathematics. In fact, the mindset revolution is reshaping math education by creating math mindedness in students at all levels (Boaler, 2013). Teachers and students that have accepted mindset theory and math mindedness have had transformational learning experiences that have shaped their view of education.

The nature of mathematical ability has been disputed in research and practice. Although Bartosova (2014) refuted the idea that math ability is "given" to some and not to others, the definition of 'ability' is a continuing debate. The term ability is defined differently in the field of mathematics, which has led to confusion and often the promotion of a fixed mindset. Traditionally, ability is defined as a set of mental qualities, like intelligence, that are necessary for success in an activity or field. In this definition, ability is considered a limited quantity to given to some. Boaler (2014), though, defined ability as a quality that changes over time. These two definitions of ability highlight the distinction between a fixed and growth mindset. Accepting this definition of ability in regard to mathematics equates to math mindedness, which suggests that mathematics ability is not innate (Boaler, 2014).

The primary belief of math mindedness is that all students have the potential to be academically successful in the field of mathematics. In order to promote this thinking among students, according to Bronfenbrenner's model, this belief needs to be embedded in their school and home environment. Boaler (1999) studied mathematical achievement (defined as the ability to use mathematics outside the classroom in a real-world setting) based on the constraints and affordances given to students during classroom instruction and found that students can successfully complete math classes and yet not learn mathematics, thereby not achieving mathematically. The fact that students can successfully complete math classes and yet not learn mathematics reveals an important distinction: there is a difference between doing and learning mathematics. Doing mathematics involves class time, homework, and assessments. Learning math involves more than just doing—understanding, applying, analyzing, evaluating, and creating are necessary to learn math. In response to this disconnect, mindset theory and math mindedness work to connect the doing and the learning of mathematics. Mathematics classrooms

need to ensure that students' success in the classroom is transferable to math applications outside the classroom.

Math mindedness provides students with a foundation for a growth mindset. A classroom with a focus on math mindedness creates a learning space characterized by open-ended tasks and the opportunity for struggle and growth. Furthermore, Good, Rattan, and Dweck (2012) connected mindset with a sense of belonging in mathematics. To have a mentality of math mindedness, it is necessary for students to feel that they personally belong in the academic domain of mathematics. A growth mindset motivates students to successfully pursue higher level mathematics; the opposite is also true, when students do not have a sense of belonging to the field of mathematics, which is necessary for math mindedness, they opt out of math courses—even if math achievement is high (Good et al., 2012). Thus, a student's sense of belonging to a specific environment and the connection they make to the subject becomes part of the student's mindset toward the environment and the subject.

Mindset is malleable. While many believe ability is innate, mindset can be changed through effort and experiences (Dweck, 2006). In line with that proposition, Yeager and Dweck (2012) further defined mindset as implicit theories of the malleability of human characteristics. Mindset, then, is a personal disposition that influences the development of the beliefs about the capabilities of a person to learn and grow. Braun (2014) showed that when teachers and students accept the reality of malleable intelligence and the malleable nature of learning, it eradicates the fixed mindset that mathematical success is only for a few. Instead, such students and teachers foster math mindedness.

Mindset theory is based on brain research that has confirmed malleability or the potential of the brain to change and grow. Boaler (2013), for example, reviewed research on brain

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plasticity and found that it is related to mindset and how mindset is communicated to students. The implications of adopting an approach based on the malleability of the brain are significant: "when students undertake an intervention to move them from a fixed to a growth mindset they immediately start performing at higher levels in school" (Boaler, 2013, p. 144). Moreover, Rattan, Savani, and Chugh (2015) even found that mindsets are malleable in the same way that intelligence is malleable. They also found that moving students' mindset toward math growth is a significant factor in achievement. All students can increase their academic motivation by shifting their mindset from a fixed perspective toward a growth mindset.

This shift is so effective because a growth mindset supports student resilience in academic settings—they know they have the ability to learn new things and, thus, can increase their intelligence. One of the primary ways to achieve this is through a mindset intervention, which are activities that teach children about malleability theories. After such interventions, students are more motivated to engage in activities that will allow them to struggle and grow. This struggle and growth is a necessary element of a growth mindset and math mindedness, resulting in academic growth. For example, Dweck (2006) measured students' mindset, conducted a mindset intervention, which consisted of instruction about the brain's capacity to grow, and then retested mindset. She found that the mindset interventions led to a greater growth mindset. This finding is foundational for mindset theory because it shows that brain development is possible for all students. Without the malleability of the brain, a growth mindset would be unrealistic.

Building on the research establishing the malleability of intelligence as a key component of mindset, other researchers have found myriad benefits of a growth mindset in a school setting. For example, Aronson, Fried, and Good (2002) showed that when students are taught to develop

a growth mindset, they report "greater academic identification and enjoyment, higher grades, and, perhaps, less stereotype threat" (p. 117). Stereotype threat occurs when minority groups are told they are less likely to be successful in specific fields, such as mathematics. Then, due to low expectations, negative feedback, and lack of support, some students within that minority group do not succeed, providing further evidence which enhances the stereotype threat. Beliefs in the malleability of intelligence and a growth mindset seems to be a key in lessening the achievement and gender gap of students in mathematics and thus reducing or eliminating the stereotype threat. In addition to that specific benefit, Yeager et al. (2014) expanded research on the effects of malleability of intelligence beyond academic achievement and found that a growth mindset has positive effects on stress levels and health during adolescence, especially during times social adversity.

Mindset and academic persistence. Mindset leads to grit and resilience, which are necessary for academic persistence and achievement. Yeager and Dweck (2012) defined resilience as how students respond to challenges in school and life. Their quantitative experimental study showed that students' mindsets impact their academic and social resilience. They found that a fixed mindset undermines resilience in academic and social settings and that an incremental theory of intelligence creates resilience and grit.

Some studies have shown age can be a factor affecting students' classroom persistence. For example, Schmidt, Shumow, and Kackar-Cam (2017) studied whether age impacts mindset or persistence. Their experimental study used a control and a mindset intervention group. The mindset group was taught about pliability of the brain through a program called Brainology, while the control group had content area writing activities. They found no difference in students' persistence or feelings of control, skill, learning, or interest for seventh grade students in the

control and the intervention group. However, the ninth-grade mindset intervention group showed positive trends in persistence including control, skill, learning, and interest as compared to their peers in the control group. Overall, this researcher found that the high school students showed more persistence in their learning when they held a growth mindset.

In addition to this investigation of age, other researchers have examined the influence of situational factors. Boaler (1999, 2016) studied these factors by examining the relationship between situated learning and student resilience in the math classroom. Situated learning refers to content area learning in an authentic situation. In traditional math classes, students often do not learn to apply math in the real world. Math resilience and grit is created when students are given academic freedom and decision-making power when solving open-ended questions as opposed to teacher-directed textbook computation math. Contrary to that traditional approach, a growth mindset in mathematics is fostered when students are given the opportunity to learn math in authentic situations. In a similar study, Shen, Miele, and Vasilyeva (2016) found "that students' academic mindsets influence their interpretation of their math problem-solving experiences as well as their persistence on subsequent problem solving" (p. 51). This was measured in a two-part survey: the first part used Dweck's (1999) measure of mindset, and the second measured the amount of time students persisted in solving two math problems. These measures revealed that the malleability of academic mindsets leads to the potential for improving a student's persistence and grit in academic problem solving. Dweck (2006) commented, "we believe that implicit theories intervention had its striking effects because it changed the meaning of challenges—instead of challenges making students feel 'dumb,' the challenges offered a way to get smarter. This belief is crucial for promoting resilience" (p. 306). Resilience is a key characteristic of students with a growth mindset.

Student mindset can predict academic achievement. Student mindset often predicts academic achievement. Blackwell et al. (2007) found an incremental theory of intelligence intervention at the beginning of seventh grade predicted higher math scores at the end of eighth grade. This study showed that, regardless of achievement level, students who adopt an incremental theory of intelligence have a trajectory of greater achievement than students with a fixed mindset. Claro and Paunesku (2014) studied the relationship between mindset and achievement in a nationwide study of 10th-grade students in Chile and found that mindset more strongly predicts test scores than income. This is profound because the same study found that students with a low socioeconomic status (SES) are more likely to have a fixed a mindset than a growth mindset. Therefore, teaching children about the malleability of intelligence can have a significant impact on disadvantaged students and create a more equitable education system. Using the same data, Claro et al. (2016) found the relationship between students' mindset and achievement was equal for all students, including different demographics of race and SES. Students who had a growth mindset outperformed their peers with a fixed mindset in all tests run on different income levels. The most striking result of this study was that "students from low-income families (the lowest 10%) who had a growth mindset showed comparable test scores with fixed mindset students whose families earned 13 times more (80th percentile)" (Claro et al., 2016, p. 4). This suggests that a growth mindset toward learning can eradicate many of the academic deficits created by poverty. This is significant because a growth mindset has the potential to change the way students interpret their environments. This perspective shift has the potential to be transformative in terms of achievement.

Mindsets of all stakeholders affect student achievement. The mindsets of all stakeholders in education affect student achievement. Stipek, Givvin, Salmon, and MacGyvers

(2001) used surveys to study the relationship between a teacher's mindset and beliefs about mathematics and how students learn. The findings indicate that teachers' beliefs about mindset affect their educational practices. Rattan, Good, and Dweck (2012) studied a specific educational practice common among teachers with a fixed mindset and found that they were more likely to label a student as having low ability based on minimal testing results, comfort students with statements such as "it's ok, not everyone is a math student," and expect and require lower levels of math achievement. Such lowered standards, in turn, further perpetuate a fixed mindset among both teachers and students. Indeed, parents, teachers, and society are often guilty of fostering a fixed mathematical mindset. Contrary to that limited perspective, Gut, Reimann, and Grob (2013) discussed the "necessity of a contextualized view of children's academic achievement, which involves the simultaneous influences of child variables, family variables, as well as other exogenous variables" (p. 441). Mindset beliefs, whether growth or fixed, are significant academic variables that need to be considered in order to understand and foster student development. This view supports Bronfenbrenner's bioecological model: variables that determine students' mindset are found within students' environment.

Teachers and students need to take this growth mindset journey together. Sirois (2014) found a connection between an educator's mindset and the opportunities given students to achieve: "when the educators believe that everyone's ability to learn can grow and they provide the opportunities, students will achieve at high levels" (p. 8). People do not naturally learn in isolation; schools should be places where all learners struggle and grow together. In another study that examined the relationship between the mindset of teachers and students, Miller (2012) concluded that teachers must realize "all students can learn and progress, that achievement for all is changeable and not fixed, and that demonstrating to all students that they care about their

learning is both powerful and effective" (p. 7). Key stakeholders that support student learning need to lead the growth mindset journey and show that with hard work, perseverance, and effort, all are capable of learning.

Religion and spirituality are a significant component of environment.
Bronfenbrenner's bioecological model (Bronfenbrenner & Morris, 2006) includes religion and spirituality as part of a person's personal characteristics and environment; therefore, it is necessary to understand a student's religiosity in order to understand the student. Emmons and Paloutizian (2003) summarized the developments of the psychology of religion over the past 25 years. One significant development is that modern society has conceptualized religion and spirituality into different constructs. Spirituality, on the one hand, is difficult to define empirically because it focuses on a range experiences including religious, natural, and humanistic spirituality (Emmons & Paloutizian, 2003). The construct of religion, on the other hand, is based in traditions and covenants of a specific community of faith with shared sacred items and beliefs regarding morality. For example, Dollahite defined religion as a "covenant of faith community with teachings and narratives that enhance the search for the sacred and encourage morality" (as cited in Emmons & Paloutizian, 2003, p. 381). Podger, Mustakova-Possardt, and Reid's (2010) view is similar to those expressed by Bronfenbrenner and Morris (2006). A comprehensive ecological approach toward educational sustainability includes the growth and development in moral motives, such as a sense of identity, sources of one's sense of authority, sense of relatedness, and the meaning of life.

Indeed, moral and spiritual elements have always been central to an individual's environment. Jones and Sheffield (2009) made this clear in their historical account of God and goodness' role in public education. Plato theorized that the first formal educational experience of

an individual needs to be about the gods of a city. Although he proposed that the elite were able to find truth solely through reasoning, wisdom, and knowledge, he believed that the majority of people "need faith in and fear of the gods in order to subdue their passions and become good" (Jones & Sheffield, 2009, p. 5). Rousseau, however, starkly opposed Plato's views on God. Rousseau (as cited in Jones & Sheffield, 2009) said, "the educational object, then, is to preserve the healthy self-love—to prevent the development of pride and vanity" (pp. 5–6). Rousseau believed there was no place for God, faith, or religion in education and that students' passions needed to be carefully educated so they did not get corrupted. Still another approach is seen in the founders of public education in the United States, who held to a different fundamental truth regarding spirituality and education. They believed that "the survival of the American republic depended upon the morality of its people" (Jones & Sheffield, 2009, p. 7). This morality was steeped in Protestant religious understandings, which had ties to all aspects of the developing United States culture. Historically, religiosity was a foundational component of education in the United States (Jones & Sheffield, 2009). However, as United States culture changed over time, the importance and significance of religiosity also changed.

As the United States grew, its culture and ethics changed. For example, Daly (2009) discussed the impact of former President Bush's faith-based initiative on the constitutional separation of church and state. As a result of those initiatives, tax benefits and federal funds for education were given to religious schools in the form of vouchers. Daly (2009) contended, "If it becomes increasingly clear that faith-based helping methods are more effective, it is possible that the current barriers separating religious activity from public services will be lowered" (p. 46). Parochial schools provide education, a type of a faith-based helping method. Parochial schools

and public schools exist simultaneously in the United States in order to uphold laws separating church and state.

Even with constitutional law separating church and state, the government has not been able to completely separate itself from religion and the spiritual needs of United States citizens. Religion is a significant environmental component and thus affects the growth and development of students. The construct of religion is vast and multidimensional: there are many different religions with a wide variety of beliefs, narratives, and views on morality. Because of that multidimensionality, it is somewhat impractical for one study to encompass every possible manifestation of religiosity in modern American culture. Therefore, for this dissertation study, religiosity refers to the Christian Protestant views of religion.

Despite the central role of religion in the history of United States education, a striking disparity becomes apparent when considering the current state public schools. Romanowski and Talbert (2000) noted that American high school students can graduate with honors and never be confronted with a religious idea. This may send a message to students that religion and academics have no relationship. Moreover, most United States history books ignore the "role that faith and religion have played in the development of the United States" (Romanowski & Talbert, 2000, p. 134). This, however, is not an accurate view of history because faith and religion have significantly impacted the motivation and actions of people throughout United States history. In response, Romanowski and Talbert (2000) provided a strategy to combat this inaccuracy: "rather than fearing a religious presence in our schools, we need to reach out and embrace the religious dimensions of history and thereby enrich our understanding of humankind" (p. 136). Indeed, students may benefit from a change of environment that allows religiosity to be incorporated into schools. Leggo (2004) noted that schools and individuals need to embrace the "whole experience

of becoming human, acknowledging the ecological interconnections of the intellectual, creative, embodied, emotional, and spiritual identities that shape who I am and who I am becoming in the world" (p. 32). Students' religiosity is an important environmental factor to fully understanding student development.

One-way religiosity can be incorporated into schools is by infusing it into specific subjects where it naturally fits, and some studies have shown the benefits of religiosity in specific subject areas. For example, Leopold and Juniu (2008) found that students in health and physical education courses are searching for meaningful and purposeful lives through deep connections. Leopold and Juniu (2008) further stated that educators have the responsibility to fill these voids and nurture the frailties of the human soul that have long been ignored in public education. Fulfilling these responsibilities is necessary to educate the whole child.

In addition to its importance in education, another major component of religiosity is the impact it has on how a person conducts his or her life and the daily choices made surrounding moral and ethical values. Beyond engagement in specific subject areas, the whole person is also educated by "considering the development of critical moral consciousness as a critical disposition for sustainability" (Podger, Mustakova-Possardt, & Reid, 2010, p. 347). Students in late adolescence and early adulthood (this literature review does not consider young children as the focus of this study is on high school students) need the opportunity to think about and develop a moral framework from which to lead their lives. Incorporating these moral motives into the curriculum is one example of how religiosity has been incorporated into the education of young adult students. In the United States, private and parochial schools are able to freely incorporate religion into students' daily lives, while public schools cannot legally do so.

Religion and spirituality impact student motivation and achievement. Religiosity impacts students' view of education, including their type of mindset and degree of persistence. Derrico, Tharp, and Schreiner (2015) found "realistic optimism was an essential quality for student success and prolonged academic engagement; this perspective was often fueled by students' faith" (p. 317). Similarly, Rettinger and Jordan (2005) studied the relationship between religion, academic motivation, and cheating in college courses. Findings suggest that students who cheated were more grade oriented (a trait related to a fixed mindset) and that students who reportedly did not cheat or cheated less were more learning oriented (related to a growth mindset). Students with less motivation were more likely to self-report more frequent cheating. Furthermore, student religiosity was also correlated with cheating: students with higher levels of religiosity were less likely to report cheating and show a reduction in grade orientation or a fixed mindset. In addition, Mvududu and Larocque (2008) studied the relationship between faith, hope, and attitude toward statistics in a religious and a secular college. The students in the Christian college reported more hope, a more positive attitude, less anxiety, and more intrinsic religious motivation than the students at a comparable secular college. Consequently, greater intrinsic religious motivation was associated with a more positive attitude toward statistics (Mvududu & Larocque, 2008). They found that students who practiced religion reported less anxiety and had more motivation in statistics courses. These studies have shown that educating the whole person and not ignoring elements of religiosity can have positive academic implications for student development.

Those positive findings extend across multiple demographic groups, including historically disadvantaged ones. For example, religiosity was found to be a common factor in a small qualitative case study which linked spirituality to the achievement of African American

men in high-level mathematics courses (Jett, 2010). Each of the men spoke of their personal religious practices as being a key element and driving force of their successes in mathematics. Due to this similarity, Jett (2010) stated that "educators cannot allow ideologies that splinter spirituality from academic performance to thrive especially in the area of mathematics" (p. 332). Similarly, Messemer (2007) studied the influence of academic programs on the academic achievement of low-literate male inmates and found that the Christian group had a mean absenteeism rate of 16.2% with only 12% being for disciplinary reasons. The non-Christian group had a mean absenteeism rate of 27.5% with 26.5% being for disciplinary reasons. In reading, math, and language arts, both the Christian and non-Christian groups showed significant growth in all three categories; however, the Christian group grew 73.8% more in reading, 37.6% more in math, and 167.5% more in language arts than the non-Christian group. Religiosity, particularly Christianity, changed the inmates' attitudes toward their environment and increased their academic achievement.

In addition to those positive effects among the disadvantaged, religiosity also has been found to help close the achievement gap. In a meta-analysis of 28 quantitative studies, Jeynes (2010) measured elements that tried to close the achievement gap: religiosity, an intact family, and improved curriculum were found to be significant. Jeynes (2010) found that a personal religious faith, defined as personal belief and adherence to any religion, had the greatest impact in reducing the achievement gap for African American students. Previously, in a large longitudinal survey study of over 18,000 students, Jeynes (2003) found that religious students achieve at higher levels academically and outperform their less religious counterparts. Religiosity had an even greater impact on the academic outcomes of urban students.

While Jeynes (2010) showed a link between religiosity and higher achievement, other studies have not favorably connected religion to academic achievement. Schubmeh, Cubbellotti, and Ornum (2009) surveyed college students involved in a campus ministry program and found no significant correlation between religiosity—defined and measured by the Index of Spiritual Experiences scale—and grade point average (GPA). In a similar study, Good and Willoughby (2011) looked for a relationship between extracurricular activities—both religious and non-religious—and GPA. They found that more frequent involvement in religious activities (but not non-religious activities) led to lower levels of substance use over time. There was a non-significant correlation between religious activity and academic achievement (as measured by grades). So, while participation in religious activity led to lower levels of substance abuse it was not correlated directly to academic achievement.

Summary of literature review. The above literature review presents a summary of the literature on mindset and religiosity as it relates to mathematics achievement. It does so by grounding those topics in Bronfenbrenner's bioecological model. In order to understand the growth and development of students, it is necessary to consider many aspects of their environment because each environmental factor acts as a lens or framework through which they view the world. The literature review can be summarized in eight claims: mindset is a form of student motivation; mindset theory as it applies to mathematics is called math mindedness; mindset is malleable; mindset leads to grit and resilience, which creates persistence in academic achievement; student mindset can predict academic achievement; the mindset of all stakeholders affects student achievement; religion and spirituality cannot be separated from a student's development; and religion and spirituality impact student motivation and achievement. The body of literature connecting mindset theory to mathematics academic achievement is large despite

mindset theory being relatively young. Religious motivation has been thoroughly studied, but the research linking this framework to academic achievement is significantly smaller than the mindset literature. No studies were found that considered a relationship between religiosity and mindset. Both mindset and religiosity are personal dispositions which significantly impact students' proximal processes which in turn impact the growth and development of students.

Review of Methodological Literature

Math mindedness, mindset theory, religiosity, and achievement have been studied through many lenses. Student achievement and academic growth are the focus of educational practices and are measured by a variety of standardized tests. The relationship between student motivation, achievement, and educational practices has been frequently studied. This study considered Dweck's (2006) construct of motivation considered mindset theory and a faith-based belief system called religiosity. Researchers have studied the relationship between mindset, math mindedness, and academic achievement using quantitative, qualitative, and mixed-method studies. Researchers have also investigated how the religiosity of a student relate to academic achievement. Many studies have considered the presence of religiosity in private schools versus the lack of religiosity (by law) in public school settings. Lubienski and Lubienski (2006) referred to some of these findings as the private school effect and argue that many of the findings are inaccurate because they do not take the demographic differences of private and public-school students into account. In this dissertation study, though, the researcher seeks to examine a possible relationship between mindset theory and religiosity at the student level, not to compare types of schools. The following section of the literature review summarizes the methodological approaches used to study the relationship between mindset, religiosity, and student achievement.

Quantitative studies. Quantitative studies focus on numerical data and use statistical methods to determine if a relationship exists between variables. Creswell (2014) defined quantitative research as "a means for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures" (p. 4).

At the onset of Dweck's (2006) development of growth and fixed theories of intelligence, researchers used both survey and intervention methodologies to determine whether a relationship existed between a growth mindset and academic achievement—and, conversely, between a fixed mindset and academic struggles. These studies typically employed correlational methods and used a variety of statistical approaches to analyze the numerical data and identify relationships among variables.

Survey methodology. A number of studies used surveys when studying the effects of math mindedness. For example, Plenty and Heubeck (2013) used surveys to examine how mathematical motivation and engagement changes during high school. They found that math motivation decreases over time and that math motivation is lower than motivation in other subject areas—as motivation decreases so does a student's belief about their ability to be successful in mathematics. Similarly, Shen et al. (2016) used surveys and an analysis of variance (ANOVA) to examine the relationship between motivation, academic mindset, and student persistence in solving math problems with different levels of difficulty. Furthermore, Good and Dweck (2012) used surveys in a longitudinal study and found that women in college-level mathematics are significantly affected by their math mindset: math mindedness gives women a sense of belonging, which impacts achievement and resilience in high levels of mathematics. Moreover, Rattan, Good, and Dweck (2012) used surveys to show that an instructor's mindset

affects curricular choices and the type of motivation they foster among their students. Another survey study identified a significant correlation between a teacher's mindset beliefs and instructional practices (Stipek, Givvin, Salmon, & MacGyvers, 2001). These surveys had relatively small sample sizes, yet the results show significant relationships between a growth mindset and academic achievement. In addition, a large national quantitative survey study measured the mindset and achievement among tenth-grade students in Chile (Claro & Paunesku, 2014; Claro, Paunesku, & Dweck, 2016). This study used statistical analysis to show significant relationships between a student's mindset, a variety of census data, and academic achievement in a large comprehensive sample. The study found that students from a low-income family that had a growth mindset were academically similar to students from a high-income family that had a fixed mindset. This implies that a student's mindset may have the power to reduce the effects of poverty on academic achievement. This has the potential to aid in closing the achievement gap.

About half of the relevant articles reviewed for this dissertation study researched religiosity, motivation, and student achievement using surveys. Descriptive statistics were used in two studies to discover whether a relationship exists between religiosity and achievement. Mvududu and Larocque (2008) found religious motivation to be significantly related to intrinsic motivation in a statistics course at a secular university; however, the same relationship was not found at a Christian university. Similarly, Good and Willouby (2011) used survey data to look for a relationship between religious versus non-religious activities, academic success, and substance abuse in high school students. Analysis of Moment Structures (AMOS) statistical analysis was used in that study because it allowed a simultaneous estimation of parameters between all variables: religious groups, non-religious groups, academic achievement, and substance use. Jeynes (2003) used regression analysis to examine the effects of religious

commitment on academic achievement among a nationally representative sample of students. Very religious students were found to achieve higher academic achievement. This relationship was even stronger for urban students.

Three different types of correlation studies were used to look for a relationship between religiosity and academic success. Rettinger and Jordan (2005) used a Pearson correlation analysis and found a higher-grade orientation (similar to a fixed mindset) predicts more occurrences of cheating while increased religiosity marginally correlates with reduced cheating. Schubmehl, Cubbellotti, and Ornum (2009) computed a bivariate correlation coefficient between the effects of spirituality, campus ministry, and academic achievement in college students. They found a significant correlation between GPA and spirituality. Messemer (2007) used the Spearman's rho correlation coefficient to determine whether a relationship exists between Christian programing and the academic achievement of low-literate male inmates. Spearman's rho was used because the sample had several cases of negative gain scores, which would skew the normal distribution curve. It was also used to lessen the effects of small and differing sample sizes from both samples—the Christian and non-Christian groups of inmates. Survey methodology was used to gather data on mindset, religiosity, and motivation, and a variety of statistical methods were used look for relationships between these frameworks and mathematical academic achievement.

Intervention methodology. Six intervention research studies found a change in students' mindsets after a mindset intervention which taught students about the malleability of the brain and its ability to grow by exerting effort and making mistakes (Aronson et al., 2002; Blackwell et al., 2007; Paunesku et al., 2015; Rattan, Savani, Naidu, & Dweck, 2012; Schmidt et al., 2016; Yeager, Johnson, Spitzer, & Trzesniewski, 2014).

Paunesku et al. (2015) conducted the first research study which measured whether theory of intelligence interventions can practically impact academic outcomes in a large-scale setting. This study used over 1500 students in 13 diverse high schools. Growth mindset and sense of purpose interventions were chosen because they were the most suitable for an initial large-scale intervention study in a heterogeneous setting—no customizations to course content were needed. Linear regression and descriptive statistics were used to measure students' mindsets both before and after the intervention. Pre-study and post-study beliefs about intelligence were measured using online surveys, which took place in two 45-minute increments.

Similarly, some experimental studies which used intervention methodology on a smaller scale found an academic benefit to believing in the malleability of intelligence. Aronson, Fried, and Good (2001) structured an intervention of pen pal college students with fictitious middle school students. The experimental group was taught about the malleability of intelligence and encouraged to use this knowledge when writing to their pen pal. ANOVA testing was used to measure changes in the participants' view of malleability from the intervention. Rattan, Naidu, Savani, and Dweck (2012) also used ANOVA and ANCOVA along with descriptive statistics in an intervention study with adults during which the experimental group moved toward a growth mindset when taught about malleability of intelligence.

Two additional experimental intervention studies looked at the effect of a belief in the malleability of intelligence on academic skills, such as control, interest in learning, helpless attribution, and effort beliefs of seventh to ninth grade students. Schmidt et al. (2017) used descriptive statistics and found no differences between the control and experimental groups for seventh grade students, but ninth grade students in the experimental group had positive trends with regard to academic behaviors.

Qualitative studies. Qualitative studies seek to understand human interactions and problems in a complex environment. Creswell (2014) defined qualitative research as

> a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes, and the researcher making interpretations of the meaning of the data. (p. 4)

The qualitative studies in this literature review used the following methodologies: critical analysis, case study, historical analysis, and policy research.

Case study. Jett (2010) used a case study to discover the role of spirituality and religion in the educational outcomes of African American male mathematics majors. Jett (2010) explained, "case study research is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 327). Case studies were necessary because relatively little empirical research connects mathematics achievement with spirituality and religion. During the case study interviews, each man revealed they were "spiritually grounded and their spirituality positively contributed to their mission to fulfill their academic goals" (Jett, 2010, p. 330). Each man reported that his spirituality was a driving force behind his mathematics successes because a spiritually nourished mind helped him to become an intellectual in his field of study.

Historical analysis. Jones and Sheffield (2009) researched the historic perspectives on God and goodness in a public-school classroom while reflecting on whether a man needs God to be good. The historical review included thoughts of dissenting great thinkers in education, including Plato, Rousseau, the founders of the common schools in America, John Dewey, and

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Nel Noddings. Jones and Sheffield (2009) found that parents and students have questions

regarding God, goodness, and morality. They proposed that the public education system needs to

be ready to answer these questions and suggested that by studying the views of great educational

thinkers from history, current educational leaders will be able to talk about religion in education

in a knowing, reasonable, and sensitive way.

   Policy research. Qualitative policy research provides policy makers with the real-world

experiences of those who would be affected by the policies being considered. The goal of policy

research is to provide answers, often in the form of greater understandings, of the issues being

addressed (Srivastava & Thomson, 2009). Educational researchers have used the results and

conclusions of previous quantitative surveys and intervention studies to further investigate the

relationship between growth mindset and academic achievement. They have also conducted

qualitative policy research to support educational institutions as they promote the importance of

teaching mindset theory to students. Most of the current policy research is strategic and uses

Dweck's (2006) or Boaler's (2016) research on mindset and math mindedness as the theoretical

framework to push educational policy makers and schools to proactively teach malleability of

intelligence to improve academic achievement in all students (Boaler, 2014, 2015; Rattan,

Savani, Chugh, & Dweck, 2015; Sirois, 2014; Yeager & Dweck, 2012). Further strategic studies

are necessary due to the newness of mindset and math mindedness as motivational factors. As

schools adopt mindset principles and incorporate them into policy, additional types of policy

research will likely be used.

   Initially, Horn's (2006) policy research incorporated contextual, evaluative, and strategic

methods into a study on lessons learned from detracking mathematics departments in high

school. Horn (2006) first looked at shared attributes of two high schools that have managed to

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radically detrack math classrooms in both a contextual and evaluative lens and developed a list of four defining shared attributes of each detracked math program—as well as practical suggestions for implementation. Horn (2006), using Boaler's (1999) research, found a relationship between detracked mathematics courses and growth mindset and conversely between a fixed mindset and heavily tracked math classrooms. Finally, Horn (2006) discussed the implications of her analysis for other schools and departments to undertake detracking reforms.

Similarly, policy research has also been conducted using the variables of faith and religion in education. For example, Romanowski and Talbert (2000) did a diagnostic policy research study addressing the influence of religion and faith in American history. This study addresses the first amendment (which discusses separation of church and state) by insisting that it does not prevent public schools from teaching about religion and that a study of religion is necessary for student development. Due to a heavy emphasis on standardized testing, which is based on mastery of selected topics, "questions about faith, religion, the meaning of life, and the role of religion in societies are entirely ignored" (Romanowski & Talbert, 200, p. 134). Similarly, Daly (2009) researched religion in the classroom using contextual policy research methodology. Former President Bush's faith-based initiative redefined how the separation of church and state was applied to education. Two major issues included prayer in public schools— for example, in graduations, sporting events, and small groups—and parochial school funding, such as in choice programs, charter schools, bussing, lunch, and milk. Bush's Equal Access Act essentially changed the separation of church and state to the cooperation of church and state.

Some qualitative research studies on mindset theory have built on the quantitative studies which found significant correlations between a growth mindset and student achievement. This

finding has prompted qualitative researchers to explain why a growth mindset increases

academic achievement and how more students can benefit from a growth mindset.

Mixed-method studies. Mixed-method studies use both quantitative and qualitative

methodologies to gather data resulting in a more complete understanding of the variables being

studied (Creswell, 2014). The two most common types of mixed-method studies are named

based on how the data is gathered. Sequential mixed-method studies begin with quantitative data

collection and analysis and are followed by a qualitative component. The qualitative component

of a sequential mixed-method study is often used to interpret the quantitative findings.

Alternatively, a sequential mixed-method study can begin with a qualitative component followed

by a quantitative component, which often supports greater generalizability. A concurrent mixed-

method study gathers quantitative and qualitative data simultaneously.

Boaler's (1999) concurrent mixed-method study involved an ethnographic three-year

case study, longitudinal cohort analysis, and a triangulation of quantitative and qualitative

methods including lesson observations, interviews, and assessment scores. This study provided

the long-term results of the cohorts as they moved through middle grades in two very different

mathematics atmospheres—one taught math strictly from the text book, and the other taught

math through real-world problem-solving scenarios. Interviews provided information about the

students' thoughts and opinions of their learning. The qualitative analysis allowed for

comparisons of achievement in terms of standardized test scores and students' perspectives of

math inside and outside of the classroom. Boaler (2001) used the same quantitative data gathered

in Boaler (1999) and expanded the understandings of the data with further qualitative interviews.

Leopold and Juniu (2008) used sequential mixed methodology to study the incorporation

of a spiritual component into the health education aspects of a physical education program.

Differential statistics and a two-way ANOVA were combined with coded responses to interview questions, making it possible to calculate the frequencies and percentages of similar responses. Similarly, Derrico et al. (2015) used a longitudinal sequential explanatory mixed-methods design to measure and explore changes in thriving based on the thriving quotient (which is a measure of how students are achieving and succeeding in their environment) administered at the beginning and end of the Fall 2013 semester. In addition, the participants were interviewed regarding changes in thriving. A hermeneutic phenomenological approach was used for interviews. A hermeneutic phenomenological approach is a qualitative research method which seeks to interpret specific phenomena of a sample.

Mixed-method studies are a relatively newer form of research than qualitative and quantitative forms, so fewer research studies have been done in this format. This pattern is true for the literature used for this dissertation study. Nevertheless, the small number of mixed-method studies have added to the breadth and depth of both mindset theory and religiosity literature.

Summary of methodological literature. Math mindedness is a fairly new construct of motivation, yet it has a large body of literature supporting the positive academic benefits associated with a growth mindset. The initial and earliest studies supporting Dweck (2006) were mostly survey studies which connect a growth mindset with academic achievement. Later intervention studies showed that teaching about the malleability of intelligence helped students develop a growth mindset and increase their academic achievement. More recent mindset motivation studies have used qualitative methodology to further explain the connection between mindset and achievement and to seek policy reform which would require public schools to teach students about the importance of mindset.

Religiosity is an old construct, but the literature is relatively small, especially in terms of recent studies. A number of quantitative studies have been done to determine whether a relationship exists between religiosity and different components of academic achievement. These studies also tried to identify which groups benefited the most from religiosity. Qualitative studies sought to explain why higher levels religiosity correlated with increased academic achievement. Other qualitative studies identified religiosity as a trait of academically successful people from a marginalized racial group. Each type of methodological study was limited in how it could be used in public schools because of laws requiring the separation of church and state.

Review of Methodological Issues

The literature reviewed above contains quantitative, qualitative, and mixed-method studies. This section presents some methodological limitations and highlights studies that were done well. An examination of the limitations of available literature informed the methodologies chosen for this dissertation study by making it possible to avoid the noted limitations and build on strengths of extant studies.

Quantitative studies. When considering limitations and issues of research studies, it is also important to notice quantitative research methodologies that were done well. For example, Paunesku et al. (2015) provided a methodological model for quantitative research. It is reliable because it compared large effect sizes in trials with highly controlled samples. It is also valid because of the large number of students and schools involved. Perhaps this study's biggest advantage is that it can be repeated with an unlimited number of students at marginally low costs. This could help the lowest performing schools in the nation identify potential tools for achieving academic growth. The authors' claims were also clearly explained and supported with statistical analysis.

The methodological approach of other studies also reveals high reliability and validity. For example, quantitative intervention studies measuring the effects of mindset and malleable intelligence theory have shown high levels of reliability and validity due to similar results being generated by different groups of students and test/retest repeated measures (Blackwell et al., 2007; Schmidt et al., 2017; Yeager et al., 2014). A nationwide study of Chile's 10th grade students is regarded as highly reliable because the relationship between mindset and academic achievement was consistent over all students regardless of demographics, including SES (Carlo et al., 2016; Claro & Paunesku. 2014). Similarly, Good and Dweck (2012) found a high degree of reliability for their study in which participants took two versus three of the surveys used to gather data measuring the relationship between a teachers' view of malleability of intelligence and the ways they interact with students. The fact that the number of surveys that were taken did not change the results shows that the surveys are reliable measures of the variable being measured.

All studies, though, do not have such high degrees of reliability and validity. For example, Mvudud and Larocque (2008) noted that convenience sampling compromised the external validity of their study, preventing the generalization of their findings to other populations. They also noted that differences within the convenience samples could have altered some of the study's results. Schubmehl, Cubbellotti, and Ornum (2009) also experienced limitations with convenience samples, such as only sophomores and juniors of the campus ministry (with an unequal number of males and females) took the survey. Similar to such convenience sampling, methodological issues are also apparent in studies with too small of a sample size. For example, Plenty and Heubeck (2013) and Stipek et al. (2001) reported

limitations due to small sample sizes, which limited the ability to generalize the findings outside of the participants studied.

In addition to those issues with methodology, other limitations with past research are related to the specific variables and questions on surveys. For example, Shen et al. (2016) noted a significant limitation with the unsolvable math problem used in their study. They acknowledged that the problem may have skewed their results measuring persistence because students may have noticed the problem was unsolvable and thus, not persisted. Similarly, Rattan et al. (2011) had a significant limitation relating to the generalizability of the results. College students answered questions regarding how they would comfort students and what beliefs they held on their students' ability to learn as if they were teachers. These 'teachers' were used as the sample for a population of classroom teachers. The results may have been different if trained and licensed teachers were used.

Issues and limitations with religiosity studies are also apparent. The degree of a person's faith or religious belief is hard to accurately quantify. Good and Willoughby's (2011) study only uses one measure of religiosity and self-reported responses to all variables (religiosity, academic success, and substance use), thus limiting its scope. Jeynes (2003) did not note any limitations; however, students also self-reported their level of religious commitment on a one to three question survey. The explanation of the measure of religiosity was not clear in the article; yet from the small quantity of questions asked, it can be assumed that a more thorough measure of different facets of religiosity may have been better.

Qualitative studies. In addition to limitations among quantitative studies, qualitative researchers must also deal with limitations. For example, a small sample size is one methodological limitation. In his case study, Jett (2010) interviewed four successful African

American men and sought commonalities to determine the reasons for their mathematical success. A strong spiritual background was a common uniting factor of each of these men. This study has limitations with the sample size—there were only four men in the study. Furthermore, Jones and Sheffield's (2009) historical review of religion in public education was limited in that only a small number of great educational thinkers were included.

Policy research designs that promoted teaching growth mindset in educational settings were based on the results of multiple quantitative studies showing the relationship between mindset and academic growth. Exemplar studies in policy research include, Boaler (2013, 2014), Horn (2006), Rattan et al. (2015), Sirois (2014), and Yeager and Dweck (2012) are all similar studies that used Dweck's (2006) quantitative research on the relationship between academic achievement and a growth mindset. The policy recommendations were based on the empirical findings from valid and reliable quantitative data.

Policy research studies discussing religion and education have different limitations. Daly's (2009) research is based off federal law and documented court cases. Daly's (2009) conclusions align with Bronfenbrenner's (2006) bioecological model of human development. Despite laws, it is impossible to separate all aspects of faith and religion from public institutions, including schools. Similarly, Romanowski and Talbert (2000) provided evidence that they had valid and reliable data but it was limited in the applicability of religion and faith in American history courses. Limitations in applicability are due to public education's avoidance of all religious topics because of political correctness. The United States is separating education from all religions, including Protestant Christianity. This separation is contrary to Bronfenbrenner's (2006) bioecological model and limitations will always occur when society tries to completely rid itself of any components necessary to individual development.

Mixed methodology. Boaler (1999, 2001) is a good model of a mixed-method research study. Boaler (1999) used a longitudinal ethnographic study and triangulated the quantitative and qualitative data including lesson observations, interviews, and assessment scores. Boaler (2001) used the same quantitative data gathered from Boaler (1999) but extended the research. By using additional interviews, she arrived at further conclusions relating to the connections that support a situated theory of learning and how that theory relates to a growth mindset in specific classrooms.

Other qualitative studies were limited in terms of a small sample size or by a convenience sample. For example, Leopold and Juniu (2008) noted that their data were limited because, for convenience purposes, it was gathered from a small sample with random assignment done by school or class and not by individual students. Leopold and Juniu (2008) also noted that age of the students may also have limited their research. Seventh grade students may be too young to cognitively reflect on the impact of spiritual health education, thus the study may have yielded different results if done with an older age and grade level of students. Derrico et al. (2015) noted that the thriving quotient variable of their research study has strong reliability and validity; yet, it was limited by the nature of qualitative research. The generalizability of the results were limited because all students included in the study were from private faith-based colleges.

Summary. The majority of methodological limitations seem to stem from a small sample size, which makes a research study not generalizable to a larger population. Measures of religiosity have not been connected to academic achievement on a larger scale because of laws regarding the separation of church and state. This dissertation study seeks to address those limitations by collecting survey data from seniors at two parochial high schools. This would be

the first study that looks for a possible a relationship between math mindedness, religiosity, and academic achievement in mathematics.

Synthesis of Research Findings

This body of literature reveals two distinct belief systems that significantly impact the growth and development of adolescent students: the construct of mindset (or math mindedness) and the construct of religiosity. This section synthesizes the main research findings relating to these belief systems.

The framework of mindset motivation was developed by Dweck (2006) and establishes a continuum of how students view their ability to learn and be successful in school. Students with a fixed mindset are on one side of the mindset continuum and believe that they are born with a certain number of academic gifts and that they can do little to change their skill set. A growth mindset is on the opposite end of the mindset continuum. Students with a growth mindset believe in the malleability of the brain and know that they are able to grow and excel academically. After Dweck (2006) published her theory of mindset motivation with its implications for increasing academic achievement, a large body of both quantitative and qualitative studies supported and extended the significance of her findings. Boaler (2013, 2014, 2016) and Good, Rattan, and Dweck (2012) specifically tied mindset literature to mathematics and thus created the concept of math mindedness. Mindset theory and math mindedness are the same theory, differing only in that mindset theory applied to mathematics is known as math mindedness.

Mindset theory is linked to brain research that supports the malleability of intelligence through brain growth (Yeager & Dweck, 2012). This connection is significant because students have the ability to change their mindset and thus their intelligence and achievement. Aronson et al. (2002), Boaler (2013), Braun (2014), Rattan et al. (2015), and Yeager et al. (2014) have

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taught students about the malleability of intelligence and brain development in interventions and have successfully moved students' mindsets toward a growth mindset.

Student mindset can predict academic achievement because a student's mindset shapes their environment and view of education, which significantly impacts their development and capability to learn. Claro and Paunesku (2014) and Claro et al. (2016) found that mindset more strongly predicted test scores than income or SES. This is significant because mindset theory could be instrumental in closing the achievement gap prevalent in the United States. Blackwell et al. (2007), Boaler (2011), and Yeager and Walton (2011) found that students with a growth mindset had higher academic achievement in a wide range of research studies on diverse groups of students. Growth mindset has a significant impact on academic achievement, leading to increased grit, resilience, and persistence in academics (Boaler, 1999, 2001; Dweck, 2006, 2015; Schmidt et al., 2017; Shen et al., 2016; Yeager et al., 2014; Yeager & Dweck, 2012). Grit, resilience, and perseverance are all significant proximal processes that impact a student's interactions with their academic environment.

The framework of religiosity is the second major belief system discussed in the literature review. Religiosity is defined in this study as a student's attitude toward religion, which can include but is not limited to prayer, devotion, study of religious texts, classes, and services. The body of research shows that religious beliefs and attitudes, determined using surveys that measure religiosity, have a significant impact on the growth, development, and academic achievement of adolescent students (Derrico, Tharp, & Schreiner, 2015; Jett, 2010; Jeynes, 2003, 2010; Messemer, 2007; Rettinger & Jordan, 2005). Religiosity leads to faith in a personal belief system, which in turn often leads to an increase of religiosity. Similarly, practicing mindset beliefs leads to greater mindset beliefs and practices.

Religiosity, a measure of a student's spirituality and religious beliefs, is another significant part of a student's environment that significantly impacts their growth and development. The literature surrounding religiosity and its relationship to academic achievement, particularly mathematics achievement, is relatively small in comparison to that on the theory of mindset motivation. Podger, Mustakova-Possardt, and Reid (2010) and Bronfenbrenner and Morris (2006) agreed that morality and spirituality are an essential part of a person's ecology and that religiosity impacts the educational sustainability of a student's growth and development. Religiosity gives a student a sense of identity and answers big questions about the meaning of life and the individual's place in the world. Religiosity also is essential for adolescent students, who are developing a personal moral and ethical consciousness which impacts all major life decisions, including education.

Religiosity and United States education has a long history of conflicting proximal processes. Jones and Sheffield (2009), Daly (2009), and Romanowski and Talbert (2000) have studied the conflicting and changing political and social implications of religion and educational practices. Views on religiosity have changed as American culture and views on morality have shifted. Laws regarding the separation of church and state have made incorporating any form of religiosity into public education difficult. Larocque (2008), Leggo (2004), Leopold and Juniu (2008), and Romanowski and Talbert (2000) noted the repercussions that education is suffering from trying to completely remove religiosity from education. This removal of religion from education contradicts the suggestions of Bronfenbrenner's bioecological model: religiosity is part of a student's environment and cannot be divorced from it. By trying to remove all things religious or related to morality and spirituality from education, schools have not been able to educate the whole child.

Furthermore, religion and spirituality, as measured by religiosity, impact students'

academic motivation and achievement. Derrico et al. (2015), Messemer (2007), and Rettinger

and Jordan (2005) studied the relationship between religion and academic achievement and

found that religiosity fostered qualities in students which led to greater academic achievement

than students with less religiosity. For example, religiosity led to less cheating behavior, less

absenteeism due to bad behavior, and greater realistic optimism toward school. This in turn

resulted in greater academic achievement. Similar to mindset motivation, religiosity was found to

have a more significant impact among minority students and students with a low SES (Jett, 2010;

Jeynes, 2003, 2010), meaning that high religiosity can contribute to reducing the achievement

gap.

Using the bioecological model as the conceptual framework for studying mindset

motivation and religiosity makes it possible to study these two belief systems through the lens of

human development and to evaluate and quantify the nature of a potential relationship between

them in regard to mathematics achievement. Bronfenbrenner and Morris (2006) defined a

proximal process as a specific interaction between an individual and his or her environment.

Mindset motivation and religiosity are specific proximal processes in a student's natural

environment. The body of literature has shown that both mindset and religiosity separately have

positive implications of academic achievement. Mindset motivation and religiosity in Protestant

Christianity belief systems have similar characteristics and more study is needed to see if a

relationship between the two constructs exists.

Critique of Previous Research

This review of research and methodological literature seeks to comprehensively discuss

the findings of quantitative, qualitative, and mixed-method research studies which pertain to

mindset theory, math mindedness, and religiosity insofar as they impact mathematics academic achievement. This critique section reviews the whole body of literature and methodological literature in order to highlight research gaps and to provide reasoning for the significance of this study.

The conceptual framework for this dissertation study is Bronfenbrenner and Morris's (2006) bioecological model. The image which visually depicts Bronfenbrenner's model (found on page 20) has the student at the center and four concentric circles going out from the student. Each of these circles represent the proximal processes that impact a student's growth and development. Significant to this dissertation study, the proximal process from the microsystem, exosystem and macrosystem combine and interact with each other in the mesosystem, influencing and impacting the growth and development of students (Bronfenbrenner & Morris, 2006). Adolescent students' experiences in the mesosystem are profound as they try to reconcile proximal processes necessary to transition from being a child to an adult. However, the majority of this dissertation study focused on the microsystem level of Bronfenbrenner's model.

From birth to adolescence, students develop a mindset toward mathematics called math mindedness. This mindset is impacted from proximal processes in their microsystem; students' peers, family, and their school's belief in their ability to learn and be successful in mathematics all contribute to their personal math mindset. This mindset is also impacted through the proximal processes occurring in the exosystem and macrosystem, which refer to local neighborhoods and the attitudes and ideals of culture also contribute to students' personal mindset. The proximal processes of the microsystem, exosystem, and macrosystem all converge in a student's mesosystem, which is where each student needs to make sense of the convergence of multiple proximal process and develop their personal mindset beliefs. Likewise, religiosity is developed

in a similar way. Proximal processes of spiritual frameworks obtained from family, neighborhood, and cultural beliefs collide in the mesosystem and a student interprets the meaning of religiosity in their personal lives.

The literature is clear regarding the academic benefits of the spiritual construct of religiosity and mindset motivation. Students with a growth mindset achieve higher than students with a fixed mindset. Religiosity impacts student characteristics that lead to greater academic achievement. Indeed, according to Bronfenbrenner and Morris (2006), the constructs of religiosity and mindset (although mindset is not specifically mentioned by Bronfenbrenner) are developed individually within the microsystem and impact the development of each student. This comprehensive review has investigated quantitative, qualitative, and mixed-method research studies on religiosity and academic achievement and mindset and academic achievement; yet, no studies were found that looked for a relationship between religiosity, mindset. and the impact they have on mathematics achievement. This is a clear gap in the literature. According to Bronfenbrenner's (2006) bioecological model, religiosity and mindset cannot be separated from the growth and development of a student. This study seeks determine whether a relationship exists between the constructs of religiosity and math mindedness.

Chapter 2 Summary

This detailed literature review informed this dissertation study. First, Bronfenbrenner's bioecological model was discussed and was used as the conceptual framework that guided the collection, analysis, and interpretation of research data. This model states that an individual cannot be separated from any aspect of their environment and that the environment, therefore, cannot be separated from an individual's growth and development. Second, a review of the literature on mindset, math mindedness, religiosity, and mathematical academic achievement

was presented through eight claims that emerged from the literature: (a) mindset is a form of student motivation; (b) mindset theory as it applies to mathematics is math mindedness; (c) mindset is malleable; (d) mindset leads to grit and resilience, which creates persistence in academic achievement; (e) student mindset can predict academic achievement; (f) the mindset of all stakeholders can affect student achievement; (g) religion and spirituality cannot be separated from a student; and (h) religion and spirituality impact student motivation and achievement.

Third, a thorough review of the methodological literature was conducted to see which methods researchers have used to study these topics. The constructs of math mindedness and religiosity have been studied with quantitative, qualitative, and mixed-method research studies. Fourth, a review of the methodological literature focused on the strengths and weaknesses of the methodologies used in research. Instruments that measure mindset have been found to be both reliable and valid. Most limitations were found in small sample sizes and convenience samples. Fifth, research findings were synthesized, and key concepts from the literature and methodologies were noted. This synthesis resulted in two conclusions: Math mindedness and a growth mindset lead to greater student mathematic achievement. Religiosity is a spiritual framework which also leads to academic achievement. Sixth, a critique of the literature revealed gaps, areas prior findings can be extended. No studies were found which look for a relationship between math mindedness and religiosity. Finally, this summary of the previous sections was provided to conclude this literature review.

Based on this review of the literature, which develops a unique conceptual framework of Bronfenbrenner's ecological model to understand the potential relationship between mathematical achievement and religion and mindset, there is sufficient reason for thinking that an investigation examining the impact of mindset and religiosity on mathematical achievement

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would yield socially significant findings. Therefore, this literature review provides strong support for pursuing a research project to answer the following multi-part research questions:

1. What, if any, relationship exists between mindset, religiosity, and math achievement among high school students?

2. Can secondary student math achievement be predicted by mindset and religiosity?

3. How do students believe their environments have contributed, if at all, to their religiosity and mindset?

4. To what extent do students report that religiosity and mindset impact math achievement?

Chapter 3: Methodology

Introduction

A partial version of Bronfenbrenner's bioecological model was the conceptual framework for this dissertation study. Process and person characteristics were investigated. The elements of context and time were not discussed in this study. This model states that to understand the growth and development of students it is necessary to understand the layered environmental factors which have played a part in the students' development (Bronfenbrenner & Morris, 2006). Environmental factors and proximal processes influence students as they develop their beliefs and attitudes about constructs that effect their education. In this mixed method dissertation study, three variables are considered: academic achievement in math—measured through the math subsection of the ACT, religiosity—a measure of students' attitude towards religion, and mindset—students' beliefs about their ability to learn. This study used follow-up interviews to further understand the role of these variables in the constructs under investigation. The goal of the research was to determine whether religiosity and mindset are similarly developed through environmental factors and what if any role religiosity and mindset have on math achievement.

Purpose of the Study

The purpose of this cross-sectional survey research study was to analyze whether a relationship existed between the motivational framework of mindset and the faith-based construct of religiosity in high school seniors who attend parochial high schools in the Midwest region of the United States. If a relationship between mindset and religiosity were to be found, the researcher would analyze if students' religiosity and mindset could be used to predict mathematics achievement. Follow-up focus group interviews were conducted after survey data had been recorded and analyzed. In these focus group interviews, students were grouped based

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upon scores on high religiosity and growth mindset, high religiosity and fixed mindset, low

religiosity and mixed mindset. The interview protocol inquired about environmental factors that

students believe led to their religiosity and mindset views and if they believed either of these

constructs influenced their math achievement and if so, in what ways.

Research Questions

1. What, if any, relationship exists between mindset and religiosity among high school

students?

2. Can secondary student math achievement be predicted by mindset and religiosity?

3. How do students believe their environments have contributed, if at all, to their

religiosity and mindset?

4. To what extent do students report that religiosity and mindset impact math

achievement?

Hypotheses

Research question 1. Null hypothesis: There is no relationship between a student's

religiosity and mindset.

Alternate hypothesis: There is a relationship between a student's religiosity and mindset.

Research question 2. Null hypothesis: Religiosity does not predict a student's

mathematic achievement and mindset does not predict a student's mathematic achievement.

Alternate hypothesis: Religiosity does predict a student's mathematic achievement and

mindset does predict a student's mathematic achievement.

Research questions 3 and 4. Due to the discovery nature of qualitative research, no

hypothesis was imposed on the participants.

Research Design

The research design for this dissertation study was mixed methods and consisted of a non-experimental, self-administered, and cross-sectional survey with a qualitative component of follow-up focus group interviews. Quantitative studies gathered numerical data and statistically analyzed it to identify generalizations about a specific construct from a predetermined population (Creswell, 2009). In quantitative research designs, knowledge can be determined by careful and objective measurement and explained by comparing it to the worldview of the population. Students' worldview is influenced by their environment. Bronfenbrenner's bioecological model states that all the components of an individual's environment are significant and contribute to the growth and development of the individual (Bronfenbrenner & Morris, 2006). Quantitative studies can examine specific constructs within an environment that may not have been considered to work together and look for relationships between them. Creswell (2009) asserted that quantitative research allows the researcher to break down a complex environment into specifically defined variables that can be statistically analyzed in order to answer research questions.

Traditional experimental quantitative studies have a dependent (y) variable and one or more independent (x) variables. A survey was initially given which measures baseline data, followed by an experiment on a group of the sample, and concluded with another survey to measure changes from the experiment. Many researchers have conducted experimental studies within the construct of mindset with overwhelming data showing that children's mindset can move towards a growth mindset from an intervention on the malleability of the brain and intelligence (Aronson et al., 2002; Pauneku et al., 2015; Yeager & Dweck, 2012). However, experimental studies in the construct of religiosity are not frequently conducted and may be

considered unethical due to the sensitivity and possible long term (eternal) risks of experimenting with a child's foundational religiosity development. Also, religious beliefs cannot be experimentally manipulated. Therefore, a non-experimental quantitative research design was selected for this dissertation study.

A cross-sectional survey was used to gather data. Fink (2013) described cross-sectional surveys as a snapshot of a specific group of people. In order to get an accurate snapshot or understanding, it is important to have a sample that accurately represents the population and a survey with valid and reliable questions. Fink (2013) contended that the power of cross-sectional surveys is in the attention to detail that a focused and clear snapshot provides. Cross-sectional study outcomes have the potential to demonstrate how things are at the moment of the survey and provide detailed information about a specific sample. Cross-sectional research is also limited by its snapshot approach of a specific time and place. Fink (2013) emphasized two cons of cross-sectional research including that it can quickly become outdated by changes to the population and that it does not measure change or growth of the population. In this dissertation study, a cross-sectional survey design was a good selection because seniors in high school are able to provide a snapshot of both their current mindset and religiosity. The culmination of mandatory K – 12 education was an appropriate time to gather a one-time detailed interview to obtain specific information from students.

Finally, the survey for this dissertation study was self-administered. This means that participants read and answered all questions without an interviewer or facilitator. Fowler (2014) said that self-administered surveys' format is extremely important and must be clear and easy to use. Fowler's (2014) five principles for designing self-administered surveys was used to develop and organize the survey for this dissertation study:

1. A self-administered questionnaire mainly should be self-explanatory. Reading instructions should not be necessary because many respondents will not read them.

2. Self-administered questionnaires mainly should be restricted to closed answers. Checking a box, clicking on a response, or circling a number should be the only tasks required.

3. The question forms in a self-administered questionnaire should be few in number.

4. A questionnaire should be laid out in a way that seems clear and uncluttered.

5. Provide redundant information to respondents by having written and visual cues that convey the same message about how to proceed. If people possibly can be confused about what they are supposed to do, they will be. Work on making everything simple and clear. (p. 105)

A self-administered survey was chosen for this study because survey information being gathered fits the criteria defined by Fowler (2014). Dweck's (2000) survey measuring mindset consists of eight Likert scale questions and Francis et al.'s (2014) religiosity survey consists of seven Likert scale questions. The demographic information gathered from this study is also designed in a short, self-explanatory manner where respondents are asked to choose a response.

Target Population, Sampling Method (Power), and Related Procedures

The target population of students for this dissertation study were seniors from two parochial high schools in the United States' Midwest region. The student body at School 1 was diverse in many categories including race, ethnicity, gender, socioeconomic status, family background, culture, and academic attainment. The student body had an enrollment of approximately 775 students in grades 9 to 12, including a senior class of approximately 160, for the 2017–2018 school year. Approximately 50% of the students at this high school qualified for

government vouchers under the state's choice programs, while the other 50% paid tuition. Approximately 75% of the student body received financial aid from either state funded vouchers or scholarships. This mix of wealthy tuition-paying students and students living in poverty who qualify for vouchers provided a unique element of diversity. This school is also geographically diverse with students from urban and suburban parts of the city. School 2 was smaller and was located in the suburbs of the same city. School 2 had a student body of approximately 320 which included approximately 90 seniors, was part of the state choice program, and was diverse in gender, socioeconomic status, and family educational attainment; however, unlike School 1, the students of School 2 were predominately Caucasian and had minimal racial and ethnic diversity.

A convenience sampling methodology will be used to select the sample population. Fink (2013) asserted that a convenience sample is necessary when participants need to be willing and available to complete the survey. For adolescents to participate in the research study, they need to provide both parent consent and their own assent. While random sampling is objective and the preferred means to gather data, it is difficult to have a true random sample and obtain consent and assent from all participants. All seniors from both schools were invited to participate in the study. The convenience sample consisted of students whose parents had not requested them to not be part of the study, who gave student assent, and were present the day the survey was administered. The surveys were administered and focus group interviews were conducted during the fourth quarter of the 2017–2018 school year.

In order to run a two-tailed multiple linear regression study with an error probability of 0.05 and a power of 0.95, 89 students needed to be part of the sample (Faul, Erdfelder, Lang, & Buchner, 2009). The minimum of 89 students was exceeded in this study, a total of 159 students participated, 101 from School 1 and 58 from School 2. A detailed description of the sample is

included in chapter 4. Although convenience sampling can lead to biased results that lower the limit and power of generalizing from the sample, this sample size would be able to detect relationships of the senior classes from the population (Fink, 2013).

Instrumentation

Denscombe (2010) stated that the credibility of a research project "needs to be demonstrated as part and parcel of the research process" and needs to be specifically defined in the instrumentation used to collect data (p. 126). The quality of findings from a research project are, in part, based on the validity and reliability of the instruments used to gather data. A valid survey produces accurate and precise data that is appropriate for the research question being investigated (Denscombe, 2010). External validity is defined as the extent to which the research findings can be applied to a similar situation at a more general level; in other words, it is not unique to a particular setting or population (Denscombe, 2010). Reliability is a different measure of credibility. A survey is reliable if similar results are found on multiple administrations of the survey, this is called test-re-test reliability (Denscombe, 2010). Another measure of reliability is internal consistency reliability, a measure that determines if the instrument remains reliable if a single question is removed. This section describes the reliability and validity of the two surveys used in this dissertation study.

Measures of religiosity are frequently found in nursing and health related studies as they relate to patients coping with life threatening illnesses. The National Institute for Health Care Research (NIHR) and the leading health care research from major United States Universities have been the key researchers in developing, testing validity and reliability, and publishing surveys that measure religiosity (Hill & Hood, 1999). Due to constitutional separation of church and state, measures of religiosity are not common in an educational setting, especially in public

education. Researchers need to be aware of the variety of ways religion is expressed as well as all of the nuances within each religious expression and to be sure to account for these aspects with the survey used to measure religiosity (Francis, Brockett, & Village, 2014).

Astley-Francis Scale of Attitude toward Theistic Faith (AFS). The Astley-Francis Scale of Attitude toward Theistic Faith (AFS) has been chosen as the measure of religiosity for this dissertation study, permission to use the measure for educational and non-profit purposes is gives by the authors in the article (Francis, Brockett, & Village, 2014). The AFS assesses the attitudinal dimensions of religion within a multi-faith context. The AFS is a 7-item short form of the full 24-item form of the Francis Scale of Attitude toward Christianity. The AFS was designed as a measure of religiosity across a person's life and measures four dimensions of religiosity: religious behavior, importance of religion, public religious practices, and personal religious practices. The AFS also provides a common instrument to measure religiosity in a diverse and cross-cultural setting. The large number of independent studies that have used AFS have made it a common measure of religiosity (Francis, Brockett, & Village, 2014). Kay and Francis (1996) have summarized and synthesized over 100 correlates between AFS and other constructs (e.g., abortion attitudes, alcohol attitudes, and gender orientation, to name a few) in children, adolescence, and adults. A high score indicated a high level of theistic belief and a low score indicated a low level of theistic belief (Francis et al., 2014). The AFS was developed and tested for reliability and validity among students in both primary and secondary schools, as well as adults.

Reliability of AFS. Francis et al. (2014) found high overall internal consistency (7 items, $\alpha = .96$). Cronbach's alpha scores were also calculated when the sample was separated by religious affiliation: no religion ($\alpha = .88$), Christian ($\alpha = .93$), Muslim ($\alpha = .77$), and other ($\alpha =$

.93). The reliability coefficient for the subscale for people of the Muslim faith was lower than the other subscale coefficients. Francis et al. (2014) surmised that the lower reliability may indicate a struggle to answer survey questions worded negatively about their own faith. The sample for this study is students from Christian schools—no students in the sample reported having Muslim faith, so the lower subscale reliability reported by Francis et al. (2014) will not affect this dissertation study. Scores for each question on the AFS are summed to provide a single measure of religiosity, which includes four distinct dimensions: religious behavior, importance of religion, public religious practice, and private religious practice.

Validity of AFS. The AFS was found to be a valid measure of religiosity. Construct validity was first measured by comparing religiosity scores with students who claimed to have a religious affiliation versus students who claimed to have no religious affiliation. Francis et al. (2014) found mean scores were higher for students with a religious affiliation ($M = 24.6$, $SD = 7.9$, $n = 2927$) than for students with no religious affiliation ($M = 13.7$, $SD = 5.5$, $n = 1367$), as seen in Table 1. Finally, construct validity was determined through factor analysis. A single factor solution, "religiosity," was determined most parsimonious based on all seven items, which explained 79.5% of the total variance. Factor loadings are included in Table 2 (Francis et al., 2014).

Francis et al. (2014) concluded that the AFS has advantages when giving it to a diverse group of students who have different religious backgrounds; however, there would be advantages to a religion-specific test when the entire sample has the same religious affiliation. The student population all attend a parochial high school and are immersed in the beliefs of the same religious affiliation in schools surveyed. However, it is not required that students be any specific religion to attend the school.

Table 1

Construct Validity of AFS

	No Religion n = 1367	Christian n = 1984	Muslim n = 817	Other n = 126	All N = 4,294
Attendance	0.09	0.50	0.18	0.40	0.70
Prayer	0.17	0.63	0.28	0.40	0.74
Religion Importance	0.17	0.66	0.41	0.52	0.80

Table 2

Factor Analysis of Religiosity Measure

| | Factor Loadings | | | | |
Items	No Religion	Christian	Muslim	Other	All
God means a lot to me.	.89	.90	.78	.92	.95
God helps me.	.89	.89	.84	.90	.94
God helps me to lead a better life.	.89	.89	.78	.92	.93
I know that God is very close to me.	.87	.87	.70	.93	.91
Prayer helps me a lot.	.73	.81	.63	.77	.88
I find it hard to believe in God.	.51	.76	.29	.73	.82
I think going to a place of worship is a waste of time.	.57	.72	.52	.67	.81

Mindset measure. Dweck's (2000) *Implicit Theories of Intelligence Scale for Children—Self-Form* was used to measure students' mindset, which Dweck (2006) defined as a personal belief about ability to learn. This scale consists of eight Likert questions where responses range from 1 (strongly agree) to 6 (strongly disagree). Permission from Dweck to use the measure was obtained through email correspondence. High mindset scores equate to entity beliefs, also known as a fixed mindset. Low mindset scores equate to incremental beliefs, also known as a growth mindset. A student with a fixed mindset would believe that they are unable to learn a new math concept because they are not smart enough in math to fully understand it. A

student with a growth mindset would believe that they are capable to increase her understanding of a new math concept with effort and perseverance in studying the topic.

Reliability of mindset measure. Dweck's (2000) measure of mindset is a reliable measure because it produces consistent information in a variety of settings and with a variety of samples (Fink, 2013). One measure of reliability is internal consistency and can be measured when growth and fixed mindset questions were reverse scored. Internal consistency is measured by Cronbach's alpha and describes how multiple survey questions measuring the same item, complement each other. For example, Levy, Stroessner, and Dweck (1998) found Dweck's (2000) measure of mindset highly reliable (8 items; $\alpha = .93$). In another example, Dweck, Chiu, and Hong (1995) found strong internal reliability with Cronbach's alpha, ranging from $\alpha = 0.94$ to $\alpha = 0.98$. Similarly, Dweck et al. (1995) found the Theories of Intelligent Scale to have test-retest reliability at .8 over a two-week period. This shows that the same samples scored similarly on multiple iterations of the same survey (Fink, 2013). Test-retest shows reliability when the correlation is high.

Validity of mindset measure. Dweck's (2000) measure of mindset is a valid measure of mindset. For example, Dweck et al. (1995) stated that Dweck's (2000) mindset measure is valid because it does not ask incremental questions because previous studies have shown incremental responses to be highly compelling over entity responses. However, Dweck (2000) needed to see if disagreement with an entity statement meant agreement with an incremental response. Dweck et al. (1995) gave Dweck's (2000) mindset measure and asked the sample to explain responses, which disagreed with entity questions and found that these responses were explained by incremental reasoning. Similar results were found with Dweck's measure of morality and implicit person theory. These results show validity for both incremental and entity responses

measuring mindset. Similarly, factor analysis was performed on the short version of Dweck's

(2000) *Implicit Theory of Intelligence Scale*, in five studies. Table 3 shows a single factor with

strong loadings from each factor (Dweck et al., 1995). The consistency of these results shows

validity of Dweck's (2000) measure of mindset.

Table 3

Factor Analysis of Mindset Measure

	Factor Loadings				
Items	Study 1	Study 2	Study 3	Study 4	Study 5
You have a certain amount of intelligence and you really can't do much to change it.	.95	.94	.94	.96	.96
Your intelligence is something about you that can't be changed very much.	.94	.95	.96	.95	.94
You can learn new things, but you can't really change your intelligence.	.93	.91	.91	.93	.95

ACT. The ACT is a standardized college readiness test was first given in 1959. College

admission teams use this test as measure of selecting and accepting students to attend a specific

institution. ACT Key Facts (2017) referred to test validity as a measure of "the gap between

what a test actually measures and what it is intended to measure" (para. 2). The goal of

standardized test validity is to be confident that a test's score reflects proper interpretation and

practical use of the score (ACT Key Facts, 2017). The construct validity of the ACT has been

examined by comparing ACT scores to similar academic tests and criterion validity has been

studied by comparing ACT scores to first year college grades. Standardized test reliability is

defined by consistency of scores and testing procedures (ACT Key Facts, 2017). The ACT test

is proctored by trained professionals who follow strict guidelines to give each student a similar

testing experience. As one of two major nationwide College Admission Tests, ACT statisticians work to ensure the exam is both a valid and reliable measure of college readiness.

Data Collection

Data were collected in three ways. First, a survey was given to students who had parental consent, who assented to be part of the study, and who were present on the day the survey was administered. When all students were seated, the researcher explained student assent, including that participation is optional and students may choose to not participate at any point in the study with no repercussions. Student assent was given by students remaining in the auditorium and beginning the survey by writing their school identification number on the top of the front page of the survey as noted. This survey was administered on a regular school day during the homeroom period in the auditorium of the school. The survey consisted of a combination of Dweck's (2000) Implicit Theories of Intelligence, Francis et al.'s (2014) Astley-Francis Scale of Attitude toward Theistic Faith, and basic demographic questions.

The guidance office at each school provided ACT math subset scores aligned with students' identification numbers. The researcher recorded the individual ACT math subset score on the survey by matching identification numbers. The guidance office from each school also provided a list of identification numbers and first and last names for each student. This information was sealed in an envelope and stored in a locked box with parental consent forms for three years after the project is finalized. After three years, the documents will be destroyed.

After quantitative data were gathered and analyzed, the researcher looked for patterns in religiosity and mindset scores, as well as how these scores have impacted math achievement. The researcher formed and interviewed small focus groups to find out students' perspectives on how their mindset and religiosity developed from their environment, both at home and at school,

and if they see a relationship between mindset and religiosity in their own lives. Focus group participants were also chosen using a convenience sample. Students who indicated a willingness to participate in a focus group were invited to attend a focus group. Students were attempted to be grouped by growth mindset/high religiosity, fixed mindset/high religiosity, and mixed mindsets/low religiosity. However, some students did not perfectly fit the group and attended a focus group that best met their schedule. This mixture of groupings led to rich conversations regarding mindset, religiosity, and math achievement. Focus group interviews were recorded, transcribed, and coded following Saldaña's (2016) Coding Manual. This data added a qualitative component and a human element to the study to see if students perceive their attitudes towards religion and their mindset work together, whether they consider these attitudes and belief systems are the result of specific environmental factors and if mindset or religiosity have contributed to their math achievement.

Operationalization of Variables

This dissertation study had three variables: math achievement, religiosity, and mindset. The dependent or outcome variable is math achievement. Math achievement was measured by the students most recent ACT math subset score (ACT, 2018). The ACT test is usually taken by students in their junior year of high school and is used by colleges as one measure to judge academic achievement through high school. The ACT is a standardized test that every student in the population has taken. Using this score removes school, teacher, and course bias and measurement error.

One independent or predictor variable was religiosity. In this study, religiosity is defined as a measure of a student's attitude towards God and religion. Francis et al. (2014) found attitudinal measures of religiosity are an advanced measure because they "offer a particularly

fruitful basis for coordinating empirical inquiry into the correlates, antecedents, and consequences of religiosity across the life span" (p. 3). Attitudinal measures of religiosity are attractive for four main reasons (Francis et al., 2014). First, attitude towards religion provides a more conceptual view of religion, as compared to behaviors and opinions which can be more volatile. "To assess attitude toward religion is to get close to the heart of religion in an individual's life" (Francis et al., 2014, p. 3). Second, "attitudes provide a purer measure of religion than either beliefs or practices" (Francis et al., 2014, p. 3). Attitudes represent a bigger picture of religion than divisions between denominational practices which can be divisive. Third, the psychological study of religions has been built on well-established psychological techniques for scaling and assessing attitudes. Fourth, attitudes can be consistently measured over a wide age range while measuring beliefs develop and change over a life span. Due to this stability of attitudinal measures, a cross-sectional survey was an appropriate measure of students' religiosity. An attitudinal measure was also appropriate under Bronfenbrenner's (2006) bioecological model because attitudes are developed through a lifetime of interactions between a student and their complex multi-layered environment.

The second independent or predictor variable was mindset. Dweck developed the concept of growth mindset versus a fixed mindset to describe a student's beliefs on their ability to learn. A growth mindset is also referred to as an incremental view of intelligence; a belief that new material can be learned through grit and hard work (Dweck, 2000). Conversely, a fixed mindset, also known as an entity theory of intelligence is the belief that a person has a limited number amount of learning potential (Dweck, 2000). A student's mindset is a crucial factor in determining students' academic success (Claro & Paunesku, 2014). Boaler (2013) took Dweck's (2000) mindset theory and applied it to learning mathematics thus coining the term math

mindedness to refer specifically to a student's mindset in regard to their mathematics achievement. In this dissertation study, students' mindsets were measured using Dweck's (2000) Measure of Implicit Theories of Intelligence Scale. Both religiosity and mindset scores were measured from the total survey score.

Data Analysis Procedures

After survey data were gathered, the researcher analyzed whether religiosity, mindset, and math achievement were correlated. A Spearman rank order correlation was used. If these variables were correlated, then a linear multiple regression would be done to see if there was an interaction affect between religiosity and math achievement and mindset and math achievement. Fink (2013) contended, "regressions use correlations as the basis for predicting the value of one variable from the other" (p. 122). The multiple regression analysis could potentially be used to predicted math ACT scores when looking at religiosity and mindset.

Following the statistical analysis, a qualitative component was conducted. Focus groups or individuals were interviewed to attempt to identify a personal relationship between the interaction of mindset and religiosity. The qualitative sample is described in chapter 4, data collection and data entry procedures are explained in Appendix A, and qualitative field notes are included in Appendix F. Morgan (1984) commented that adding focus groups and interviews to a quantitative study provides personal information about the participants shared experiences with mindset and religiosity. The researcher attempted to make collective sense of these experiences. Creswell (2009) added that focus groups and interviews can also add to quantitative research by probing into outlier cases to see why and how they differ from the sample. The researcher gets the opportunity to focus on participants' interactions and experiences that are centered on the attitudes and experiences being studied (Morgan, 1984). In this study, the researcher used

findings from the survey data to form small focus groups and identify outliers from the sample. Morgan's (1984) work led to the merging of quantitative and qualitative studies, later coined mixed methods research.

Questions for conversation starters include the following: To what extent do you think students can increase their intelligence based on their effort? How does a person's attitude towards religion affect his development? Can you describe whether your mindset (attitude towards your ability to learn) affects your religiosity (attitudes towards God and the importance of religion)? How does your religiosity affect your mindset? Do you believe that mindset impacts academic achievement in general? Math achievement, specifically? If so, how? Does religiosity impact academic achievement in general? Math achievement, specifically? If so, how? Are there any connections you have seen in your life/school experiences that connect religiosity, mindset, and/or math achievement that we have not discussed? Has attending a Lutheran high school impacted your religiosity? If so, how? Do you have anything else to add?

In order to better understand the human elements and dynamics between the constructs of religiosity, mindset, and achievement, follow-up focus group interviews were audio recorded, transcribed, and then coded in layers to look for emergent themes. Member checking was not done and is discussed in the limitations. Saldaña (2009) defined a code as "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (p. 3) and "coding is not a precise science; it's primarily an interpretive act" (p. 4). The art of coding is meant to discover themes in data without any specific formulas to follow. Saldaña (2009) further defined coding: "the act of coding requires that you wear your researcher's analytic lens. But how you perceive and interpret what is happening in the data depends on what type of filter covers that lens" (p. 6).

The lens of this dissertation study was Bronfenbrenner's (2006) bioecological model, which indicated that in order to understand a student, it is necessary to understand their environment. Interviews and focus groups had students reflect on how their environments and past experiences have played a part in their religiosity and mindsets.

Limitations and Delimitations of the Research Design

Limitations for this study are found in the convenience sample of the population. The convenience sample will exclude any student who was absent the day the survey was given or students whose parents did not give consent. This sampling method could mean that specific groups of students, like those who are frequently absent, do not take part in the study. Convenience sampling makes results biased and limits the power to generalize the results to the entire population.

Another limitation to this study was the lack of a public-school district or school to participate. Public school districts in the same geographical region did not want to give this survey to students because of the religious nature of the topic and fear of mixing church and state. To be able to generalize this study to a more diverse group of high school seniors, it would be necessary to increase the population to include public, private/charter, and parochial schools in the sample.

A final limitation was the lack of member checking. Interviews were audio recorded while the researcher took notes. Later, the interviews were transcribed and coded. Focus group participants were not given the chance to check the transcribed interviews for accuracy or to clarify their comments.

Expected Findings

I expected to find that students with a strong growth mindset and high religiosity score also had high math achievement. Through small focus groups (qualitative interviews), I expected that students with strong growth mindset and high religiosity would have the confidence and faith to push themselves in mathematics and to take higher level/college prep courses which would increase the likelihood for higher ACT scores. Conversely, I expected students with a fixed mindset and low religiosity to have lower mathematics achievement. Through small focus groups (qualitative interviews), I expected to find students with a family history of not being good at math and no desire to push themselves to be successful (they would believe being successful is not possible).

While I expected both mindset and religiosity to contribute to mathematic success, I believed that mindset will play a bigger role in this success than religiosity. Many studies have frequently correlated mindset with achievement (e.g., Boaler, 2013; Claro & Paunesku, 2014). Religiosity and achievement have not been as thoroughly studied. I believed the target population of parochial high school students may have a stronger correlation between achievement and religiosity that other populations.

Ethical Issues in the Study

This dissertation study has minimal ethical risks for students and school participants. CU-IRB approval and permission from the principal at each participating school was obtained prior to data collection and analysis. IRB approval included a conflict of interest assessment— all participants with a prior relationship with the researcher were not invited to participate in this study. All participants, both from the quantitative and qualitative research, were kept confidential.

Results of this study could be beneficial for all parties involved. Individual results were kept confidential and not shared with administration or school representatives. Participation in this study was voluntary and students could back out at any point. No deception was used in this study. Results were made available to students when the dissertation was complete.

Summary

Bronfenbrenner's bioecological model was the conceptual framework for this dissertation study. This model stated that to understand the growth and development of students it is necessary to understand the layered environmental factors which have played a part in the students' development (Bronfenbrenner & Morris, 2006). Environmental factors and proximal processes lead students as they develop their beliefs and attitudes about constructs that effect their education. The goal of the research was to see if religiosity and mindset are similarly developed through environmental factors and what if any impact religiosity and mindset have on math achievement.

Seniors from two parochial high schools are the population for this study. Seniors who were chosen though convenience sampling took a survey to determine both a mindset and a religiosity score. This data, if correlated, would be used run a linear multiple regression study to measure if either religiosity or mindset could be used to predict mathematic achievement. A qualitative element asked select students to talk about life experiences that believed have contributed to their personal religiosity and mindset. This study added to the current literature both on mindset and religiosity as an understanding developed on the potential of these constructs working together to impact academic achievement.

Chapter 4: Data Analysis and Results

Introduction

The purpose of this study was to examine whether or not a relationship existed between students' mindset and religiosity and, if a relationship was found, to examine whether or not mindset and religiosity predicted academic achievement. A convenience sample of seniors at two parochial high schools were surveyed to gather demographic information and measure both mindset and religiosity. In this study, mindset was defined as students' attitude toward their ability to learn and mindset beliefs range from a fixed to a growth mindset. Students with a fixed mindset believed that their ability to learn and retain information was dependent on their intellect; conversely, students with a growth mindset believed that academic success could be attained through grit and perseverance (Dweck, 2006). In this study, religiosity was a measure of students' attitude toward God and faith in their lives. Scores on the religiosity assessment could range from low religiosity to high religiosity. A low religiosity score meant that God and faith were not important to a student; a high religiosity score reflected the personal importance of God and faith to a student. Academic achievement was measured through students' math scores on the American College Test (ACT)—a college readiness exam that is popular in the United States. In this study, ACT math scores were obtained from the guidance department at School One. The ACT measures student achievement in a variety of subjects and students' level of academic achievement are reported (for each subject and a combined composite score) to colleges.

This mixed methods study used both quantitative and qualitative methodologies to examine whether a relationship existed between students' attitudes toward religion and mindset and if these variables could predict math achievement. A qualitative component was conducted using focus group interviews to understand students' perspective on a possible relationship

between their own religiosity and mindset and how these constructs were initiated and supported in their home and/or school environment. Finally, results from both the quantitative and qualitative analyses were discussed together.

This study's focus and design was guided by Bronfenbrenner's Bioecological model. Bronfenbrenner's theory states that to understand the development of a child, it is necessary to understand the environmental factors which affect the child. Bronfenbrenner and Morris's (2006) model was chosen for the conceptual framework for this dissertation because the model is based on the interconnectedness of the parts of an individual's environment and it describes how these environmental factors impact development. Although Bronfenbrenner's model does not explicitly discuss mindset, mindset as well as other personal attitudes and beliefs are established and reinforced in every part of a student's environment. Based on Bronfenbrenner's (2006) model, both mindset, although not explicitly included in the model, and religiosity have a profound impact on individuals and cannot be separated from the way they holistically view and interpret the world.

This chapter discusses the sample and instrumentation used for the quantitative and qualitative analysis. Quantitative and qualitative results are presented separately and the chapter concludes with a discussion of how the quantitative and qualitative results support each other.

Sample

During the planning phase of this dissertation study, permission was secured to survey students at three different parochial high schools. The three high school principals were given the survey instrument and plan for administering surveys and gathering data from the guidance offices at each school. The week before the survey was to be administered, one principal declined to participate for fear of the study being too close to final exams, and he did not want to

burden his students. In order to run a two-tailed multiple linear regression, which is discussed later in the chapter, with an error probability of 0.05 and a power of 0.95, the sample needed to be a minimum of 89 students (Faul et al., 2009). School 1 alone had a sample of 101 students, which provided adequate statistical power for the study. Thus, the researcher decided to proceed by conducting the study in only two of three intended schools.

A second challenge occurred when administering the survey to School 2. The student identification numbers were missing from the instrument. However, the surveys were still administered and the other data were gathered. The lack of Student ID numbers meant that the survey results could not be matched with students' ACT math score. Therefore, School 2's data could not be used as part of the linear regression in this study. Instead, the data for School 2 was only used to determine correlations among demographics, religiosity, and mindset. The final challenge in the data collection process came from an unforeseen incident unrelated to the study that affected School 2, and their students were not able to be part of focus group interviews. The implication for this study was that only two (versus the planned for three) schools were surveyed. From this survey data, only School 1's data were able to be analyzed with ACT math scores. Follow-up focus group interviews were conducted using students from only School 1.

The population of students for this dissertation study consisted of seniors from two parochial high schools in the United States' Midwest region. The student body at School 1 was diverse in many categories including race, ethnicity, gender, socioeconomic status, family background, culture, and academic attainment. The student body had an approximate enrollment of 800 students in grades 9 to 12, including a senior class of approximately 160, for the 2017–2018 school year. Approximately 50% of the students at this high school qualified for government vouchers under the state's choice programs, the other 50% paid tuition.

Approximately, 75% of the student body received financial aid from either state funded vouchers or scholarships (School 1, n.d.). This mix of wealthy tuition-paying students and students living in poverty who qualify for vouchers provides a unique element of diversity. This school is also geographically diverse with students from urban and suburban parts of the city. Of the senior students invited to participate in this research project, 101 students participated, which resulted in a response rate of 64%.

School 2 was smaller and was located in the suburbs of the same city. School 2 had a student body of approximately 320, which included approximately 90 seniors. School 2 was part of the state choice program, where public funds were used to pay tuition at private schools, and was diverse in gender, socio-economic status, and family educational attainment. However, unlike School 1, School 2 was predominately Caucasian and had minimal racial and ethnic diversity. Of the senior students invited to participate in this research project, 58 students participated, which resulted in a response rate of 65%.

Demographic information of the participants can be found in Table 4. Socioeconomic status, measured through participation in State Choice—similar to vouchers—can be found in Table 5. Students who qualify for the state choice program need to meet income requirement, thus have a lower socioeconomic status than non-choice students. Religious affiliation of study participants can be found in Table 6. The sample included a total of 159 seniors from two schools, 101 surveys were collected from School 1 and 58 surveys were collected from School 2. The sample was almost equally split between genders. However, the sample was predominately Caucasian students (67%). African American students represented 16% of the sample, followed by 10% Hispanic/Latino students, and Asian students represented 6% of the sample. School 1 and School 2 were both parochial schools associated with the Lutheran denomination and Table

6 shows that 84% of the sample was affiliated with the Lutheran denomination and 11% of the

sample was affiliated with another Christian religion. A small percentage, less than 5%, of the

sample reported having other non-Christian religious affiliation, no religious affiliation, or did

not respond.

Table 4

Demographics of Survey Participants

	Male	Female	African American	Caucasian	Hispanic Latino	Asian	Other	No Response
School 1	45	56	23	60	10	7	0	1
School 2	35	23	2	47	6	3	0	0
Total	80	79	25	107	16	10	0	1
Percent	50%	50%	16%	67%	10%	6%	0%	1%

Table 5

Socioeconomic Status of Survey Participants

	Choice	Not Choice	Not Sure	No Response
School 1	39	56	5	1
School 2	16	39	3	0
Total	55	95	8	1
Percent	35%	59%	5%	1%

Table 6

Religious Affiliation of Survey Participants

	Lutheran	Other Christian	Other	None	No Response
School 1	83	12	2	3	1
School 2	51	6	1	0	0
Total	134	18	3	3	1
Percentage	84%	11%	2%	2%	1%

Quantitative Data Analysis

Survey responses were entered into an Excel spreadsheet for analysis following four steps of processing data as described by Floyd and Fowler (2014): designing the code rules, coding responses into categories, data entry, and data cleaning. Then, the data were transferred into SPSS for analysis. Details of data entry and data cleaning are found in Appendix A.

Missing data. Floyd and Fowler (2014) stated that when surveys removed for nonresponse are less than 5% of the sample, there is minimal distortion to the analysis and results. Using Floyd and Fowler's work as a precedent, incomplete survey responses were removed from the sample and not included in analysis in this study. Specifically, five surveys from School 1 and one survey from School 2 were not included in the completed surveys because they were not completed; the back side of the survey document was left blank for each of these six surveys. Thus, from 165 surveys collected, 159 were analyzed. This resulted in less than 1% missing data removed, which falls under the threshold discussed by Floyd and Fowler (2014).

This survey data were used to determine if a statistically significant relationship existed between student mindset and religiosity. ACT scores were only gathered from School 1. The

guidance office from School 1 provided ACT math scores for each student who participated in the survey. Due to students from School 2 not knowing their student identification numbers, it was not possible to match their survey results with their ACT math scores.

Descriptive statistics. Garson (2012) contended that it is a best practice to run descriptive statistics on data before performing inferential statistical analysis. This practice provides confidence that the data are normally distributed and it reveals any data points that fall outside of expected ranges. In this study, histograms and scatterplots were examined for normality, skewness, kurtosis, and to identify any outliers in the data set. Histograms and scatterplots are found in Appendices B and C.

Tables 7 and 8 show descriptive statistics for mindset, religiosity, and ACT math scores. Mindset and religiosity scores were calculated from a sample of 159 students from two schools. ACT math scores were taken from a sample of 101 students from School 1. This sample had a slight tendency towards a growth mindset ($M = 2.91$, $SD = 1.03$). Mean mindset scores of 1–2 indicate a growth mindset, 3–4 are neutral, and 5–6 are associated with a fixed mindset. The sample regarded themselves as highly religious ($M = 4.13$, $SD = 1.09$). Religiosity scores of 1–2 show low religiosity, a religiosity score of 3 is neutral, and a religiosity score of 4–5 shows high religiosity. The sample had a higher average math score ($M = 22.90$, $SD = 5.63$), exceeding both the state ($M = 20.40$) and national mean ($M = 20.60$) for this standardized test (ACT State Report, 2016).

Table 7

Descriptive Statistics

	N	Mean	Std. Error	Std. Deviation
Mindset	159	2.91	.081	1.03
Religiosity	159	4.13	.086	1.09
ACT Math Score	101	22.90	.560	5.63

Table 8

Descriptive Statistics

	N	Skewness		Kurtosis	
		Statistic	Std. Error	Static	Std. Error
Mindset	159	.274	.192	.069	.383
Religiosity	159	-1.58	.19	1.52	.38
ACT math score	101	.18	.24	-.88	.48

Normality and independence. Appendix B contains histograms of the descriptive statistics from Tables 7 and 8. Mindset data appeared to be normally distributed from studying the histograms with a skewness of .27 (*SE* = .19) and kurtosis of .07 (*SE* = .38). Garson (2012) contended that normality for skewness falls between +1 and -1 while normality for kurtosis values fall between +2 and -2. Similarly, ACT math scores were normally distributed, yet a negative kurtosis value of -.88 (*SE* = .47) means that the distribution curve was flat. The histogram depicting ACT scores showed that math achievement scores were not skewed, but that the curve was slightly flat—which supports the negative kurtosis statistic. The histogram appeared to show bimodal data, meaning that ACT scores of 16 and 25 were the most prevalent scores in the sample and better represent the sample than the mean of 22.9.

Religiosity data does not fit a normal curve as shown in Tables 7 and 8. Religiosity's

kurtosis value of 1.52 (SE = .19) measured in the high/normal range. Religiosity scores had a

skewness of -1.58 (*SE* = .38), showing that the sample had more students that viewed themselves

as highly religious—this skewness was clearly seen in the religiosity histogram (see Appendix

B). This was not surprising because both schools in the sample were religious, specifically

Christian, schools. Both the kurtosis value and the histogram reveal a flattening of the curve,

which taken together means that the data are heavy tailed. The skewness and kurtosis values,

while not normal, did not affect the data analysis for this small-scale study. In order to

generalize the results of this study to a larger population, it would be necessary to survey a

population with a normal religiosity histogram, which was not the case in this study and is

further discussed in Chapter 5.

Outliers. Osborne and Overbay (2004) defined an outlier as any data point that is "far

outside the norm for a variable or population" (p. 1). It is critical for researchers to look for and

examine outliers in data. Outliers have the potential of distorting statistical analysis or inflating

error rates. Osborne and Overbay (2004) stated outliers exist for one of six reasons: data errors,

sampling errors, standardization failure, intentional or motivated misreporting error, faulty

distributional assumptions, and finally legitimated cases sampled from the correct population.

Osborne and Overbay (2004) recommended looking for data points that are three or more

standard deviations away from the mean to identify testing for outliers. These points need to be

examined closely by the above criteria to distinguish why they are outliers. Outliers that are less

than three standard deviations from the mean can be harder to detect.

Scatter plots and box and whisper plots were examined for outliers. Scatter plots (see

Appendix C) revealed a few questionable data points. Box and whisker plots (see Appendix D)

revealed that all ACT math scores fell within three standard deviations of the mean, one mindset score was outside of three standard deviations of the mean, and 13 religiosity scores were three standard deviations outside of the mean. The mindset outlier was a study participant who also represented one of the 13 religiosity outliers. The reason these outliers exist were considered using Osborne and Overbay's (2004) list of causes. It was determined that all of the outliers were legitimate data that was sampled from the correct population. Religiosity data were significantly skewed to the left, which means that a large majority of the students surveyed consider themselves highly religious. Of the total population of 159 students, the 13 outliers were students who reported not being religious. None of the outliers were removed from the data set because they were valid student responses and represented a portion of the population that was important to this research study.

Summary of descriptive statistics. Religiosity, Mindset, and ACT math scores were gathered from a sample of students at two choice parochial high school in the Midwest region of the United States. Histograms, scatterplots, and box and whisker plots were studied before descriptive statistics were run. Mindset and ACT math scores were normally distributed; religiosity scores were significantly skewed to the left. This skewness led to 13 religiosity outliers, some of which were more than three standard deviations away from the mean. The skewness and decision to keep all participant data and not remove the outliers is discussed as a limitation in the next chapter.

Instrumentation

Validity and reliability. The validity and reliability of Dweck's (2000) mindset measure and Francis, Brockett, and Village's (2014) religiosity measure, and the ACT's measure of math achievement were discussed in Chapter 3. Tables 9 and 10 include reliability statistics for

religiosity scores in this study's sample. Likewise, Tables 11 and 12 include reliability statistics for the samples' mindset scores.

Reliability. Using Cronbach's alpha to assess reliability of an instrument is a common practice when a survey uses multiple questions to measure one variable (Tavakol & Dennick, 2011). Cronbach's alpha measures the internal consistency of each item against the whole test. It ranges from 0 to 1. High alpha values show high internal consistency, which means that all the questions are measuring the same variable. Taber (2018) contended that an alpha score of .9 is excellent and an alpha score .8 is good. Taber (2018) recommended using an alpha score of .8 as a minimal score for an instrument to have internal reliability.

The religiosity measure's reliability statistics are summarized in Table 9 along with item-level statistics. The data gathered were highly reliable, with a Cronbach's alpha of .96. Table 10 shows alpha scores ranged between .95 and .97 when individual questions were removed. This shows that each question measured the same variable, religiosity, and that the survey had strong internal consistency, so no questions were removed.

Similarly, mindset reliability statistics are summarized in Table 11. Results in Table 12 show that if an individual item were removed from the survey, the alpha values remained above the 0.8 threshold (Taber, 2018), which further supported the decision to include all items. This mindset survey showed internal reliability with Cronbach's alpha of .89 and that each question was measuring the same construct, mindset.

Table 9

Religiosity Item Descriptive Statistics

	R. Q1	R. Q2	R. Q3	R. Q4	R. Q5	R. Q6	R. Q7	Religiosity
N	159	159	159	159	159	159	159	159
Mean	4.29	4.30	4.17	4.22	3.90	3.99	4.02	4.13
Standard Deviation	1.30	1.20	1.26	1.27	1.19	1.25	1.24	1.09

Table 10

Religiosity Reliability Statistic

	Scale mean if item deleted	Scale variance if item deleted	Cronbach's alpha if item deleted
R. Q1	28.73	57.27	.96
R. Q2	28.72	57.25	.95
R. Q3	28.85	56.62	.95
R. Q4	28.80	56.48	.95
R. Q5	29.12	59.77	.96
R. Q6	29.03	61.31	.97
R. Q7	29.00	58.67	.96

Table 11

Mindset Item Descriptive Statistics

	Mindset Q1	Mindset Q2	Mindset Q3	Mindset Q4	Mindset Q5	Mindset Q6	Mindset Q7	Mindset Q8	Mindset
N	159	159	159	159	159	159	159	159	159
Mean	2.99	2.82	2.88	2.60	3.03	3.173	2.89	2.87	2.908
Standard Deviation	1.46	1.39	1.39	1.29	1.38	1.40	1.34	1.34	1.03

Table 12

Mindset Reliability Statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total Correlation	Squared Multiple Correlation	Cronbach's alpha if item deleted
Mindset Q1	20.27	50.98	.68	.74	.87
Mindset Q2	20.44	50.90	.73	.77	.86
Mindset Q3	20.38	51.47	.70	.51	.87
Mindset Q4	20.66	52.69	.69	.57	.87
Mindset Q5	20.23	53.21	.60	.47	.88
Mindset Q6	20.09	55.47	.47	.35	.89
Mindset Q7	20.37	51.51	.73	.65	.86
Mindset Q8	20.39	52.74	.66	.59	.87

Quantitative Findings

The purpose of this mixed methods cross-sectional survey research study was to analyze whether a relationship existed between the motivational framework of mindset and the faith-based construct of religiosity in high school seniors who attended parochial high schools in the Midwest region of the United States. If a relationship between mindset and religiosity was found, the researcher would examine whether students' religiosity and mindset predict mathematics achievement.

Research question and hypothesis 1. The first research question was "what, if any, relationship exists between mindset and religiosity among high school students?" The null hypothesis stated there is no relationship between a student's religiosity and mindset and the alternate hypothesis stated there is a relationship between a student's religiosity and mindset. Correlations provided a measure of the direction and strength of a relationship between variables. A two-tailed test was selected to analyze a possible relationship between mindset and religiosity. A two-tailed test was chosen because current mindset and religiosity literature does not specify a

possible direction for a relationship and it was therefore necessary to test a possible relationship in both directions (positive or negative correlation).

Correlation values range between -1 and +1. A correlation of +1 represents a perfectly linear positive correlation, conversely, a correlation of -1 is a perfect linear negative correlation. A correlation of 0 represents no linear correlation. The scatterplot (see Appendix C) of mindset and religiosity data did not show an apparent visual relationship. However, as seen in Table 13, a small weak negative correlation existed between mindset and religiosity ($r = -.24$, $p = .003$). Therefore, in this sample, mindset and religiosity scores were significantly statistically related and the null hypothesis was rejected in favor of the alternative hypothesis. This should be interpreted as when the mindset of the sample increased (moved towards a growth mindset) there was a slight decrease in religiosity and conversely, when the mindset of the sample decreased (moved towards a fixed mindset) there was a slight increase in religiosity. While this relationship is statistically significant, it is a weak correlation. This relationship was also studied through a qualitative lens. Students described the phenomenon as when one construct is in struggle they are able to lean on the other construct for support. Both constructs, religiosity and mindset, function a continuum so it is appropriate to discuss small changes in both religiosity and mindset attitudes.

Table 13

Mindset and Religiosity Spearman's rho Correlation

		Religiosity	Mindset
Religiosity	Correlation Coefficient		-.237**
	Sig. (2-tailed)	.	.003
	N	159	159
Mindset	Correlation Coefficient	-.237**	
	Sig. (2-tailed)	.003	.
	N	159	159

**. Correlation is significant at the .05 level (2-tailed).

Research question and hypothesis 2. The second research question was "Can secondary student math achievement be predicted by mindset and religiosity?" The null hypothesis stated that religiosity does not predict a student's mathematic achievement and mindset does not predict a student's mathematic achievement. The alternate hypothesis stated that religiosity does predict a student's mathematic achievement and mindset does predict a student's mathematic achievement. A small significant negative relationship existed between mindset and religiosity. Therefore, a possible interaction relationship between these variables and math achievement was considered—could religiosity or mindset be used to predict academic success? As seen in table 14, religiosity and math achievement were not correlated ($r = -.04$, $p = .704$). Similarly, mindset and math achievement were not correlated ($r = .092$, $p = .358$), as seen in table 15. Scatter plots showing these relationships are found in Figure 5 and Figure 6 of Appendix C. Therefore, it was not appropriate to use linear regression testing. Religiosity and mindset cannot be used to predict math achievement.

Table 14

Religiosity and Math Achievement Spearman's rho Correlation

		Religiosity	Math Achievement
Religiosity	Correlation Coefficient		-.04
	Sig. (2-tailed)	.	.704
	N	159	101
Math Achievement	Correlation Coefficient	-.04	
	Sig. (2-tailed)	.704	.
	N	101	101

Table 15

Mindset and Math Achievement Spearman's rho Correlation

		Mindset	Math Achievement
Mindset	Correlation Coefficient		.09
	Sig. (2-tailed)	.	.358
	N	159	101
Math Achievement	Correlation Coefficient	.09	
	Sig. (2-tailed)	.358	.
	N	101	101

Qualitative Data Collection and Analysis

Data collection. It was intended to have four focus groups: one focus group for students with a fixed mindset and high religiosity scores, another with fixed mindset and low religiosity, another with growth mindset and high religiosity, and the last with a growth mindset and low religiosity. However, the data did not support this design. The sample's religiosity scores were skewed, which means that most of the sample identified themselves as religious/highly religious and, thus, recruiting two focus groups of students with low religiosity scores from the sample

used was not possible. Thus, three focus group categories were used. Students with a fixed

mindset and high religiosity scores comprised one focus group. Another focus group consisted

of students with a growth mindset and high religiosity. A final focus group consisted of students

with low religiosity and either a growth or fixed mindset, this is later referred to as a mixed

mindset. There were not enough students in the low religiosity group to have two separate focus

groups.

Of the 101 completed surveys from School 1, 26 of the students agreed to be contacted

for follow-up focus group interviews. Each of these students was sent an email invitation to be

part of a focus group interview. Specific dates were chosen and email reminders were sent to the

26 students who expressed a willingness to consider being part of the focus group interviews.

Nine out of the 26 students responded to the email invitation and were part of focus group

interviews. Table 16 shows the number of students that took part in focus group interviews.

Table 16

Mindset and Religiosity of Sample for Focus Group Interviews

	High Religiosity Fixed/Neutral Mindset	High Religiosity Growth Mindset	Low Religiosity Mixed Mindset
Sample Participated in focus group interviews	4	3	2
Total Sample**	50	37	14
Percent of students that participated from each category	8%	8%	14%

**The total sample refers only to students included in the study sample at School 1.

Sample demographics. As seen in Table 17, the nine students who participated in focus group interviews represented the diversity of the school. Five participants were male and four were female. Two Hispanic/Latino students, three African American students, and four Caucasian students made up the focus group sample.

Table 17

Demographics of Focus Group Participants

	Male	Female	African American	Caucasian	Hispanic/Latino
High Religiosity Fixed/Neutral Mindset	2	2	0	2	1
High Religiosity Growth Mindset	2	1	2	1	1
Low Religiosity Mixed Mindset	1	1	1	1	0
Total Sample**	5	4	3	4	2

**The total sample refers only to students included in the study sample at School 1.

Data analysis. Focus group interviews were transcribed and analyzed using qualitative data analysis. As recommended by Saldaña (2016), qualitative analysis kept the research questions and conceptual framework established for this study in the mind throughout the coding process. The first coding was a brief "search and seizure," which Saldaña (2016) described as looking "for the cream" from the data set (p. 24). This provided a quick assessment of patterns that were immediately apparent in the data. It was apparent that responses to the focus group questions were very similar for the students with both a growth and a fixed mindset. Similarly, responses that rationalized how religiosity was personally developed and its relation to mindset and achievement, were also similar for both students with high and low religiosity scores. Following this initial and brief coding, reflections of the qualitative analysis were recorded in a journal as analytic memo writing. Two first cycle coding methods were used to analyze the data.

Through Process Coding, In Vivo Coding, and analytic memo writing and reflection two themes and a key assertion were developed. Field notes from qualitative data collection and analysis are found in Appendix E.

Qualitative Findings

The purpose of this qualitative study component was to provide more depth and understanding of the quantitative findings. Statistical analysis showed that a small statistically significant relationship existed between mindset and religiosity but that there was not a significant statistical relationship between either mindset and math achievement or between religiosity and math achievement of high school seniors. Focus group interviews were used to further examine how religiosity and mindset have interacted, or not interacted, in students' personal lives and experiences and if students believe mindset and religiosity impacted their math achievement despite lack of evidence of a statistical relationship. Another focus of this qualitative portion of the study was to examine environmental factors that students perceived to aide in the development of their personal mindset and religiosity.

Through multiple rounds of In Vivo coding, Process coding, and analytic memo writing, two themes and a key assertion were developed. The two themes emerged from the focus group interviews: 1. *Environmental factors impact religiosity and mindset* and 2. *Religiosity and mindset impact academic success.* A key assertion also emerged through coding: *Religiosity and Mindset are two distinct yet harmonious constructs within adolescents. Religiosity and Mindset influence each other as students grow, develop, and achieve in school.* These themes and key assertion are summarized in Table 18 and described in detail in the following section. Field notes which detail the exact codes and frequency of the coding can be found in Appendix F.

Table 18

Description of Emergent Themes

Theme	Description of Theme
Environmental Factors	Do students believe environmental factors impacted the development of personal religiosity and mindset?
Academic Success	Do students believe that personal mindset and religiosity have contributed to academic success?
Key Assertation	Religiosity and Mindset are two distinct yet harmonious constructs within adolescents. Religiosity and Mindset influence each other as students grow, develop, and achieve in school.

Research question 3. The third research question was "Do students believe their environments have contributed to their religiosity and mindset? If so, how?" All of the student participants agreed that both their mindset and religiosity were developed and fostered by their environments. Nobody believed they developed their religiosity or mindset independent of their environment.

The participants described how their religiosity was impacted from their familial and home environments. The participants stressed how their immediate family initially laid the foundation for their beliefs in God and attitude towards religion. Celebrations of religious holidays, attending worship services, and family devotions are some of the earliest memories described by focus group participants. A student from the high religiosity and fixed mindset group commented, "Jesus was always important in my family. My grandma took me to church and taught me to pray when I was very young." Another student from the same group agreed saying, "When I was growing up, morals and values were always stressed at home as being the most important characteristic a person could have." Many participants discussed how religious education, including elementary, middle, and high school, was also a key factor to supporting

and increasing religiosity. Another student from the high religiosity and growth mindset commented, "It was important to my family that I continue my religious education in my school that they made personal and financial sacrifices so I could attend a school that supported these values."

Students were asked if they believed their religiosity, or attitude towards God and religion, would be different if they attended a non-religious school. Three different categories of responses were found. First, students acknowledged that a religious school provided them with a safe space to practice, learn, and question their religion and students believed that their religiosity was reinforced and strengthened by attending religious school. Second, students expressed that they would still be religious at a public school, but they would acquire their beliefs differently. A student from the high religiosity and growth mindset group commented, "Religiosity at a public school would have to be more private. Instead of my religiosity growing through classes and chapel, I would have to learn and study it independently and at home with my family." The environment where learning took place would be different, but the end result would be the same, increased religiosity.

Students with low religiosity agreed that religious education for students who did not perceive themselves as religious tended to push them further away from God and religion and, thus, lowered their religiosity even further. A student from the high religiosity fixed mindset group made an interesting comment regarding his classmate, "My best friend's parents put him in a Christian school because they wanted him to grow in his faith but (he) did not want any part of Christianity pushed on him. He was ultimately asked to leave the school because his values didn't conform to what was being taught and practiced here." Students with low religiosity- meaning they did not feel God or religion was important in their lives- resented both home and

school environments, which pushed or forced religion on them. This resentment led to academic struggles.

Similarly, students believed their mindset was also initially rooted and established in their home environments and later continued to be fostered and developed by teachers and other community members. Students discussed the value and importance their parent(s) placed on education and learning. One student commented, "Growing up, my parents and grandparents always told me how important school was and that I needed to do well in order to be successful as an adult." This was a common sentiment among focus group participants.

However, as students started school, they realized that valuing education is different from mindset—a student's belief about his specific ability to learn and be successful. One student from the high religiosity, fixed mindset group commented, "Most kids start school eager to learn and excited to be there, however it doesn't take long for some kids to realize they are good at school and others to realize they are not good at school." Another student in the same group commented, "It is really sad when somebody wants to learn but either doesn't know how or doesn't believe they can and stops trying."

Students with both a fixed and a growth mindset agreed that another important factor of developing personal mindset came from teachers. When teachers believe that a student is capable of learning the material, then the students reported that they were able to learn the specific content. One student, from the low religiosity/mixed mindset group commented, "Last year I was really nervous about a math class I had to take—I've always struggled with math. My teacher was amazing and he believed that I could do it. It was like he willed me to be successful and I was." Another student with a neutral mindset commented that he did poorly in middle school and was placed in "dummy math" his freshman year. His teacher stressed from the

beginning of the class she did not care about where the students start academically as long as each student worked hard and grew. He commented further, "I learned how to change my attitude towards learning during dummy math…oh and I also learned a bunch of math."

A theme that emerged from the participants was that in order for students to have a growth mindset, it was crucial that the teacher established a classroom environment that values the contributions of all students in the course. Students also commented that it was essential for teachers to notice when students learn and grow even if they still have a low grade in the course. One student from the low religiosity/mixed mindset group commented, "I learned more in some of the classes that I failed than the ones that I got good grades in and when the teacher acknowledged how much growth I made it pushed me to keep trying—even though I was still not likely to do well in the class." Students agreed that teachers need to acknowledge this learning because ignoring it leads to a fixed mindset where students believe they were not capable of learning the required content.

Research question 4. The last research question was "To what extent do students report that religiosity and mindset impact math achievement?" Students in the sample agreed that both mindset and religiosity are developed through their environments and both are variables that impact achievement.

Both students with a fixed mindset and a growth mindset described their mindset as impacting academic achievement. Students defined mindset as a person's ability or capacity to learn and be successful. Students with a growth mindset believed that there was no limit to growth potential or no cap to academic success and that with hard work and dedication to an academic pursuit there were no limits. Conversely, students with a fixed mindset believed that there was a limit to success and a limit to academic success.

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Students also described religiosity as impacting their academic success. Students in this sample were skewed toward high religiosity—the school from which the sample of focus group interviewees was drawn was a parochial choice high school. That said, being religious or belonging to a specific religious organization was not necessary for enrollment in this particular school. Rather students, or their parents (or guardians), choose for them to attend this school. Each day, students are required to attend a religion class and a chapel service. Students with high religiosity agreed that attending a religious school significantly impacted their academic success. Students described the comfort they felt when their courses and teachers support the same religious values they hold.

Students with high religiosity described specific aspects of their religion as setting the parameters for how they approached their academics. For example, one student shared an experience they had in a specific math class. He was taking an upper level math class and was frustrated with both the course content and the teacher—his mindset was becoming increasingly fixed as his frustrations grew: "When I was at my lowest point in this course and was sure I was going to fail the class, I started to pray about it. As I continued to pray I felt that my mindset changed. Instead of frustrations and a lack of motivation I committed to showing respect to the teacher—despite our differences—and working hard on the assignments. I don't know how it happened but soon I was doing much better. I actually got an OK grade in that class." This example illustrated how religiosity impacted the mindset and achievement for a specific student. Other students in the high religiosity focus group agreed that because of their religiosity they give respect to teachers and work hard to be successful. They described an obligation to God to use their academic abilities to their full potential.

Conversely, students with low religiosity agreed that attending a religious school was a detriment to academic success. When students felt that religion was pushed or forced on them and the values of the institution did not agree with personal beliefs or ideologies, then they pushed back against the teachers, classes, and ultimately the school and were not able or found it difficult to attain academic success. One student in the high religiosity and fixed mindset group said, "The smartest person I know was not successful here [referring to the school] because he did not hold to the same religious beliefs that were taught and reinforced in every class. At the same time, there are students with far fewer academic abilities who are successful and able to graduate [from specific school] because their religious beliefs align with those taught at the school." Highly religious students believed that their intelligence and religion were separate constructs yet they supported each other. However, these same students viewed a kind of cognitive conflict for students they believed to be highly intelligent students but did not agree with the religious teachings of the school. This conflict, for some students, resulted in a lack of academic success.

Discussion of Quantitative and Qualitative Findings

Students were also asked if they believed there was a connection between their religiosity and mindset, if one impacted the other. Interestingly, the responses were similar for students in all categories: high religiosity, low religiosity, growth mindset, and fixed mindset. Through coding, a key assertion was developed. According to study participants, religiosity and mindset are two distinct, yet harmonious constructs which influence each other and impact academic achievement.

During focus group interviews, after students described struggling with their mindset, they were asked how (or if) they were able to overcome the struggle and be successful. Five of

the seven students, all with high religiosity scores, who described a mindset struggle cited religiosity as a main contributor to overcoming the struggle, regardless of having a growth or a fixed/neutral mindset. All five of the students mentioned prayer, both personal prayers and prayers as a class, as a primary method for improving mindset. Religiosity defines prayer as a way to communicate with a higher being. Students mentioned praying for strength, perseverance, and the ability to be successful in either specific classes or in general when they were struggling with a fixed mindset. Three of the five students, who described a mindset struggle being helped by religiosity, discussed how their religious beliefs instilled a sense of responsibility to use their God-given gifts and abilities to their full potential and to show respect to their teachers by doing what they ask. One student commented, "by doing work to the best of my ability and following the directions of my teachers, I am expressing love for my God and therefore it is an act of worship." These students depended on their religiosity when they were struggling with their mindset.

Similarly, students described situations where they struggled with their religiosity and how their mindset helped them with their struggle. Of the nine students who participated in focus group interviews, five students described struggles with religiosity, each of whom had high religiosity scores. For example, one student commented, "during times in my life when I really questioned my religiosity (student told an elaborate story about a devastating house fire), I relied on my mindset to get me through. I believed that I was able to persevere and continue to be ok." After follow-up questions, the student described his religiosity struggle as questioning the existence of a God that would allow such a horrific event to happen in his life. The other four students who described a struggle with religiosity described some sort of questioning around God's presence in their lives. The students described these religiosity struggles as being

overcome in part by elements of their mindset. For example, the student who experienced a house fire which led to questioning the existence of God said, "I don't believe in quitting or giving up. While I struggled with my religion, I was hesitant to completely abandon my faith." He continued to describe how he reached out to trusted people in his life to talk about his religiosity struggles. A growth mindset contributed to his desire to try to understand and rectify his struggle. Without a growth mindset, the desire to work through the struggle would not exist.

Characteristics of a growth mindset encourage grit, tenacity, and a desire to learn and grow. Students discussed their mindset applying to academic achievement as well as other areas in their lives, including religiosity. As a result, students did not give up on God and religion in the face of hardship, instead they further devoted themselves to studying their religion to find answers to their questions and doubts. Of the five students who reported religiosity struggles, one resolved them by becoming less religious, three resolved them by becoming more religious, and the other two did not describe how or if the struggle was resolved. A growth mindset led these students to work through the religiosity struggles. While religiosity and mindset are two distinct constructs, they support each other.

It is important to realize that both mindset and religiosity are measured on a continuum from low (fixed) to high (growth). Mindset and religiosity values fluctuate depending on many different factors. For example, students may value and rank the importance of God in their lives differently when their environments or peer group changes. In this sample, religiosity values were skewed—the mean population had religiosity values, this means that most students believed that God and faith were important and valuable to their lives. Similarly, mindset values fluctuate depending on a variety of environmental factors. In order to understand the key assertion that was developed from the focus group interviews it was necessary to take a closer

look at the sample's mindset scores. On Dweck's (2000) measure of mindset, a score of 1–2 represents a growth mindset, a score of 3–4 represents a neutral mindset, and a score of 5–6 represents a fixed mindset. This can be a little deceiving because a score of 4.9 would fall into a neutral mindset while 5.1 would be a fixed mindset and there is only a small distinction between the two. Also, because of the mindset continuum, these numbers fluctuate frequently and students' can thus move between a growth, neutral, and fixed mindset. Also, when looking at a specific group of students, the group with highest mindset scores can be referred to as a fixed mindset, even if they are in the category of neutral mindset or growth mindset because they have the most fixed mindset of the population being considered. In this sample, mean mindset scores were 2.91 (*SD* = 1.03). This means that the average student's mindset fell into the very end of the growth mindset category and close to the neutral mindset category. Dweck (2000) described students in the neutral mindset category as having both growth and fixed mindset characteristics depending the situation.

Religiosity and mindset constructs were established and fostered by environmental factors throughout a student's life. Familial experiences and traditions were students' first contact with both religiosity and mindset beliefs. For example, one student described an early memory she had of attending a weekly story hour at a library with her mom weekly before she started school. She remembered being encouraged to learn and try new things. She stated this same attitude persisted throughout her school years. Another student described early memories of sitting on his grandma's lap during church services, hearing his grandma sing, and holding her wrinkled hand as they prayed together during the service. In this sample, both religiosity and mindset were first established by home and family environments starting at a young age.

The sample further described both religiosity and mindset as important factors in academic success at their parochial school. Students described a relationship between mindset and religiosity that reflects the small significant statistical relationship that was discussed earlier in this study. In this sample, students with high religiosity scores, who were struggling with their mindset felt as though they were able to fall back on their religiosity and seek support, encouragement, and guidance from their religion. These students believe that because they have a God who is there for them during hard times, they have a duty to live up to their God given potential (religiosity) and strive to work towards academic growth (characteristics of a growth mindset). Similarly, when students begin questioning their religiosity, they rely on their mindset. Students described situations where they questioned their faith and religious values. At these times, when religiosity was lower, students used their mindset to reevaluate their religiosity. Characteristics of a growth mindset encourage grit, tenacity, and a desire to learn and grow. As a result, students did not immediately give up on God and religion in the face of hardship, instead they further devoted themselves to studying their religion to find answers to their questions and doubts. While religiosity and mindset support each other, they remain two distinct entities.

Summary

The purpose of this study was to determine if a relationship existed between a student's mindset and religiosity, then to determine environmental factors that contributed to the growth and development of mindset and religiosity, and finally to determine if student believe mindset and religiosity impact their math achievement. The sample of the quantitative portion of the study consisted of high school seniors from two parochial high schools. The sample for qualitative focus group interviews consisted of students from one of the parochial schools surveyed.

The sample was surveyed and demographics information along with a religiosity and mindset score was determined for each participant. The data were cleaned and descriptive statistics were analyzed. Both mindset and academic achievement scores were found to be normally distributed. Religiosity scores were skewed; showing that the sample was highly religious. This is sensible because the entire sample attended parochial high schools. Religiosity and mindset scores were both valid and reliable.

Through correlation analysis, religiosity and mindset were found to be significantly related to each other. However, mindset and math achievement were not correlated, likewise, religiosity and math achievement were not correlated. There was no evidence to reject the null hypothesis, and therefore it was not appropriate to see if religiosity and mindset combined to predict math achievement in a multiple linear regression.

Focus group interviews were conducted for the qualitative portion of the study. Students were asked to explain how they believe their specific mindset and religiosity attitudes were developed. Students explained how their environments helped to established and foster both religiosity and mindset. Similarly, students discussed how religiosity and mindset affected their academic achievement at a parochial high school. Through In Vivo and Process coding, two themes and one key assertion emerged from the interviews. The first theme was that mindset and religiosity were both established and fostered through personal environments. Students discussed the importance of family, especially their parent(s) in instilling religious and educational values in their early lives. Many of the students in the sample had been in religious schools for their entire K–12 education. Students described how the religious and academic attitudes that began at home were fostered throughout their formal education. The second theme was mindset and religiosity both were influential in students' academic achievement. Students

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described specific situations where either mindset or religiosity impacted a specific academic outcome. Key Assertion: *Religiosity and Mindset are two distinct, yet harmonious constructs within adolescents. Religiosity and Mindset influence each other as students grow, develop, and achieve in school.*

Students described a relationship between mindset and religiosity where they can rely on one when they are struggling in the other. While mindset and religiosity do not necessarily function at the same time in all situations, many students rely on both mindset and religiosity frequently in academic situations.

Chapter 5: Discussion and Conclusion

Introduction

In this dissertation, a relationship between mindset, religiosity, and math achievement was studied. As separate constructs, growth mindset and religiosity have been shown to increase student achievement (Blackwell et al., 2007; Boaler, 2011; Claro et al., 2016; Claro & Paunesku, 2014; Jeynes, 2003, 2010; Messemer, 2007). However, no research was found connecting these two belief systems in the literature. This research gap resulted in interesting questions regarding a possible relationship between these constructs. Can a student's religiosity and/or mindset be used to predict math achievement? Are highly religious students more likely to have a growth or a fixed mindset? Are non-religious students, students with a low religiosity score, more likely to have a growth or a fixed mindset?

The research design for this mixed method dissertation study was quantitative, cross sectional, survey with a small qualitative component of follow-up focus group interviews. Bronfenbrenner's (2006) bioecological model served as the conceptual framework for this study. According to his theory, in order to understand the growth and development of a student, it is necessary to understand the multilayered environment that influences the student. The purpose of this final chapter is to summarize and synthesize both the quantitative and qualitative research results and discuss the findings through the lens of both the conceptual framework and literature review. A discussion of these results as they relate to theory and other empirical work is included, followed by a description of limitations and recommendations for future research, and a conclusion.

Summary of Results

A sample of 159 seniors at two parochial high schools in the Midwest participated in the quantitative portion of this study. These students completed a survey which was administered to measure their religiosity and mindset. ACT math scores were also collected from the guidance department at School 1 and used as the measure of academic achievement. Survey results were transcribed into SPSS for statistical analysis. A statistically significant relationship was found between mindset and religiosity, however, neither mindset nor religiosity were correlated with math achievement. These results are discussed in detail in this chapter.

Follow-up focus group interviews were conducted with nine students from School 1, for the qualitative component of this study. This process provided a personal voice to compliment the statistical analysis. Therefore, the relationship, or lack of relationship, between the constructs of religiosity, mindset, and achievement could be better understood. Through the focus group interviews, two themes and a key assertion were developed. The two themes that emerged from the focus group interviews were (a) *Environmental factors impact religiosity and mindset,* and *(b) Religiosity and mindset impact academic success.* A key assertion also emerged through coding: *Religiosity and Mindset are two distinct, yet harmonious constructs within adolescents. Religiosity and Mindset influence each other as students grow, develop, and achieve in school.*

Research question 1. What, if any, relationship exists between mindset, religiosity, and math achievement among high school students? The relationship between mindset and religiosity was statistically significant ($p < .05$). A Spearman's rho correlation found a weak negative relationship between mindset and religiosity ($r = -.237$) with a two-tailed significance of $p = .003$ at an alpha level of .05. In other words, when students' religiosity was high, it was

likely that their mindset was fixed, or moving towards the fixed side of the mindset continuum, and conversely, if their religiosity was low, it was more likely that their mindset was closer to the growth side of the mindset continuum. This weak correlation can be seen in the scatterplot which shows mindset versus religiosity (see Appendix B, Figure 4).

There was not a significant relationship between religiosity and math achievement ($r = -.04$, $p = .70$). Similarly, there was not a significant relationship between mindset and math achievement ($r = .09$, $p = .358$). This means that mindset and math achievement were not correlated, and religiosity and math achievement were not correlated. Said differently, in this sample, a student's mindset could not be used to predict their level of academic achievement on the ACT math exam. A student with a growth mindset had no higher chances of performing better on the ACT math exam than a student with a fixed mindset. Conversely, a fixed mindset did not equate to a lower score on the ACT math exam in comparison to a growth mindset. The same is true for religiosity. High or low religiosity did not equate to higher or lower achievement on the ACT math exam.

Research question 2. Can secondary student math achievement be predicted by mindset and religiosity? A non-significant relationship existed between achievement and mindset, and achievement and religiosity; their correlation coefficients were both close to zero. This means that the data points collected from the sample were truly scattered and do not have a linear relationship. This can be seen in the scatterplots in Appendix B. When variables do not have a statistically significant relationship, meaning they are not correlated, they cannot be used in a multiple regression model. Neither mindset nor religiosity could be used to predict math achievement through quantitative analysis in this research study. This research question is discussed through a qualitative lens in research question 4.

Research question 3. How do students believe their environments have contributed, if at all, to their religiosity and mindset? Students discussed how their personal beliefs and attitudes toward their mindset and religiosity were initially fostered through their home and familial environments. Parents or guardians were the first people to instill religiosity and mindset beliefs and attitudes into their children. As young children begin school, these beliefs and attitudes continued to be shaped by church and school experiences. One student described his experience saying, "My parents taught me the importance of having a solid relationship with God from early on. When I started school, that relationship continued to be supported by my teachers and friends." Another student commented similarly, "My grandma always encouraged me to try new things, to learn everything that I could, and to try each new experience that was offered to me. My teachers also encourage me to try new things, this year I am taking a music spectrum class and I am learning to play the piano and guitar—this is amazing because I'm not the least bit musical." The sample for this study had a unique shared experience because they attended a parochial high school. Religiosity beliefs were fostered throughout the school day by teachers and staff in a deliberate manner.

Through In Vivo and Process coding of focus group interviews, a theme emerged. Environmental factors impact the development of mindset and religiosity. The students in this sample reported that their life experiences and environment have been foundational in shaping their religiosity and mindset. The environmental factor that most clearly impacted and shaped students' mindset and religiosity was personal relationships with adults and peers close to them. While students were young, they were taught the importance of moral and educational ethos. As students matured, this ethos eventually developed into mindset and religiosity beliefs.

Research question 4. To what extent do students report that religiosity and mindset impact math achievement? As the students reflected on their K–12 educational experiences, they were asked to consider and describe how they believe that their mindset contributed to their achievement or lack of achievement in a specific course or class. It is important to remember that mean mindset score of this sample was 2.91, which equates to a low growth mindset (a score of 3 would be a neutral mindset). Students with a neutral mindset have characteristics of both growth and fixed mindset. These stories all had similar components. When a student believed they were capable of learning (growth mindset), they reported that they showed more grit during the course and sought help when/if they struggled, which resulted in academic achievement. Conversely, if students believed they were not capable of learning course material (fixed mindset), they reported that they did not bother to try to learn. They believed trying was not worth their time and effort because they were not going to be successful anyway.

Students were also asked to reflect on their K–12 educational experiences and to consider if their religiosity impacted their achievement. It is important to note that the sample for this study was skewed and included students who were highly religious. Specifically, the students in this study attended one of two parochial schools where Christian values were saturated into all parts of students' educational experiences. Students with high religiosity described specific aspects of their religion as setting the parameters for how they approached their academics. They described an obligation to God to use their academic abilities to their full potential. For example, one student said, "I feel that it is my responsibility to do the best that I can in each of my classes, even if they are hard and I don't like them. By doing this, I am showing respect to God for giving me teachers, school, and smarts." Conversely, students with low religiosity agreed that attending a religious school was a detriment to their academic success. This

detriment to achievement was a cognitive conflict that arose because their religiosity did not align with the values taught at the schools. Another student commented, "I get frustrated when I am trying to learn math or history or whatever, and the teacher won't just teach the subject because they try to add religion where it doesn't belong. I get frustrated and either tune out the teacher and quit trying or I get in trouble by disagreeing with the religious views being presented."

During each focus group interview, through discussions of mindset, religiosity, and academic achievement, a philosophic tie between these distinct variables became apparent and the key assertion developed: *Religiosity and mindset are two distinct yet harmonious constructs within adolescents. Religiosity and mindset influence each other as students grow, develop, and achieve in school.* Students described both mindset and religiosity as being important to their personal and academic development both in and out of school. Through Process Coding, four gerunds (aligning, centering, supporting, and focusing) were used to summarize students' descriptions and explanations of these distinct yet harmonious relationships between mindset, religiosity, and achievement. As described in Appendix F, the frequency of these coded gerunds to support the assertion is 23.

This described connection between mindset and religiosity was also supported by a small significant weak negative correlation in the quantitative findings (see Research Question 1). Specifically, students reported that when they struggled with their mindsets (moving towards a fixed mindset on the mindset continuum), they felt as though they were able to fall back on their religiosity and seek support, encouragement, and guidance from their religion. Similarly, when students began questioning their religiosity, they used their mindset beliefs (along with other environmental factors) to reevaluate their religiosity. Students described situations where they

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questioned their faith and religious values and how their mindset helped them to address questions of their religiosity.

Students struggle with their mindset anytime they question their ability to be successful at a particular task or when their mindset moves away from the growth and towards the fixed side of the mindset continuum. This often results in comments such as "this is too hard," "I am going to quit," "I am not good at this," "I will never be able to figure this out," and other types of negative self-talk describing ability to be successful. Seven of the nine focus group participants discussed times that they struggled with their mindset, including students with both a growth and a fixed/neutral mindset and students with both high and low religiosity.

Students with a growth mindset described themselves struggling with their mindsets as isolated incidents or with isolated classes. One student with a growth mindset commented, "I am a good student and learning usually new stuff comes naturally to me. However, during one math class I constantly doubted my ability to be successful and do well. I got stuck believing that I'd never be able to get through the course." This student struggled because the teaching style of the instructor was different than what she experienced from other math instructors and she was pushed out of her comfort zone by learning new and challenging material. Another student with a fixed mindset described her entire academic career as being "a constant state of doubting [her] ability to be successful." She reported being nervous if she could scrape by with a passing grade. She was convinced that she was not smart enough to be a good student or earn good grades.

In summary, this dissertation is a mixed methodological study which considered the relationship between mindset, religiosity, and math achievement. In the quantitative component, the researcher surveyed 159 high school seniors from two Lutheran high schools in the Midwest region of the United States. A statistically significant relationship (weak negative correlation)

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was found between students' mindset and religiosity. No statistically significant relationship existed between mindset and math achievement, nor between religiosity and math achievement. A qualitative component of this study was conducted with 9 students from School 1, using focus group interviews. Students described environmental factors that contributed to the development of their mindset and religiosity. Then, students reflected on and discussed how they perceived their mindset and religiosity worked together and the impact these constructs have on academic achievement. The two themes emerged from the focus group interviews: (a) *Environmental factors impact religiosity and mindset,* and *(b) Religiosity and mindset impact academic success.* This qualitative finding, *b*, is in contrast to the non-significant relationship between mindset, religiosity, and math achievement found in the quantitative portion of this study. A key assertion also emerged through coding the qualitative data: *Religiosity and Mindset are two distinct yet harmonious constructs within adolescents. Religiosity and Mindset influence each other as students grow, develop, and achieve in school.*

Discussion of Results

The purpose of this section is to discuss results as they relate back to the conceptual framework and mindset and religiosity literature. Bronfenbrenner's bioecological model is used as a lens to understand how religiosity and mindset can coexist within an individual and the impact of both religiosity and mindset on development and academic achievement of high school seniors. Bronfenbrenner's bioecological model lead to deeper understanding of the constructs being studied. Finally, the results of this study were discussed in comparison to the current mindset and religiosity literature.

Connecting findings to conceptual framework. This research study is based on Bronfenbrenner's bioecological model of human development. A bioecological model is an

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evolving scientific theory, which Bronfenbrenner and Morris (2006) defined as a "phenomenon of continuity and change in the biopsychological characteristics of human beings, both as individuals and as groups" (p. 793). The overarching theme of this conceptual framework is the powerful impact of the environment on individual development. In this dissertation study, the relationship between students' mindset and religiosity and how these separate constructs influenced student growth and development, specifically academic achievement, was considered. Bronfenbrenner's bioecological model is used appropriately when it deals with research in the discovery mode (a beginning attempt to study relationships between environmental factors and student development) versus the verification mode (large scale empirical testing which would lead to theories). No research was found on how religiosity and mindset relate to each other in an academic setting; therefore, this study is in the discovery mode.

The first step in the discovery mode of studying religiosity and mindset was a statistical analysis of participants' survey responses which measured their mindset and religiosity. While Bronfenbrenner's model states that all areas of one's environment contribute to proximal processes and, thus, shape development, it does not say that all areas of the environment are related to each other or that they impact each other. For this reason, this study utilized statistical testing that determines if variables are correlated, which indicates whether any observed relationship between variables occurred by chance or whether it will be likely observed with a similar sample. In this sample, religiosity and mindset were significantly related. Bronfenbrenner described the interdependence of human behavior and encourages follow-up studies on significant findings in order to more fully investigate the highly nested nature of human development (Bronfenbrenner & Morris, 2006). In order to understand how and why religiosity and mindset are significantly related and to discover how this relationship impacts

students, further study is needed. Bronfenbrenner's bioecological model is used as a lens to understand how religiosity and mindset can coexist within an individual and the impact of both religiosity and mindset on development and academic achievement of high school seniors.

The second step in the discovery mode of studying religiosity and mindset was a qualitative analysis of these constructs, which allowed the study participants to reflect on and discuss how these constructs can exist simultaneously within a person. Then, participants further described the significant relationship that existed between these variables. When this qualitative data was analyzed through the lens of Bronfenbrenner's bioecological model, it allowed for deep discovery between proximal process (personal interactions between individuals and their environment) and specific environmental factors that contribute to a relationship between constructs (Bronfenbrenner & Morris, 2006). Through focus group interviews, students reflected on environmental factors that impacted their proximal processes and, therefore, their development and academic achievement. Focus group interviews allowed students to think about and discuss how both their home and school environments impacted individual religiosity and mindset. Bronfenbrenner and Morris (2006) stated deep discoveries between constructs are made when they are analyzed at a macrosystem level, meaning it is necessary to analyze individual person factors and then to examine attitudes and ideologies of the collective sample. Through reflection and discussion, students were able to go beyond individual experience from the microsystem level and describe the relationship between mindset and religiosity at a macrosystem level.

The reciprocal relationship between mindset and religiosity was discovered in both the quantitative and qualitative portion of this study. Students' mindset and religiosity scores were initially measured individually through surveys. Later, in focus group interviews, students

shared individual experiences from their proximal processes and person characteristics. Finally, when students discussed religiosity and mindset at a macrolevel, they were able to assimilate shared experiences and come to a consensus that religiosity and mindset are two distinct, yet harmonious, constructs that impact academic achievement in a parochial school. Students whose religious values align with those of the school are encouraged by their religion, which supports their education. Students whose religious values do not align with those of the school find religion to be a stumbling point in their education. The majority of students attending the parochial schools in this sample were highly religious and the data were skewed towards high religiosity.

This created an interesting environment where highly religious and not religious students were learning in an atmosphere that supported and encouraged the beliefs and ideologies of highly religious students yet hindered, and became a detriment, for non-religious students. The macrosystem discussed was the school culture where religion was taught and supported by administration, teachers, and curriculum. Inside this macrosystem, both highly religious students and nonreligious students had very different experiences. Instead of simply comparing the experiences of individual students, studying the macrosystem or school culture of these combined experiences led to a consensus and understanding of the relationship between mindset, religiosity, and achievement. Using both the discovery and verification mode of Bronfenbrenner's bioecological model lead to deeper understanding of the constructs being studied.

Connecting findings to literature.

Mindset literature. Dweck's (2006) mindset theory is a framework of motivational beliefs that states that academic achievement is impacted by personal beliefs regarding the ability

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to learn and be academically successful. Students with a growth mindset believe that intelligence is malleable and that they can face challenges, overcome them, and succeed through perseverance and hard work. For example, students with a growth mindset see mistakes as opportunities to learn and use them to grow and achieve. In contrast, students with a fixed mindset do not believe they can increase their skills and knowledge. Students with a fixed mindset see mistakes as highlighting their lack of ability to learn. Out of frustration, they lose hope of being able to succeed. Thus, a fixed mindset can lead to failure and a lack of grit and perseverance in academic pursuits (Dweck, 2006). Students' mindsets can act as a filter through which they perceive school and the world. Through the lens of a growth mindset, students may welcome changes and challenges because they believe they can try new things and be successful. Conversely, students with a fixed mindset may fear challenges and lack the persistence necessary to be successful.

Dweck (2008) and Boaler (2013) contended that mindset theory plays a key role in student math achievement. Students who believe that math intelligence is a fixed trait and only attainable by some have fewer successes in math than students who believe that their math intelligence and ability can be developed. Blackwell et al. (2007) found that mindsets predicted math achievement in a longitudinal study of middle school students.

The quantitative results of this current research study were different than what was found in mindset literature (Blackwell et al., 2007; Boaler, 2011; Claro et al., 2016; Claro & Paunesku, 2014). In this sample, mindset and math achievement were not correlated. There was no pattern found between students' mindset and academic achievement. This means that the mindset of this sample could not be used to predict math achievement. However, in the qualitative portion of the study, students did verbalize connections between mindset and achievement. Students

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described how their personal mindset attitudes were developed and impacted through proximal

processes between home and school environmental factors. Students described a connection

between mindset and math achievement. They believed that their mindset impacted how well

they achieved in specific courses. Students made a small distinction between math mindset and

math achievement and mindset and academic achievement in general. This is consistent with

Boaler's (2011) work on mathematical mindset. Students in the sample noted that it is possible

to have an overall growth mindset and to be a good student in most subjects and then to have

tendencies towards a fixed mindset in mathematics and perform lower in math than other

subjects. However, most focus group interviews did not differentiate between math mindset and

math achievement and an overall general mindset and achievement.

The inconsistencies of the quantitative data with previous literature and the qualitative

portion of this study could be due to the small sample that came from a single school. Mindset is

malleable, meaning that it changes in different situations and environments (Braun, 2014;

Dweck, 2006; Yeager & Dweck, 2012). Students were not specifically asked to think of math

courses or content when they were evaluating their mindsets. This lack of specificity in

measurement may explain why mindset and achievement were not statistically related in this

study. Furthermore, the measure of mindset was taken in May of 2018 while most students took

the ACT in February of 2017. This time difference could have allowed for changes in mindset

beliefs from the time of the achievement measure and mindset measure.

Religiosity literature. Bronfenbrenner's bioecological model (Bronfenbrenner & Morris,

2006) includes religion and spirituality as part of a person's personal characteristics and

environment. Leggo's (2004) research aligns with Bronfenbrenner (2006) when he contends that

schools and individuals need to embrace the "whole experience of becoming human,

acknowledging the ecological interconnections of the intellectual, creative, embodied, emotional, and spiritual identities that shape who I am and who I am becoming in the world" (p. 32). Students' religiosity is an important environmental factor to fully understanding student development.

Religiosity impacts how a person conducts his or her life and the daily choices made surrounding moral and ethical values. Beyond engagement in specific subject areas, the whole person is educated by "considering the development of critical moral consciousness as a critical disposition for sustainability" (Podger, Mustakova-Possardt, & Reid, 2010, p. 347). Therefore, adolescences should have the opportunity to experience proximal processes in multiple environments that allow them to develop a moral framework from which they lead their lives and make decisions that will impact their futures.

Religiosity impacts students' view of education, including their type of mindset and degree of persistence. Derrico, Tharp, and Schreiner (2015) found that "realistic optimism was an essential quality for student success and prolonged academic engagement; this perspective was often fueled by students' faith" (p. 317). Realistic optimism, as discussed here, is similar to how Dweck (2006) discussed mindset beliefs. Realistic optimism is believing that oneself is capable of learning course material or subject matter, similar to growth mindset. Without this, individuals do not believe that they can succeed in a course or with specific subject matter, similar to a fixed mindset.

Religiosity, like mindset yet on a smaller scale, has been shown to positively increase academic achievement in some studies. In a small qualitative case study, spirituality was found to increase African American men's achievement in high-level mathematics courses (Jett, 2010). Each of the men spoke of their personal religious practices as being a key element and driving

force of their successes in mathematics. Due to this similarity, Jett (2010) stated, "educators cannot allow ideologies that splinter spirituality from academic performance to thrive especially in the area of mathematics" (p. 332). Jeynes (2003) also found that religious students achieve at higher levels academically and outperform their less religious counterparts.

While Jeynes (2010) found a link between religiosity and higher achievement, other studies have not favorably connected religion to academic achievement. Schubmeh, Cubbellotti, and Ornum (2009) surveyed college students involved in a campus ministry program and found no significant correlation between religiosity, which was defined and measured by the Index of Spiritual Experiences scale, and grade point average (GPA). In a similar study, Good and Willoughby (2011) looked for a relationship between extracurricular activities, both religious and non-religious, and GPA. They found that more frequent involvement in religious activities (but not non-religious activities) led to lower levels of illegal substance abuse over time. There was a non-significant correlation between religious activity and academic achievement (as measured by grades). While participation in religious activity led to lower levels of substance abuse, it was not correlated directly to academic achievement. Religiosity research, especially studies which relate achievement to religiosity, are limited.

The results of this study contribute to the current religiosity literature because no other studies used a sample of adolescent students. In addition to measuring religiosity of adolescents, this study involved students reflecting on different factors that contributed to their religiosity and then how their religiosity impacts academic achievement.

Similar to mindset results, quantitative measures did not show a significant relationship between religiosity and academic achievement in high school seniors; yet, the qualitative results showed students believed that their religiosity impacted their academic achievement. More

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studies need to be done to discover if religiosity impacts academic achievement in different samples of high school students, other subject areas, or other age groups, as well as using different measures.

Mindset and religiosity literature. Similar to the current dissertation study, Mvududu and Larocque (2008) studied the relationship between faith, hope, and attitude toward statistics in a religious and a secular college. The students in the Christian college reported more hope, a more positive attitude, less anxiety, and more intrinsic religious motivation than the students at a comparable secular college. Consequently, greater intrinsic religious motivation was associated with a more positive attitude toward statistics (Mvududu & Larocque, 2008). They found that students who practiced religion reported less anxiety and had more motivation in statistics courses. These studies have shown that educating the whole person and not ignoring elements of religiosity can have positive academic implications for student development.

In this study, qualitative findings further supported the quantitative findings that there was a significant relationship between mindset and religiosity constructs. These findings add to the literature by finding and examining the significant relationship between mindset and religiosity in this sample of high school seniors. Students discussed how their personal mindset and religiosity beliefs impacted their identity as a student at the parochial school they attended. For example, a large majority of students considered themselves religious ($m = 4.1$ on a 5-point scale, which denoted high religiosity); while the mindsets were normally distributed ($m = 2.9$ on a 6-point scale, which denoted a slight growth mindset).

The majority of students in the sample described how both religiosity and mindset attitudes were equally important in their success, this is a new finding and adds to current religiosity and mindset literature. While mindset and religiosity remain distinct constructs, they

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work together to impact student growth, development, and academic achievement of students with high religiosity. One student said, "mindset and religiosity are two foundational pillars that my entire education is based on." She continued to discuss how when her mindset pillar was weak (e.g., struggling academically, lack of effort, questioning if she could be successful), she would lean heavily on her religiosity pillar. From this pillar, she would lean on the faithfulness of God and his promises to her and expectations of her and would find motivation to push through the academic struggles. Conversely, when her religiosity pillar was weak (e.g., doubting faith or God's presence in her life), she would lean on her mindset values and, with grit and tenacity, commit to digging further into her religious beliefs until she was solidly balanced again on both pillars.

The focus group began to discuss this two-pillar idea as being significant to their entire K–12 educational and life experiences. A different student commented, "ideally (in a perfect world) both (referring to mindset and religiosity) would be strong all the time but in reality, when life gets hard one takes a beating and it is necessary to have the other to build it back up." This concept of religiosity and mindset supporting each other in times of struggle was consistent among students with high religiosity.

Students with low religiosity and mixed mindsets (both growth, fixed, and neutral) also discussed this two-pillar concept and how it did not work for them. Students with low religiosity struggled to fit into the religious part of a parochial school. They attended a parochial school for reasons other than religion (academics, choice, sports, fine arts, etc.). Religiosity was not a pillar that supported their education. They described being "turned off of religion" when they felt that religious values and ideologies were "forced on them." They desperately sought a second pillar (teams, groups, clubs, friends, etc.) that was aligned with their views and values. They either

could not find one or, when they did, the pillar was not supported by the institution, which created animosity and feelings of failure (both academic and personal) for the students with low religiosity.

Limitations

One limitation of this study is found in the convenience sampling method. Only students from parochial schools were included in the sample. To be able to generalize and extend the results of this study to a more diverse group of high school seniors, it would be necessary to increase the population to include public, private, and parochial schools in the sample. Public school districts in the same geographical region were contacted to be included in this study, but all declined because they did not want their students taking a survey to measure religiosity. In the future, expanding the research population to include students at non-religious schools would strengthen the study because it would potentially decrease the skewness of the data. To increase the inclusion of students with a wider religiosity background it is suggested to use a sample of students not connected to a school or religious institution. The convenience sampling of this study may have led to bias and limited the power to generalize or extend the results beyond the specific sample studied.

Another limitation in this study occurred with surveying the second school. There was a miscommunication with students not knowing their school identification numbers. Because students did not know their identification numbers, it was not possible to match ACT math scores with specific mindset and religiosity surveys. This had two implications for this dissertation study. First, correlations between mindset and religiosity were able to use the entire sample of approximately 160 students. Second, correlations between religiosity and achievement and mindset and achievement were only able to use data from the sample from

School 1, which had a sample of approximately 100 students. This smaller sample was still above the power threshold needed for the sample.

Another limitation in the quantitative portion of this study occurred with the instruments and timing used to survey students and gather data. Students were not given specific instructions to consider mathematics courses when measuring their mindset values—the instrument has them broadly consider mindset. The measure of academic achievement was their ACT math subset score. This test was taken in February of their junior year, over a year prior to the mindset and religiosity measures.

Implications of Results

Implications for research. Little research has studied the relationship between mindset and religiosity. In this study, mindset and math achievement did not have a statistically significant relationship. This does not agree with the vast majority of mindset literature which shows statistically significant relationships between mindset and religiosity (Blackwell et al., 2007; Boaler, 2011; Claro et al., 2016; Claro & Paunesku, 2014). Similarly, religiosity and academic achievement were not correlated in this study, while religiosity was positively correlated with academic achievement in the literature (Jeynes, 2003, 2010; Messemer, 2007). This study, done in the discovery mode, found a statistically significant relationship between mindset and religiosity. During focus group interviews, students described the same weak inverse relationship between religiosity and mindset that was found in the quantitative survey. This means that when students had a growth mindset they had lower religiosity scores.

Conversely, when students had a fixed/neutral mindset, their religiosity was high. This relationship is consistent with the sample studied which had high religiosity scores ($m = 4.1$ on a 5-point scale) and a growth mindset ($m = 2.9$ on a 6-point scale). Students with a high religiosity

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score had scores on the fixed side of the mindset continuum. However, since the sample mean had a growth mindset, this set of students, in reality, had a neutral mindset. This neutral mindset allowed students to still exhibit elements of a growth mindset. These results contribute to both mindset and religiosity literature because it shows one example of how mindset and religiosity, two distinct entities, work harmoniously within high school students and impact academic achievement.

Future research studies that consider the relationship between mindset and religiosity would help to further understand how students can hold two different constructs/attitudinal belief systems simultaneously and how both constructs work together to affect academic achievement. The relationship between mindset and religiosity was significant in this small sample of high school seniors from parochial schools. Additional research could look at this relationship with different groups of students to determine if a significant relationship exists.

Implications for practice. High school is a place and time where and when adolescent students try to find their identity in the world. During this time, students experience periods of struggle and conflict as they try to assimilate different experiences and belief systems. Bronfenbrenner's (2006) bioecological model describes how times of conflict and struggle are necessary for development. One example of struggle and conflict that adolescents experience is understanding how a person can simultaneously hold two separate belief systems—one that governs attitudinal beliefs concerning academic achievement and motivation and one that concerns religious beliefs and attitudes that govern personal morality and spirituality. As students experience conflict trying to reconcile these belief systems, they are forced to reflect on previous experiences and their environment. This reflection either leads to a change by developing a new schema that allows for growth by restructuring previously held beliefs and

attitudes or reflection confirms previously held beliefs and, therefore, these beliefs are strengthened.

In this study, students expressed a sense of comfort and greater academic achievement when their religiosity views were supported by important people in their environment, such as immediate family, peers, teachers, and administration. However, religiosity became a stumbling block for students' when their religiosity was not in alignment with either their families' or their schools' belief. When deciding what school is the best fit for each individual, families may need to look at what impact environmental factors, such as religiosity, has on the students' academic achievement.

Students are most successful when their beliefs and ideologies are aligned with the institutions/schools they are attending (Darling-Hammond, 2012). Parochial education is one example of students' aligning their beliefs with an institution. Parochial education works when students, families, staff, and curriculum have similar beliefs and focus on these beliefs to support learning. This alignment of beliefs creates buy in and stakeholders are more apt to work together to support learning, hence making it critical for students and families to select schools that closely align with their beliefs and ideologies, especially in communities where there are multiple choices for school attendance. Nonpublic choice/voucher schools need to be clear and upfront to students and families about beliefs and ideologies that are taught and that students are expected to follow. Potential students and families need to be clearly told that if their beliefs do not align with those of the institution that there is a high likelihood that the student will not be academically successful.

Students and families should be careful when picking a choice school to be sure they agree with the beliefs and ideologies taught. For example, choosing a religious school because

of strong academics or a good fine arts program is not a good idea if the student is going to struggle to abide by religious standards and values. Parochial education can impede academic success when the religious beliefs are not common. In the case when a student is poorly aligned with a parochial school, teachers need to be cognizant of this and be honest and upfront with the student and family about the likelihood of academic success. Trying to be understanding and to help a student be successful while also working with a guidance department to assist them in finding another school that would more closely adhere to family beliefs and ideologies is critical for student success.

Recommendations for Further Studies

Bronfenbrenner's (2006) bioecological model is best suited for research projects in the mode of discovery, versus the mode of verification. Looking at proximal processes and environmental factors that have contributed to the population's religiosity and mindset, this study was able to develop emergent research findings for these constructs. Bronfenbrenner's (2006) model encourages any study of discovery to be further evaluated according to proximal processes and environmental factors: "this iterative process of successive confrontations between theory and data leading toward the ultimate goal of being able to formulate hypotheses that both merit and are susceptible to scientific assessment in the verification mode" (Bronfenbrenner & Morris, 2006, p. 802). This study is a start to understanding the relationship between mindset and religiosity and the impact these constructs have on academic achievement in high school students. However, in order to better understand the relationship between the constructs of religiosity and mindset, further research needs to be done. This is the iterative process discussed by Bronfenbrenner and Morris (2006). Future studies are needed to verify this study's results and

lead to a theory regarding if and how the constructs of mindset and religiosity work together and if and how they impact academic achievement.

Religiosity and mindset are both attitudinal beliefs that are established, at least partly, from a child's environment. These beliefs fluctuate throughout life and can change in different situations. To get a deeper understanding of the connection between mindset and religiosity, more research is needed. A longitudinal study that follows a group of students to view how religiosity and mindset grow and change as they experience different aspects of life would add to the understanding of how environmental factors impact these constructs. Examining how other environmental factors, such as socioeconomic status, cultural factors, and demographic factors, impact mindset and religiosity would align with Bronfenbrenner's bioecological model which states that all aspects of an environment need to be considered to fully understand the growth and development of a student (Bronfenbrenner & Morris, 2006).

The convenience sample for this study was limited for a variety of reasons previously discussed. In the community where the schools from this study are located, a strong school voucher system was established. This means that a large number of students are leaving the local public schools and attending choice or voucher schools (these are non-public schools that receive state money to cover tuition costs). Many of these schools are religious. This study could be strengthened by broadening the sample outside of parochial high school seniors. The relationship between mindset and religiosity could be studied with students from a wider background of religious upbringing. Researching religiosity and mindset of students from public, non-religious private schools, and from non-Christian religions would add depth to the constructs of religiosity and mindset.

Conclusion

The purpose of this research study was to examine if a relationship exists between religiosity, mindset, and math achievement. No studies were found that previously considered a relationship between these variables. Both mindset and religiosity are personal dispositions which impact students' proximal processes, specifically, the interactions between students and their educational stakeholders which include immediate family, teachers, administration, peers, and church leaders (Bronfenbrenner & Morris, 2006). This, in turn, impacts the growth and development of students. In order to understand the growth and development of students, it is necessary to consider many aspects of their environment because each environmental factor acts as a lens or framework through which students view the world. This includes the person, process, and context pieces of Bronfenbrenner's bioecological model which include both the environment and the individual's capacity to interpret and make sense of the environment (Bronfenbrenner & Morris, 2006).

Religiosity, mindset, and math achievement were first analyzed quantitatively. A statistically significant relationship (a weak negative correlation) was found between religiosity and mindset. A qualitative analysis using focus group interviews supported this finding. Students described religiosity increased when mindset decreased (moved down the continuum towards a fixed mindset) and, conversely, mindset increased (moved up the continuum towards a growth mindset) when religiosity decreased. In other words, students described that during times of academic struggle (doubting their ability to be successful and learn material, indicating a more fixed mindset), they relied on their religiosity and faith as one resource to bring them through the difficult time of academic struggle. Believing that God would get them through a difficult academic struggle helped them to focus and stay positive in the class or activity. Conversely,

when students felt their religiosity was weakening, they relied on their mindset as one resource to devote themselves to the study of religious texts or to talk to religious leaders until their religiosity was once again stable.

A qualitative analysis also gave students the opportunity to describe environmental factors that contributed to their specific mindset and religiosity. Through the focus group interviews, two themes and a key assertion were developed. The two themes that emerged from the focus group interviews were (a) *Environmental factors impact religiosity and mindset* and *(b) Religiosity and mindset impact academic success.* A key assertion also emerged through coding: *Religiosity and Mindset are two distinct yet harmonious constructs within adolescents. Religiosity and Mindset influence each other as students grow, develop, and achieve in school.*

The relationship between mindset and religiosity needs to be further to understand how these separate constructs can exist together within a person. According to Bronfenbrenner's (2006) bioecological model, working through these proximal processes are a joint function of both the developing person and the present environment where the processes are taking place. Both religiosity and mindset are attitudinal measures that, when applied to new situations, force people outside their comfort zone. This cognitive dissonance must be thought through and then either assimilated into current religiosity and mindset beliefs or used to alter previously held beliefs (Bronfenbrenner 2006). The relationship between mindset and religiosity, in this sample of highly religious students, showed that these constructs are foundational pillars that aid and support the growth and development of students throughout their education.

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Appendix A: Quantitative Data Entry

Floyd and Fowler (2014) insisted the first step to coding is to assign an identifying number to each data point. This is critical in order to check the completed file for completeness and accuracy. Floyd and Fowler (2014) stated that coding data in the same order it appears on the survey is a type of quality control that reduces errors in the coding process. Floyd and Fowler (2014) stated, "One critical criterion for a good code is that it must ambiguously assign each answer to one and only one code number" (p. 129). Another critical criterion for coding survey data is to put survey responses into meaningful categories.

Data were coded in the same order that it appeared on the survey. An identifying number was used for each student and was digitally coded first. The code was constructed so that a distinct abbreviation was used to delineate "no response," "don't know," and "other" responses from student surveys. One category on the survey for religious affiliations included "other Lutheran" but because this category had minimal responses it was merged with "other Christian" because combining them created a more meaningful category. Floyd and Fowler (2014) would agree saying the categories "other Lutheran" and "other Christian" were analytically similar and should be coded the same.

Data Cleaning

Data entries were recorded and then checked to be sure coded responses were accurate. Initially data were entered into a password protected spreadsheet and cleaned for accuracy. Cleaning is the process where all data entered is checked for accuracy, for example, extra spaces were removed and all capital and lower-case letters were the same for abbreviated responses. Any found errors were compared with the original survey before changes were made. After data were cleaned, it was imported into SPSS for data analysis.

Qualitative Data Analysis

Focus group interviews were transcribed and analyzed using qualitative data analysis. Qualitative coding is a heuristic process. Heuristic comes from Greek origin and means to discover. Saldaña (2016) described coding as an "exploratory problem-solving technique without specific formulas or algorithms to follow" (p. 9). Problem-solving in qualitative research involves dividing, grouping, organizing, and reorganizing data in order to consolidate meaning by finding patterns within the data. Saldaña (2016) described coding as a cyclical process. Each time data is analytically broken apart and coded in detailed relevant ways, new questions about the data surface which leads to further coding and analysis. Saldaña (2016) defined qualitative analysis as a search for patterns within the data and then a search for understanding why the patterns exist.

Saldaña (2016) contended, "qualitative inquiry demands meticulous attention to language and images, and deep reflection on the emergent patterns and meanings of human experiences" (p. 11). Qualitative analysis takes data and uses multiple coding methods to find categories and subcategories within the data. Through additional coding, themes and concepts emerge from categories and subcategories. A possible end result of coding is to develop a new theory which is applicable to similar data from different samples. Saldaña (2016) stressed that theory development is a complex process and that theories are not developed from most qualitative research studies. Successful qualitative analysis moves real data towards abstract meaning. A key assertion "proposes a summative, interpretive observation of the local contexts of a study" and like a theory, a key assertion "attempts to progress from the particular to the general" (Saldaña, 2016, p. 15). Similarly, a result of qualitative data can be generating themes which

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Saldaña (2016) defined as an "outcome of coding, categorization, and analytic reflection" (p. 15).

As recommended by Saldaña (2016), qualitative analysis for this study kept the research questions and conceptual framework established for this study in the mind throughout the coding process. After focus group interviews were transcribed, the initial coding method was a brief "search and seizure," which Saldaña (2016) described as looking "for the cream" from the data set (p. 24). This provided a quick assessment of patterns that were immediately apparent in the data. It was apparent that responses to the focus group questions were very similar for the students with both a growth and a fixed mindset. Similarly, responses that rationalized how religiosity was personally developed and its relation to mindset and achievement, were also similar for both students with high and low religiosity scores.

Following this initial and brief coding, reflections of the qualitative analysis were recorded in a journal as analytic memo writing. Saldaña (2016) described analytic memos as conversations a researcher has with themselves about the data and coding process. "Coding and analytic memo writing are concurrent qualitative data analytic activities, for there is a reciprocal relationship between the development of a coding system and the evolution of understanding a phenomenon" (Saldaña, 2016, p. 44). Throughout the qualitative analysis and coding of this study, analytic memo writing was used to reflect upon and organize developments.

Two first cycle coding methods were used to analyze the data generated by focus group interviews. Codes were written in the margins of the printed transcript. Saldaña (2016) recommended manual coding for small studies. In Vivo Coding is a process that looks for a word or short phrase from the participants own words. The interview transcripts were first coded looking for In Vivo responses that applied directly to the studies research questions. After the

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first round of In Vivo Coding and further reflection through analytic memo writing, Process

Coding was used to describe what was happening in the context of the In Vivo Code. Process

Coding uses only gerunds to code observations. Following this initial round of first cycle

coding, the codes were separated by the research question they pertained to and then organized

by grouping similar gerunds and participants' words. Through Process Coding, In Vivo Coding,

and analytic memo writing and reflection themes and a key assertion were developed.

Appendix B: Histograms
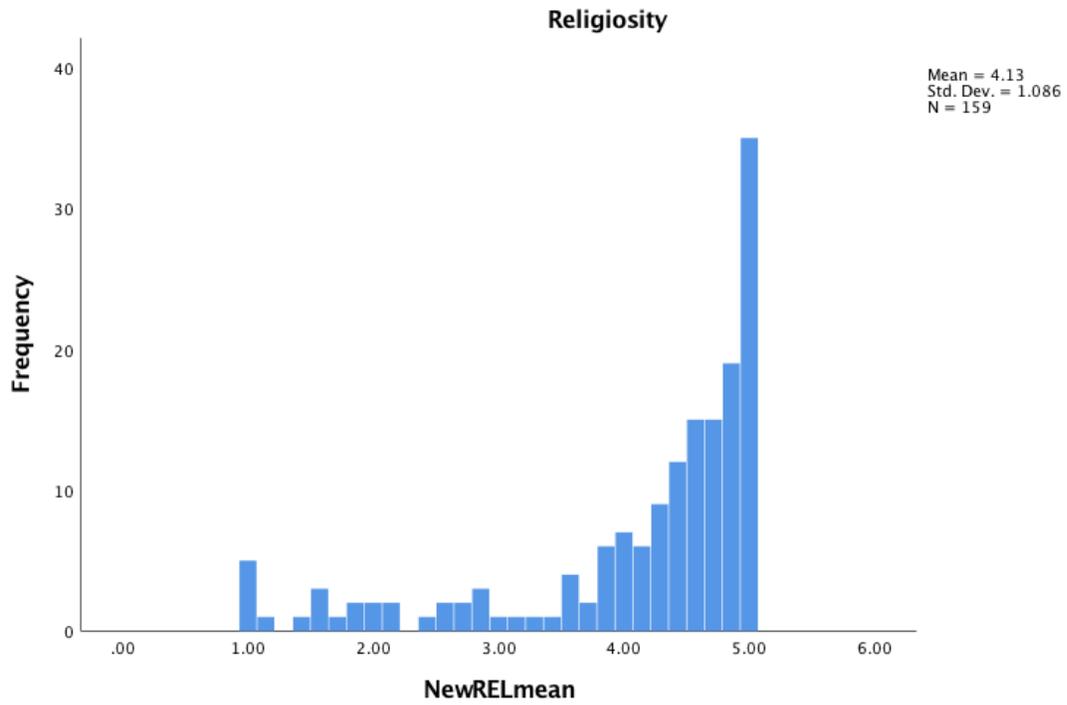
Figure B1. Religiosity Histogram.
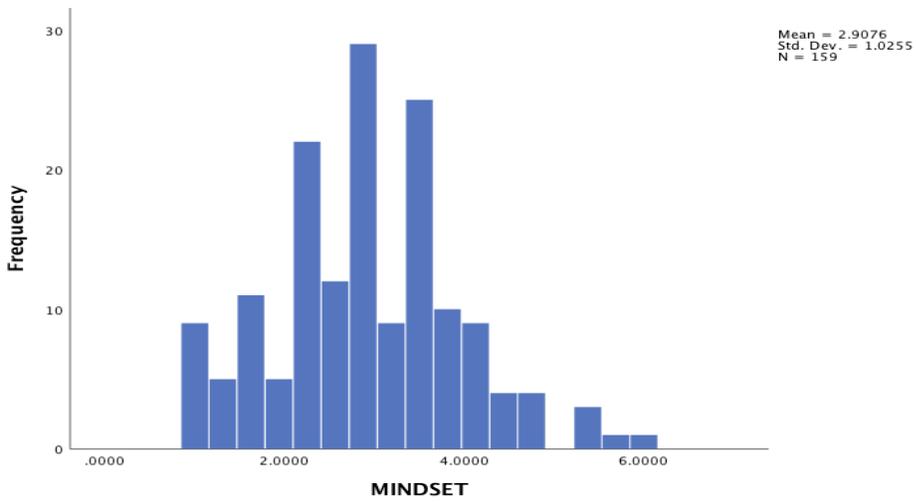
Figure B2. Mindset Histogram.

Mean = 22.9
Std. Dev. = 5.626
N = 101
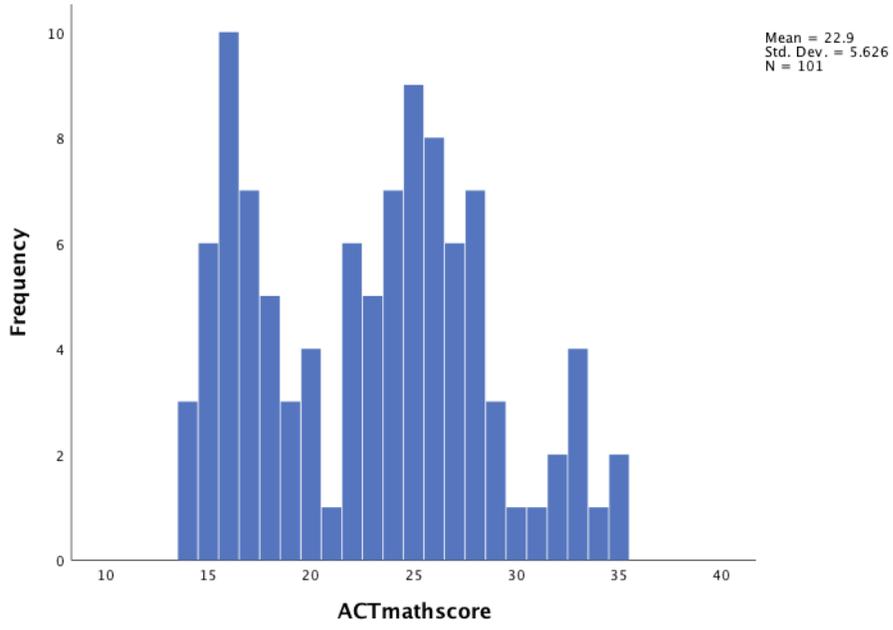
Figure B3. ACT Math Achievement Histogram.

Appendix C: Scatterplots
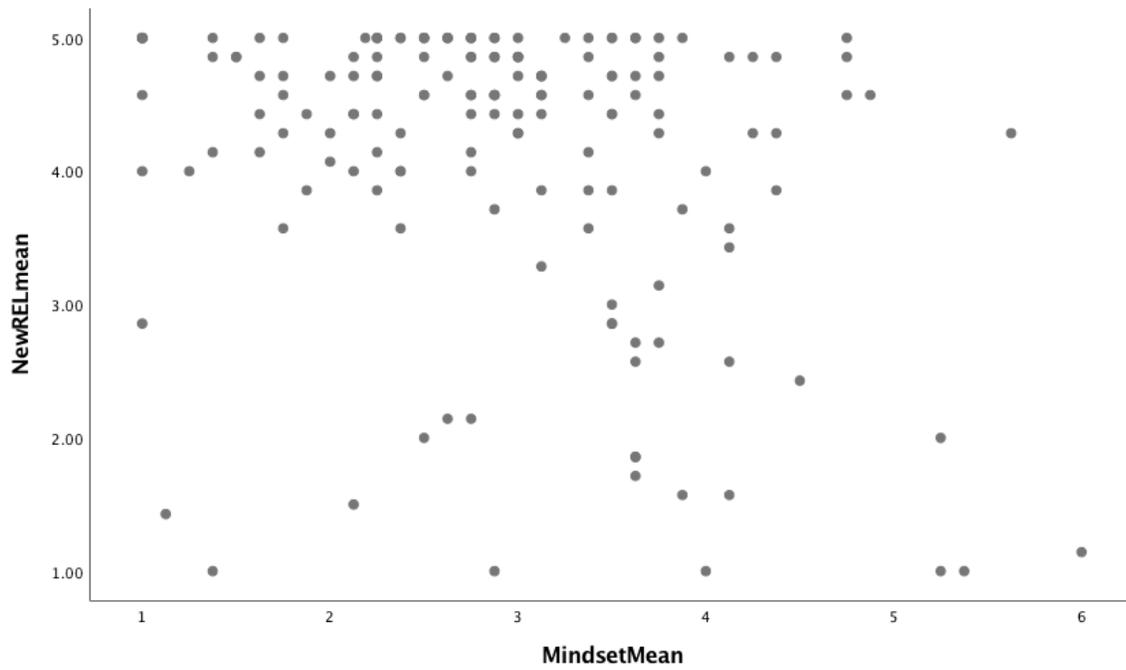
Figure C1. Religiosity and Mindset Scatterplot
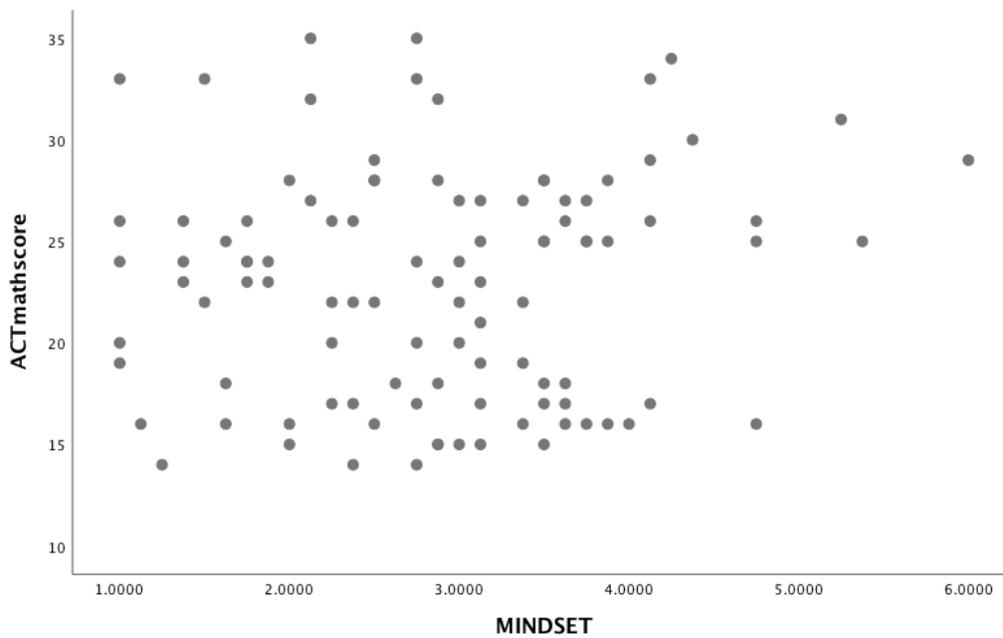
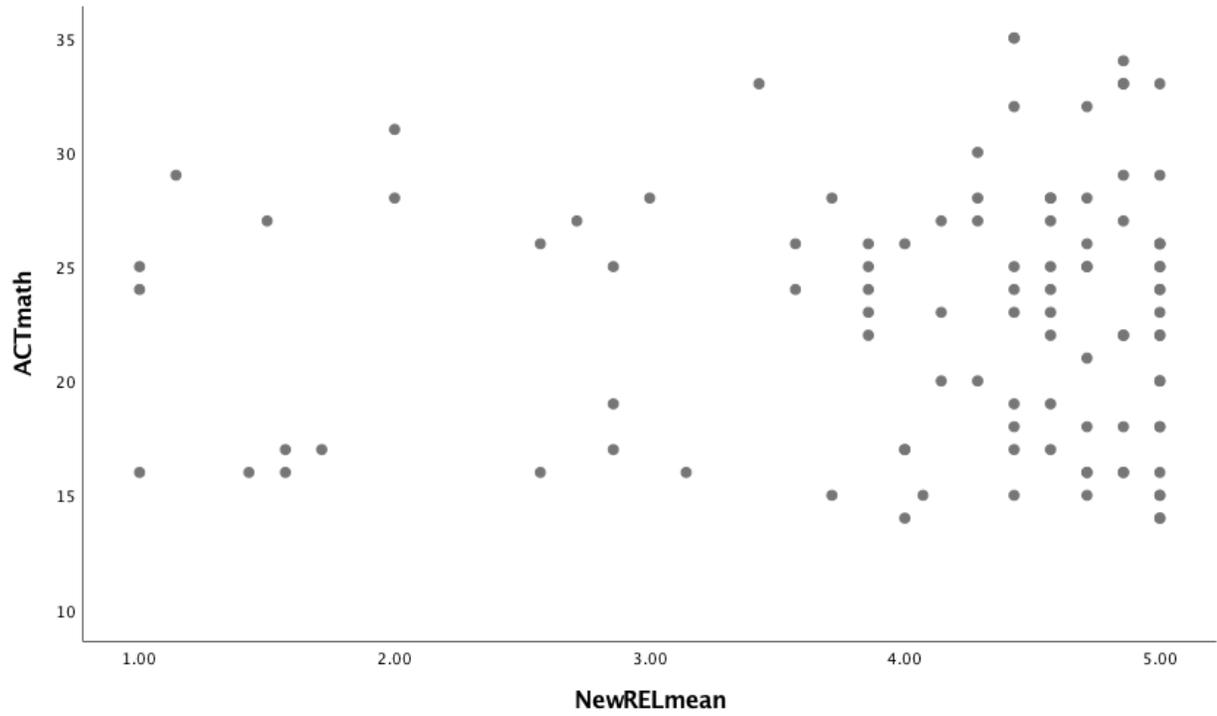*Figure C2:* Mindset and ACT Math Achievement Scatterplot

Figure C3. Religiosity and Act Math Achievement Scatterplot
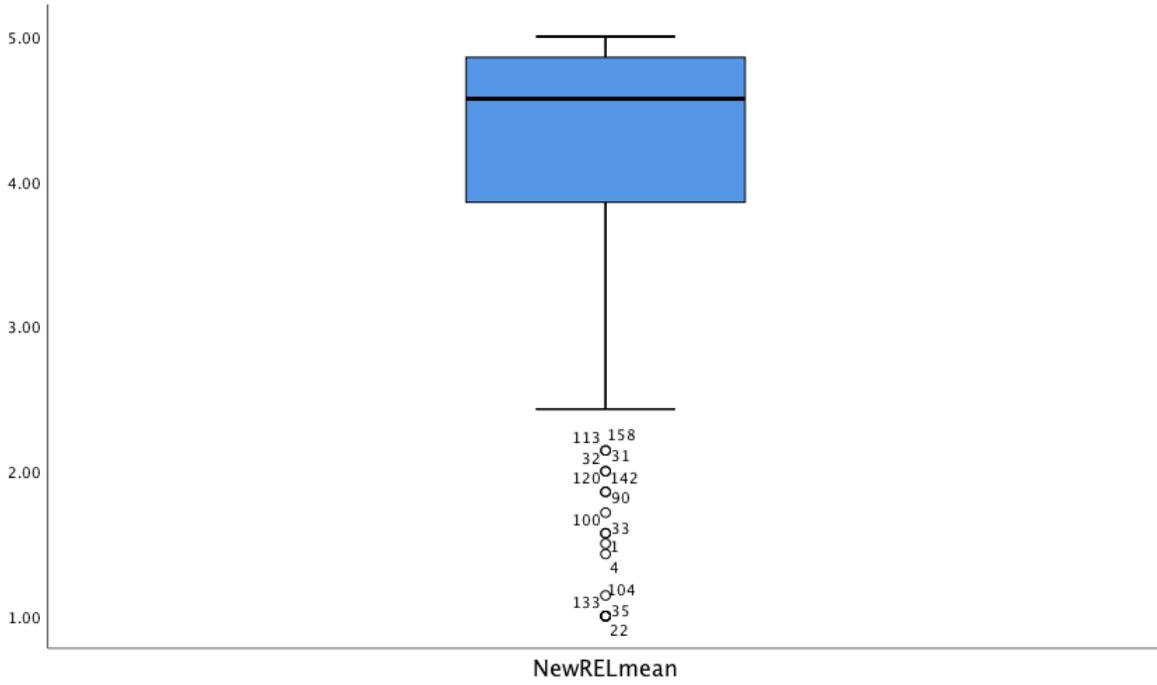
Appendix D: Box and Whisker Plots
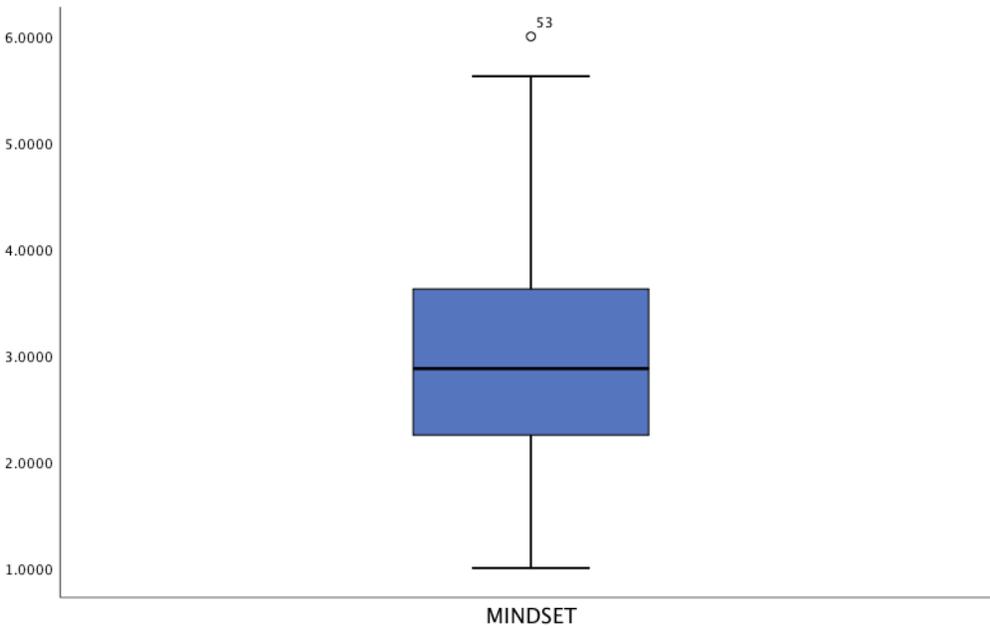

Figure D1. Religiosity Box and Whisker Plot
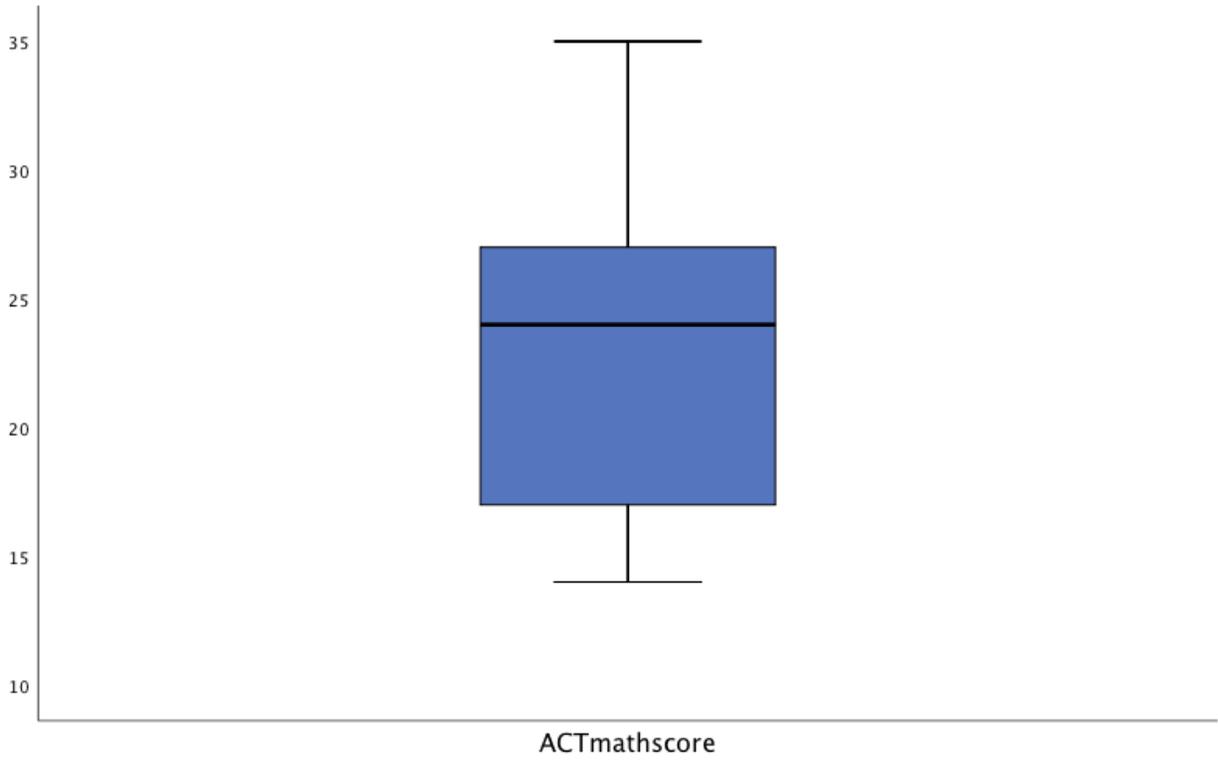

Figure D2. Mindset Box and Whisker Plot

Figure D3. Act Math Achievement Box and Whisker Plot

Appendix E: Qualitative Field Notes

Table 19

Qualitative Field Notes

Theme	In Vivo Code	Process Code	Frequency
Environmental Factors	"Supporting environments give me confidence in my abilities." "My parents taught me mindset and religiosity separately." "My support system helps me handle overwhelming academic pressure." "My immediate family, church, and Christian school, allowed me to be religious and academically strong at the same time." "If I wasn't at a Christian school, the rest of my environment would have supported my religiosity."	Trying Devoting Balancing Prioritizing	12
Academic Success	"Belief that we should always try out best, devote ourselves fully, and not squander gifts, keep driving forward." "When my teachers have the same views on mindset and religiosity as I do, they become part of my support system and work with my family to support and encourage academic achievement."	Limiting Training Questioning Respecting Willingness	15
Key Assertation	"Math is a study of God's order in creation. With having the big picture in mind, it helps the pieces come together." "Religion provides the purpose for the things I am studying." "Mindset and religiosity are two important things to focus on." "Mindset and religiosity are separate entities until I have a personal struggle (with either faith or academics), then I can rely on the other one." "I believe that my talents are a gift and they are not my own. I have a duty to use my abilities to my potential." "Guided by faith and driven by excellence are two separate things."	Aligning Centering Supporting Focusing	23

Appendix F: Statement of Original Work

The Concordia University Doctorate of Education Program is a collaborative community of scholar-practitioners, who seek to transform society by pursuing ethically-informed, rigorously-researched, inquiry-based projects that benefit professional, institutional, and local educational contexts. Each member of the community affirms throughout their program of study, adherence to the principles and standards outlined in the Concordia University Academic Integrity Policy.

This policy states the following:

Statement of academic integrity.

As a member of the Concordia University community, I will neither engage in fraudulent or unauthorized behaviors in the presentation and completion of my work, nor will I provide unauthorized assistance to others.

Explanations:

What does "fraudulent" mean?

"Fraudulent" work is any material submitted for evaluation that is falsely or improperly presented as one's own. This includes, but is not limited to texts, graphics and other multi-media files appropriated from any source, including another individual, that are intentionally presented as all or part of a candidate's final work without full and complete documentation.

What is "unauthorized" assistance?

"Unauthorized assistance" refers to any support candidates solicit in the completion of their work, that has not been either explicitly specified as appropriate by the instructor, or any assistance that is understood in the class context as inappropriate. This can include, but is not limited to:

- Use of unauthorized notes or another's work during an online test
- Use of unauthorized notes or personal assistance in an online exam setting
- Inappropriate collaboration in preparation and/or completion of a project
- Unauthorized solicitation of professional resources for the completion of the work.

Statement of Original Work (continued)

I attest that:

1. I have read, understood, and complied with all aspects of the Concordia University–Portland Academic Integrity Policy during the development and writing of this dissertation.

2. Where information and/or materials from outside sources has been used in the production of this dissertation, all information and/or materials from outside sources has been properly referenced and all permissions required for use of the information and/or materials have been obtained, in accordance with research standards outlined in the *Publication Manual of The American Psychological Association*.

Kathryn Louise Luebke

_____
Digital Signature

Kathryn L Luebke
_____
Name (Typed)

5/28/2019
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Date